A geographical study of post-war rural populations in North-East England

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A GEOGRAPHICAL STUDY OF POST-WAR RURAL POPULATIONS IN NORTH-EAST ENGLAND

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ABSTRACT

The work may be divided into two parts. The first is concerned with obtaining a geographically significant definition of rurality and applying it to the twenty pre-April 1967 Rural Districts of Northumberland and Durham at the Civil Parish level. A composite index of rurality based upon the four prime geographical factors of population density, land use, employment and situation shows truly rural conditions over much of Northumberland as well as in west Durham and a surprisingly large area of south Durham.

The second part establishes the major criteria by which the heterogeneous populations found within the 147 units derived from the Rural Districts may be categorised. Three major definitional axes are found through multivariate analysis and three unit types established which are characterised by (a) dense population, industry, mining and a near urban situation; (b) remoteness and the predominance of agriculture; (c) high social status. Distinct zones of such units are found : the first type in south-east Northumberland, central and east Durham; the second in west Durham and much of the remainder of Northumberland; the third around the major conurbations and extending down the Tyne valley.

The remainder of the work comprises an analysis of the areal variation of individual demographic, social, socio-economic and economic variables both to establish significant distributional features and the nature of any association with the earlier classification. Many such links are found. Thus, the industrial/mining type units tend to be characterised by such features as short distance population mobility, high unemployment or overcrowding; the agricultural and remoter rural units by an old age structure, a large number of households with no family unit or little recorded journey to work movement; the high social status units by high sex ratios and a substantial population increase between 1951 and 1971.

PREFACE

We are well accustomed to the fact that the vast majority of population in England and Wales lives in urban areas. It is, therefore, not at all surprising that in the main branches of human geography as applied to this country, the major interest has been with that urban population, its economy and society. However, large absolute numbers of people live in rural areas and it is towards the populations of the Rural Districts of Northumberland and Durham during a part of the post-war period that the attention of this work is turned. What are the predominant characteristics of this heterogeneous 'rural population'? Can it be further sub-divided? And what variations do selected parameters exhibit over space? It is to answering questions such as these that attention is directed in the ensuing pages.

One preliminary point must be made. The research and analysis undertaken for this thesis occupied the period between September 1969 and April 1972. Consequently, whilst the mechanical chore of committing these results to paper in both written and diagrammatic form has occupied the period since (combined with a full-time career since October 1972) no account can be taken of the 1971 Census results which are now being published, nor the recently effected reorganisation of Local Government. Neither of these should be accounted serious omissions in the context of this study. In the first place, the work stands in its own right as an investigation into populations in Northumberland and Durham over a specific period of time. Moreover, that period is not so far removed from the present day as to be of only or even mainly historical interest. Second, the study of rurality in Part I of the work (which was itself completed in the early part of the research/analysis period with a preliminary paper on the topic being given by the present author to the Conversazione in Human Geography during the British Association for the Advancement of Science meeting in Durham during the summer of 1970) does not lose by the reorganisation of Local Government in England and Wales as from 1 April 1974. Indeed, the problem of definition of rural and urban is now even more complex in so far as the administrative definition through Rural and Urban Districts has ceased to exist and has not been replaced. Nevertheless, most statistics will still be produced with administratively defined areas as their basis and attempts to look at rural or urban areas will often have to begin from this none-too-certain point.

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CHAPTER 1

THE CONCEPT OF RURALITY

1.1 Introduction

Whatever definition of geography, if any, one accepts, it is apparent that the subject is replete with divisions which give the various branches of study. Thus, one has, for example, a differentiation into regional and systematic, and physical and human sectors, though as all geographers must admit, the essential integrity of the discipline is of paramount importance and such dichotomies must be seen in their true light, namely a meaningful breakdown of the overall chorological section of knowledge into more manageable parts for the purpose of study (Hartshorne 1959). Accordingly, it is perfectly reasonable and legitimate that an entire population may be subdivided into subareas or subsets by means of some particular criterion or criteria of relevance, and the resultant populations (assuming the validity of the divisional criteria used) subjected to analysis essentially as separate entities (Bogue 1969). By far the commonest, and seemingly perhaps the simplest, of such divisions of a total population is that which involves a separation into urban and rural components. Therefore, in taking post-war rural populations in North-East England as the field of study, it might well appear at first sight that a reasonable and well defined area of operation has been adopted. However, whether this be so or not, some consideration must be given to the precise terms of definition. Indeed, one may agree with Vince when he stated in his basic article on rural population distribution and structure that: "An immediate problem ... is to define the term 'rural population'" (Vince 1952 p.53).

To this deceptively simple problem of definition, the American geographer Zelinsky has given an immediate answer in: "Anything that is not urban" (Zelinsky 1962 p.493). However, as he goes on to point out, whilst a simple residual definition such as this might once have been perfectly adequate, it is now becoming progressively less so as the locational and functional complexity of both rural and urban populations increases. If this is so in the developing lands of the world at the present time, as it undoubtedly is, the significance of its application to such advanced countries as the United Kingdom or United States of America may, with good reason, be considered. It is hardly surprising that Smith and Zopf (1970 p.23) come to the conclusion that: "Nothing seems more apparent than the contrast between the city and the country. However, one who attempts to set forth the specific differences between the city and the country, to distinguish accurately between rural and urban, is immediately confronted with some serious difficulties, obstacles that are not readily perceptible".

To look at the problem from a different angle and perhaps cite it in more precise terms, as well as to begin to appreciate its essentially complex nature, one can do no better than refer to a comment expressed by Longstaff in a paper given to the Royal Statistical Society over three-quarters of a century ago on the then emotive question of rural depopulation:" ... although everyone has a general idea of what is meant by rural as distinguished from urban population, it is not so easy in all cases to draw the line" (Longstaff 1893 p.380). He notes that at this time of increasing mobility, progressively more townspeople were seeking country residence, and in some areas were adding considerably to the nominally rural population. Nevertheless, though they were resident in the country, such adventitious residents were certainly not of it. Similarly, at the other end of the scale, he concluded that most of the smaller towns which provided services for, and supplied the immediate needs of scattered farms and villages, were an essential part of the rural organisation. Quite rightly he surmised that, in the face of such problems, only a rough division of an area and population into rural and urban components was possible. Yet, even though this may well be true, it gives little basis from which to operate even a rough division into rural and urban, and it is towards the search for some solution to this problem that attention must now be turned.

1.2 Rurality - the International Approach to Definition

The problem outlined above, of satisfactorily defining the rural and urban segments of a population has, of course, received much attention, not least from official sources. For a variety of social, economic and demographic reasons, the differentiation of rural from urban population is generally regarded by world governments as being of great interest and utility. Here, therefore, one has numerous prospective solutions to the definitional problem, and analysis of the basic elements of such answers will at least reduce the problem to its common factors, if any.

Clearly, such official definitions fall into one of several distinct categories. Firstly, one has the solution, whereby certain localities of a given population size are simply classed as urban. Within this type of definition, however, homogeneity is lacking, with, for example, urban status being granted to places with as few as 200 inhabitants in Denmark, whilst in Austria this lower limit is as many as 5,000. Secondly, it is frequently found that the administrative centre of a minor civil division is classified as urban while the remainder of the divison is regarded as rural. Brazil and Egypt are nations which have adopted such a classification. Thirdly, there is a further category in which minor civil administrative divisions are classed as rural or urban on the basis of a single criterion or combination of several criteria. These vary quite enormously in nature and include type of local government, occupation of inhabitants, type of housing and the possession, or non-possession, of services and facilities of varied nature. Finally, one has what might best be called a residual category, often using a combination of the methods. Here, perhaps, the most frequently cited example is that of the United States where urban is taken to be incorporated places of 2,500 persons and over, together with the urban fringes of cities having a population of 50,000 or more, whilst the rural population since 1920, as a result of general increases in suburbanization, has itself been divided on occupational grounds into rural-farm and rural non-farm sectors.

The result of having several distinct methods of classification, together with the observed inter-class heterogeneity in detailed definition may well be imagined. In its investigation into urban and rural classification, one recent United Nations Demographic Yearbook (U.N.O. 1962) noted that in Bulgaria, urban refers to places with urban status, regardless of size; in Israel it implies predominantly non-agricultural centres; in Finland and Sweden it refers to built-up areas with less than 200 metres between houses, whilst in Malta it is defined as being built-up areas devoid of agricultural land.[1] Indeed a hardly encouraging position and one in which the difficulties are augmented by the fact that official designation of urban and rural is generally so intricately intertwined with political, cultural and administrative considerations, that any progress towards uniformity is at best painstakingly slow. For many reasons, definitional criteria, once established, particularly on an administrative basis, become fixed and resistant to change.

In consequence of this bewildering array of definitional complexity which is itself increased in so far as similar wordings

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1 The various national definitions of urban and rural are generally given in the relevant tables of each United Nations Demographic Yearbook. A specific tabulation of these definitions is given in the 1967 edition pp.2-4.

of classifications in different countries may nevertheless have significantly differing meanings it has been recommended (U.N.O. 1962) that, in addition to the national mode of classification, governments should, for the purpose of international comparability, classify their populations also by the size of the locality. This would have the further advantage of recognising that, probably in the majority of cases, there is no definite division on the continuum between the rural and urban extremes. Twelve size categories were, in fact, suggested for adoption, and these varied in size from a residual category of persons who do not reside in identifiable localities, to agglomerations of 500,000 or more.

Whatever the merits of this and other ideas may be, they do little to clarify any attempt to decide on some workable definition of rural population. At best one can merely note that the numerical factor is the single point which appears to be the most often present in definition, and even this limited common basis is qualified by Beaujeu-Garnier and Chabot (1967), who point out that many objections have been made to a classification of this nature which is subject to a precise figure. Such a threshold value is, in any case, difficult to determine and, as might be expected, is not established everywhere according to the same criteria.

1.3 Rurality - the Example of England and Wales

Thus far, it has been established that there is little general agreement, and certainly none in detail, concerning the international view of urban and rural. Having, therefore, no standard by which to judge the bases of a national differentiation, the next logical step must involve a descent from the macro to the meso-level in order to consider the validity of the criteria used within England and Wales, during the period covered by this study, in this relevant division of population, and, subsequently, its application to the study area. Immediately, however, problems appear. Nowhere perhaps, is the criticism by the United Nations Organisation (U.N.O. 1962) of resistance to change in administrative boundaries more true than for England and Wales, where the definition of urban and rural for the purposes of the presentation of population statistics in the quarter of a century following the close of the Second World War has entirely depended upon the type of local government area.

One author who has written extensively on local government in England and Wales from a geographical standpoint has stated in no uncertain terms that nothing could be more misleading than to regard the local government map as effectively representing the limit on the ground, of a rural or urban landscape (Freeman 1968). Similarly, Saville (1957 and 1966) has noted that in 1851, when it was considered that for the first time in England and Wales the urban section of the population was as large as the rural, the dividing line between town and country remained strongly marked. Even at the outbreak of the 1914-18 War, urban and rural were quite distinct physical and cultural entities throughout Europe notwithstanding the slow but irrepressable changes that had taken place in the latter part of the nineteenth century as a result of industrial growth. In the remainder of the twentieth century, however, the differences have begun to seriously weaken. He concludes: "Suburbanization and rurbanization have in many areas blurred the distinction between town and country and the problem of definition becomes increasingly difficult the nearer we get to our own day" (Saville 1957 p.60). Overall, it is indisputable that the nature of the rural/urban differentiation in England and Wales with its piecemeal development and only an occasional spate of minor readjustments in local authority areas and designations, has progressively fallen further behind reality. Indeed, if one briefly considers the historical development of modern local government in England and Wales up to 1970 from this point of view, a greater appreciation is gained concerning the nature of the problem of defining rural population in a geographically significant manner, with reference to the present area of study.

Though many writers trace back the origins of the present system of local government in England and Wales no further than the latter half of the last century, Bracey (1959) considers that its antecedents reach as far back as Saxon times with, at the lowest level of authority, civil parish administration finally developing from the thirteenth and fourteenth century organisation of the Vestry meeting. This was originally created to meet the temporal needs of the Church, but during Tudor and Stuart times increasingly took up secular responsibilities. At the county level, the Justice of the Peace reigned supreme in local administration from the time of Elizabeth I. This ancient system of County and Parish administration lasted successfully until the beginning of the nineteenth century, when the Industrial

Revolution, with the consequent growth of towns, together with the depression which followed the Napoleonic Wars, caused problems of poverty and crime of a far more acute form than previously. The cumulative effect is generally recognised as having put the final strain upon what was rapidly becoming an outdated machine of local government (Peake 1930 , Thomson 1950, Bracey 1959 and 1970). Consequently the 1830s saw a number of reports and measures, undertaken in an attempt to solve some of the more obviously pressing social and economic problems. It is in these that Freeman (1968) sees the beginnings of what he terms 'the Island System of Local Government', which ultimately had the effect of theoretically separating town from country.

The Royal Commission on Municipal Corporations was appointed in 1833 and culminated in the 1835 Municipal Corporations Act providing for a uniform system of elected councils. At the same time town boundaries were established or revised to take account of what was considered to be either superfluous rural land lying within the town, or physically continuous suburbs outside. Similarly, 1834 saw the passing of the Poor Law Amendment Act, combining parishes for the purposes of unemployment relief into Poor Law Unions. Generally, the site of the Union Workhouse became the market town towards which the surrounding parishes looked. It would not seem to be too far-fetched to see in this something of an embryonic city-region concept, though an obvious reversal of any trend apparent here and a complete division of the rural and urban sectors was not to be long delayed.

The next significant step in rural/urban definition came in 1848, although as Freeman (1968) points out at times quite humorously, it was already by then established practice that, for many purposes, town and country had quite different problems; that, for example, legal justice must exist everywhere but street lighting belonged to towns alone. With the increasing problem of contagious disease in urban areas, however, town definition was not merely of academic concern. So, in 1848, the urban parishes of the Poor Law Unions established Local Boards of Health which were separate entities in so far as public health and highway administration were concerned. Additionally, prior to a regulatory Act of Parliament in 1868 many large villages claimed urban powers in an attempt to avoid contributing to road maintenance costs in the surrounding countryside. An extension of this legislation occurred in 1872 when, directly contrary to the principles behind the Poor Law Amendment Act of 40 years before, the Local Boards of Health were transformed into Urban Sanitary Districts, and those parishes which were in the Poor Law Union outside the urban area, into Rural Sanitary Districts.

Finally, by the Local Government Acts of 1888 and 1894, the detailed system of the present local government organisation existing at the time of this study and, therefore, the definition of rural and urban areas and populations, was established. As the nineteenth century historian Thomson (1950) points out, by the later stages of the century, it was becoming increasingly clear that the social problems attacked by the new Poor Law and subsequent legislation, had resulted in the establishment of a complex series of local administrative boards whose functions were often ill-defined and even overlapping. Thus, the 1888 Act established County Councils to take over the administration of the counties outside the largest towns, which were themselves established as separate County Boroughs though it has been noted, that in the course of the relevant Bill's passage through Parliament, the original ten towns which it had been proposed to exclude from County Council control were joined by all towns having over 50,000 inhabitants, as well as some smaller ones (H.M.S.O. 1969 Cmnd 4040).

The 1894 Local Government Act completed the system by renaming the Sanitary Districts in the Counties as merely Urban or Rural Districts and giving them a more democratic constitution. Moreover an increase took place in the number of small rural authorities resultant upon the stipulation of the 1894 Act that no county district should traverse a County boundary. Previously, in the Poor Law Unions, this had not been the case, and quite frequently the Union had been bisected by a County boundary. Whilst Peake (1930) saw this modification as being a mixed blessing, other geographers have been far less certain of any benefits. Fawcett (see Gilbert 1948) bemoaned the fact that whereas for example, the whole of Upper Teesdale had previously been organised as one Poor Law Union based upon the small market town of Barnard Castle, under the 1894 Act its unity was shattered in its division into Barnard Castle Urban District and Barnard Castle Rural District in Durham on the north bank of the Tees, and Startforth Rural District in the North Riding of Yorkshire on the south.

From what has already been said, one may appreciate the complex interplay of social, economic and political factors especially at the local level, which finally resulted in an area being designated as urban or rural. The varied, and occasionally contrasting combination of such factors at this level, together with the inbuilt resistance to change in established institutions had even at this time created the beginnings of anomalies, be they large and quite densely populated Rural Districts or small, often village-like Urban Districts, which rather than diminish in the first seven decades of the present century, despite the sporadic modifications to the local government pattern, increased in number.

Between the passing of these two momentous Acts and the end of the period under study, many but only minor adjustments have occurred, the system itself remaining untouched in its basics (subsequent to the study period, far reaching changes in the structure have been implemented, too late however for their implications to be covered in the present work.[1]). Thus, the period between 1888 and 1926 saw the number of English County

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1 Following the White Paper Cmnd 4584 (H.M.S.O. 1971a) and subsequent Bill on Local Government Reorganisation (HMSO 1971b), a complete transformation of the present structure was scheduled from 1 April 1974, with existing local government areas in England and Wales to be replaced by six Metropolitan Counties in the more densely populated tracts and by Shire Counties elsewhere. This new structure will apparently see the end of the differentiation between rural and urban in administrative areas. From 1 April 1974 Northumberland and Durham possess four new local government areas:

1 The Tyne-Wear Metropolitan County
2 Durham County
3 Northumberland County
4 Cleveland County

All four new counties contain an undifferentiated mixture of administrative areas previously classed as urban or rural. Thus, although all but five Civil Parishes (Hazlerigg, Brunswick, Dinnington, North Gosforth and Woolsington from Castle Ward R.D. which are located in the new Tyne-Wear Metropolitan County), are included in the new Northumberland, to these are added such pre-1 April 1974 urban administrative areas as Morpeth, Alnwick, Berwick or Hexham. The new County Durham, on the other hand, is considerably more complex, containing eight new County Districts against the five in Northumberland. Durham loses both pre-existing rural and urban administrative areas to the new Metropolitan County of Tyne-Wear and the County of Cleveland.

Boroughs increase from 59 to 78 whilst almost all the original ones expanded (H.M.S.O. 1969 Cmnd 4040). In Northumberland, Tynemouth M.B. was accorded County Borough status in 1904 whilst, in Durham, a similar upgrading was experienced by West Hartlepool in 1902 and Darlington in 1915. More significant in the present context, however, was the fact that the same period of time also saw 270 Urban Districts formed from rural areas, with no less than 183 of these having a population of less than 5,000 (Richards 1965). Similarly, Freeman (1968) notes that of a record number of 1,122 Urban Districts (including those of M.B. and C.B. status), 215 had populations below 3,000 and 426 below 5,000. In Northumberland at this time, Seghill U.D. had a mere 2,000 inhabitants and Rothbury U.D. only just over 1,000. In Durham, Stanhope U.D. was unable to reach the 2,000 level. Certainly, any meaning of the terms rural and urban was subordinate to that combination of mainly local social, economic and political factors operative in causing a settlement or area, not at one extreme or the other, to be designated as urban or rural.

With the concern that existed over the territorial spread of the County Boroughs, the indisputable large village nature of some Urban Districts and, correspondingly, the urbanisation or suburbanisation of some nominally rural areas, one effect of the

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In unequal return, however, it gains both Rural District territory from the North Riding of Yorkshire and the previously "autonomous" Darlington C.B. Each of the eight new County Districts contains an undifferentiated amalgam of urban and rural administrative areas from the earlier structure - for example, Darlington includes both the former County Borough and most of the Rural District, whilst Teesdale includes the former Urban and Rural Districts of Barnard Castle - together with 21 North Riding rural parishes on the south side of the Tees. This latter District makes an interesting appendix to the note (see above, this section) on the effects of the 1894 Local Government Act in Teesdale.

1927 Local Government Commission's work may be seen in the revisions made by the County Review Orders between 1929 and 1938. In England and Wales as a whole, the number of Urban Districts was reduced from 783 to 572, though 33 were upgraded to Borough status, and the number of Rural Districts fell from 652 to 475 (Freeman 1968). The intensity of the modifications in the pre-existing pattern, however, varied. In Durham, the Review Orders caused the disappearance of 4 of the 14 Rural Districts, though only in the case of South Shields R.D. was none of the population involved transferred to another Rural District. Likewise, whilst one new Urban District (Boldon) was created, six others disappeared, with Consett and Stanley U.D.s absorbing four of these. Willington U.D. was amalgamated with Crook U.D., to which was added just under 20 per cent of the population from the abolished Auckland R.D. The resultant unit formed was the heterogeneous collection of settlements termed Crook and Willington U.D. Perhaps less questionably, the minute Stanhope U.D. with its shrinking population was absorbed by the surrounding Stanhope C.P. into Weardale R.D. At the same time, adjustments were made in terms of the areas and populations of all remaining County Durham Rural Districts and most Urban Districts (G.R.O. 1937).

These moderate alterations to the pattern in County Durham were not reflected in Northumberland. Here, the composite County Review Order of 1935 embodied relatively few changes, for whilst in the south-east of the county, Longbenton, Seaton Valley and Whitley and Monkseaton U.D.s absorbed four other small Urban Districts, only six out of the ten Rural Districts had any concern whatsoever in the changes, and of these, only two (Castle Ward and Morpeth) had anything more than extremely minor population losses. A small gain was made by Rothbury R.D. which absorbed the population (1,255 in 1931) of Rothbury U.D. (G.R.O. 1935).

Since 1945 a series of Local Government Commissions has had little effect overall though it will be pointed out where they have influenced the study area during the period under consideration (see section 2.1). Thus, what has remained during the first 25 years of the post-war era has been the slightly modified pattern of a basic structure from a bygone time, with its repercussions on the operational definition of rural and urban.

The relevance of this to the purpose in hand is not difficult to discern, for in addition to what is appearing as a most unsatisfactory basis of rural and urban delimitation, such modifications as were made by the County Review Orders, for example, were essentially fragmentary. Despite their apparent comprehensiveness, they left many Urban Districts of small size and influence such as Tow Law and Barnard Castle in County Durham or Amble in Northumberland. Likewise many Rural Districts still contained tracts of land with substantial populations as in the southern part of Morpeth R.D. in Northumberland and, most obviously, much of Easington R.D. in County Durham.

Not surprisingly, therefore, the fact that for many years the nearest approximation in England and Wales to a rural area for official statistical purposes, has been the administrative Rural District, has been strongly attacked by various writers. One (Robertson 1969), in criticising the administrative nature of the Census units, for their lack of homogeneity in size and composition, the lack of stability in their boundaries, and their lack of comparability with recognisable social and economic divisions, applied her criticism especially to 'rural' areas, noting that only 12 of the 477 Rural Districts in the 1951 Census of England and Wales, conformed to the definition of 'rural' proposed to the International Statistical Institute. Elsewhere (Robertson 1961), she concludes that 75 per cent of all Rural Districts in England and Wales are rural-urban in their nature.

Even our own decennial Census reports have, from time to time, commented upon the shortcomings of the definition of rural and urban populations adopted for their purposes in this country. The General Report to the 1951 Census of England and Wales (G.R.O. 1958) noted that a number of Rural Districts contained urban patches with the reverse being true for some Urban Districts. Hence, a special analysis of the 1951 Census was made in this context, for which it was unashamedly admitted that the administrative classification of areas was totally inadequate. In the study, a tract of land was designated as being built-up when, primarily at ward and civil parish level it fell within the then Ministry of Housing and Local Government Density Categories I and II, which comprised land with a population density of over 24.7 persons per hectare. The assignment was then modified by reference to the actual pattern of settlement on the ground, as this was revealed by aerial photographs and Ordnance Survey maps. In consequence of this revision, many wards and parishes were subdivided into two or even three zones of different population density categories.

The conclusions of this study were that, in every region of England and Wales, there were more people living on non-urbanised land in urban administrative areas than on urbanised land in rural administrative areas. In the five counties of the Northern Region it was considered that of the 2.4 million people in urban administrative areas, nearly 0.5 million were non-urban by this definition, whilst only slightly over 60,000 of the total Rural District population of 720,000 were considered urban. Nationwide, it was concluded that whilst only slightly over 0.5 million persons were wrongly classed as rural, nearly 4.5 million were inaccurately described as urban in the 1951 Census. In other words, 72 per cent of the population of England and Wales were here designated as urban compared to slightly over 80 per cent officially. This conclusion is a little perplexing when it is elsewhere recorded (G.R.O. 1951) that one effect of the County Review Orders between 1931 and 1939 (extremely few boundary changes occurring between the latter date and the 1951 Census) was to transfer on balance nearly 0.5 million persons from the rural to the urban category and thus reduce the official rural population from 20 percent of the total at the former date to 17.6 per cent at the latter.

If, however, the above is considered to be something of a paradox, the apparent confusion outside official circles regarding the applicability and results of applying a local government criterion to urban and rural definition, is no less. Osborne (1964) considers the above-mentioned 80 per cent urban figure to be a conservative estimate for England and Wales in 1951, whilst Willatts and Newson (1953) in criticising the administrative structure in terms of its urban and rural connotations, put a figure of 85 per cent as a minimum value on the urban population in the two countries at that time. On the other hand, whilst Dickinson (1964) agrees in general terms with the conclusions of the forementioned two authors, some support for the special study of the 1951 Census comes from Fawcett (1929) who, writing even before the effects of the inter-war County Review Orders began to appear, still maintained that the British system of definition of urban and rural populations tended to exaggerate the actual numbers of the former.

1.4 The Concept of Rurality - The Sociological Approach

Whatever the true story may be in so far as the relative proportions of urban and rural elements in the population of England and Wales are concerned, one thing is by now apparent, namely that the administrative Rural District is far from being the ideal unit for study, often containing non-rural population with the opposite being equally true of urban administrative areas. In the search for a more satisfactory delimitation and appreciation of the meanings of urban and rural one may perhaps return to the Census as the statistical source of paramount importance in most population studies, and see upon what basis it justifies acceptance of administrative definitions, especially bearing in mind the criticisms made by the Census itself.

In the Preliminary Report to the 1961 Census of England and Wales (G.R.O. 1961) it is stated that the accepted basis for the division of urban and rural is sociological, in terms of the characteristics of town living. This involves a close proximity of dwellings, a distinct street formation and the emergence of a socially and economically interdependent population cluster. However, it is then stated that, as the primary objective of the Census is to meet the essential needs for demographic information of central and local government organisations, and that as, in consequence, the unit of enumeration must be designed to correspond with the boundaries of local authority areas, for Census purposes only an approximation to the sociological approach may be made. This is recognised as being especially so in view of the time lag between the relevant changes in communities and any compensatory boundary modifications.

Nevertheless, if ideally a sociological approach should yield a reasonable definition of urban and rural, it would seem equally fair and appropriate to investigate the basis of this approach. It is of interest that recent works on urban and rural sociology on both sides of the Atlantic (Mann 1965, Smith and Zopf 1970), cite as their criteria for differentiation the eight principles of Sorokin and Zimmerman (1929): (a) occupation, (b) environment, (c) size of community, (d) population density, (e) heterogeneity and homogeneity of population, (f) social differentiation and stratification, (g) mobility, and (h) systems of interaction. Yet, if a wider sample of authors on the subject is considered, before even questioning the geographical validity of the sociological methods used, it is found that confusion and incomparability reign supreme. The American sociologist Dewey looked at eighteen prominent writers on urban and rural society and listed the items used by them as distinguishing features of ruralism and urbanism (Dewey 1960). He found 140 different items listed, but of these only one, that of heterogeneity with regard to urban society, was mentioned by even a simple majority of the authors (11), whilst 16 items were each mentioned by a single author and nine by only two. Not very helpfully he concluded:"The only thing that seems to be agreed upon generally by writers on rural or urban topics is that in some vague way the terms in question are related to city and country, to community variations in size and density of population" (Dewey 1960 p.60). At the same time he notes that many have criticised what he considers in this case to be a demographically oriented basis for a sociological definition of rural and urban.

Indeed, it might equally well be argued, that though a sociological approach has a fuller history of adoption with regard to rural and urban definition, for the geographer this can not but be somewhat less than satisfactory. One may reasonably question whether it is really significant for most geographical purposes that, for example, it is frequently stated by sociologists (e.g. Reade 1968 and Kötter 1964) that some of those groups in society which embody the most recent benefits of economic growth and social change, and which best exemplify in their intellectual orientations the attitudes usually referred to in sociological literature as 'urban', often lead much of their lives in what appear as undoubtedly rural areas, and vice versa. Furthermore, it is quite feasible that in terms of present day western society, the sociological attitude and modus vivendi oriented concepts of rurality, are considerably at variance with the geographer's chorological and landscape orientations. Consequently, the contrast between the sociologist's statement: "The time has come, it seems, when we must realise that it really makes no great difference where the line between rural and urban is drawn", (Anderson 1960 p.21), and that of a demographer considering the vital rates of American populations: "From a demographic point of view, I suggest that the urban and rural populations stand in greater contrast in their structure today than possibly ever before ..." (Beale 1969 p.99), is a clear indication that the increasing complexity of western technological society has obliterated the correspondence which once existed between rural attitudes and society, and rural residence.

1.5 The Concept of Rurality - Towards a Geographical Approach

It would therefore seem that a search for a geographically significant definition of ruralism and urbanism must also forsake academic sociological hypotheses as a starting point. More properly, one may begin by asking what geographers and allied workers themselves have to offer. The reply would seem to be a paradoxical yet again non-enlightening one. It would appear that in generalities much has been said but surprisingly little in specific terms. Thus Bogue (1969) writing as a demographer on urban and rural delimitation considered that: "Although often it is difficult to state the specific criteria for delimitation, the conceptual differences between the two are well known and appreciated. Urban areas are densely populated areas where manufacturing, commerce, administration and a great variety of services are available. Rural areas are more sparsely populated and tend to be specialised in agriculture, forestry or other exploitation of resources. Small towns that provide services to those who pursue rural industries are also part of the rural area, as are non-agricultural aggregations of population that are too small or too dispersed to be classed as urban" (p.465).

Mentioned here in general terms as criteria for differentiation are function (measurable in terms of employment structure) and density, with an implicit recognition also of situation and land use, each of which is a factor of significance to the geographer. All four points are elements of rurality which are recognised either individually or in various combinations by geographers and each must be taken into account for a comprehensive assessment of rurality from a geographical point of view

(Clarke 1972). Precisely how significant, or at what level they commence to be of threshold character though, is greatly contentious. This will be considered in taking the study area together with its urban administrative areas and, in an attempt to clarify the term 'rural', subjecting it to analysis from a geographical approach.

CHAPTER 2

RURALITY IN NORTH-EAST ENGLAND

2.1 The Area

It can be seen, therefore, that any attempt to delimit the geographically rural areas of Northumberland and Durham in a clearer light has none too certain foundations upon which to build. Certainly, to begin with a negative point, one may express the customary discontent with the official mode of definition. Prior to the Ministry of Housing and Local Government Orders which became effective from 1st April 1967 and 1st April 1968 (see G.R.O. 1969 and 1970) and which implemented some of the proposals of the 1958-66 Local Government Commission (H.M.S.O. 1963a and 1963b) with regard to the North-East at least in part, there were 20 Rural Districts in the counties of Northumberland and Durham (Figure 2.1). These varied greatly in size and no less in population. Bellingham, the largest Rural District, covered an area approaching 100,000 hectares, whilst Sunderland, the smallest, spread over less than 3,000. Similarly, Easington R.D. in Durham boasted a population of over 85,000 in 1967 (the preliminary figure for the 1971 Census being 85,410), compared to the most northerly of the Rural Districts in the two counties, that of Norham and Islandshires, which in an area over one-third as large again contained under 4,000 inhabitants (3,450 in 1971). It is not inappropriate at this point to note that certain of the mining settlements in Easington R.D. dwarf some entire Urban Districts such as Barnard Castle, Tow Law and Amble in so far as population is concerned with only the first mentioned of the latter settlements achieving even 5,000 inhabitants.

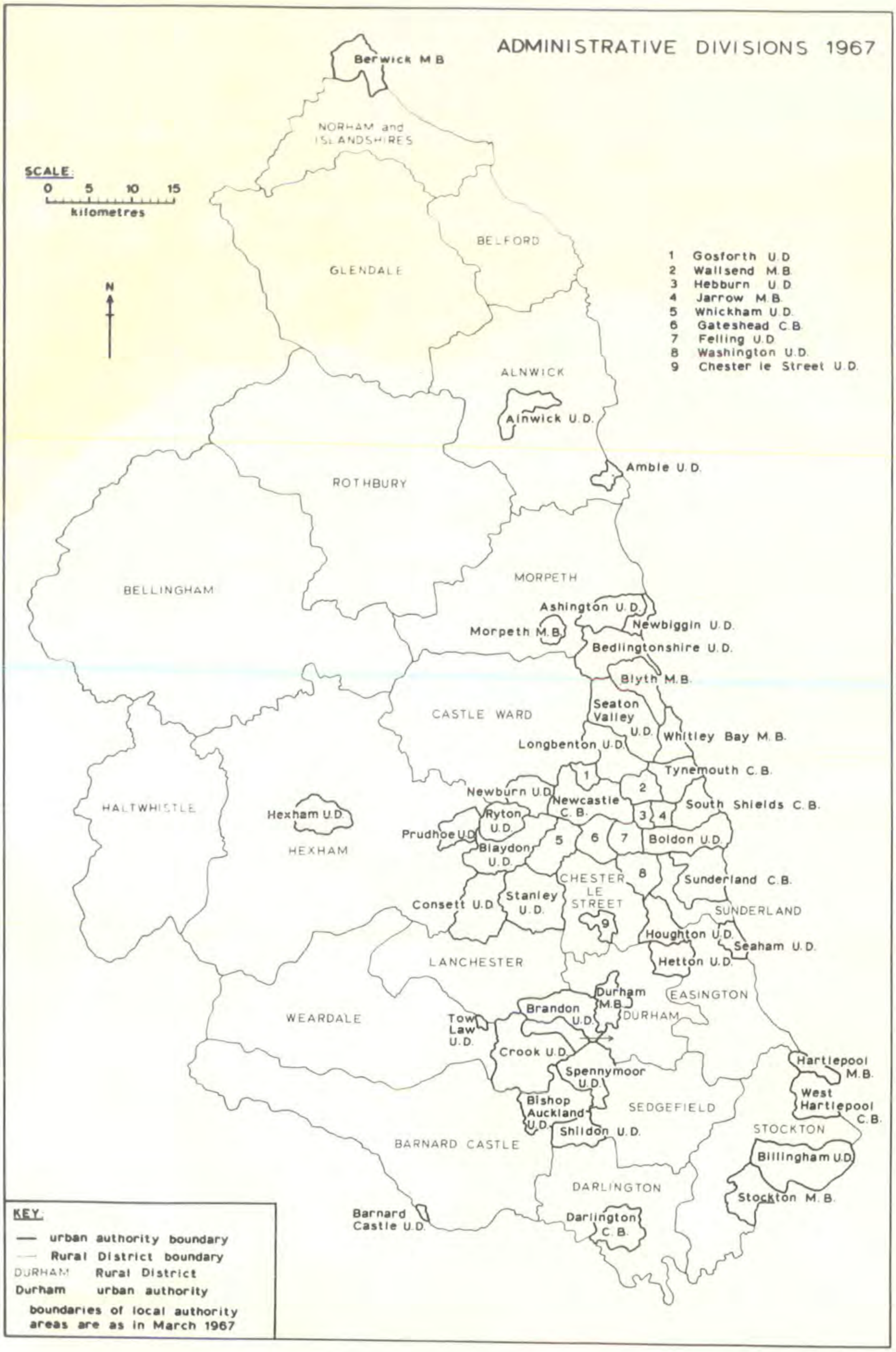
ADMINISTRATIVE DIVISIONS 1967
SCALE:
0 5 10 15
kilometres
N
1 Gosforth U.D.
2 Wallsend M.B.
3 Hebburn U.D.
4 Jarrow M.B.
5 Whickham U.D.
6 Gateshead C.B.
7 Felling U.D.
8 Washington U.D.
9 Chester le Street U.D.
Berwick M.B.
NORHAM and ISLANDSHIRES
GLENDALE
BELFORD
ALNWICK
Alnwick U.D.
Amble U.D.
ROTHBURY
BELLINGHAM
MORPETH
Ashington U.D.
Newbiggin U.D.
Morpeth M.B.
Bedlingtonshire U.D.
Blyth M.B.
Seaton Valley U.D.
Whitley Bay M.B.
CASTLE WARD
Longbenton U.D.
Tynemouth C.B.
Newburn U.D.
Newcastle C.B.
South Shields C.B.
HALTWHISTLE
Hexham U.D.
Ryton U.D.
Prudhoe U.D.
Blaydon U.D.
Boldon U.D.
HEXHAM
CHESTER LE STREET
Sunderland C.B.
Consett U.D.
Stanley U.D.
SUNDERLAND
Houghton U.D.
Seaham U.D.
LANCHESTER
Hetton U.D.
Durham M.B.
EASINGTON
WEARDALE
Brandon U.D.
DURHAM
Tow Law U.D.
Crook U.D.
Spennymoor U.D.
Hartlepool M.B.
West Hartlepool C.B.
Bishop Auckland U.D.
SEDGEFIELD
Shildon U.D.
STOCKTON
BARNARD CASTLE
Billingham U.D.
DARLINGTON
Stockton M.B.
Barnard Castle U.D.
Darlington C.B.
KEY:
urban authority boundary
Rural District boundary
DURHAM Rural District
Durham urban authority
boundaries of local authority areas are as in March 1967

Figure 2.1

In consequence of the County Review Orders mentioned above (Section 1.3) there were few and only extremely minor changes in local government areas from 1939 to 1967 in the North-East. Indeed, if the rationalisation of parish structure which, for example, dramatically reduced the number of parishes in Northumberland by their amalgamation into larger units, is ignored, the only interchanges of population and area between rural and urban administrative units, despite a continuously changing distribution of population, were those documented by House and Fullerton (1960), with a total of approximately 400 hectares and 100 persons being transferred from Stockton R.D. to West Hartlepool C.B. and Stockton M.B. with, in addition, a smaller gain of territory and population for Durham M.B. and Darlington R.D. at the expense of Durham R.D. in the former case, and Shildon U.D. and Sedgefield R.D. in the latter.

As a result of the 1967 and 1968 boundary changes, the local government situation as shown on Figures 2.1 and 2.2 changed slightly. By far the most important alteration was the creation of Teesside C.B. from pre-existing local authority areas on both banks of the lower Tees. With regard to the Rural Districts, however, except in one instance, the changes up to the end of the decade were extremely minor and in population terms entirely restricted to County Durham. Thus Darlington C.B. absorbed something over 120 hectares and 300 persons from surrounding Rural District parishes, mainly that of Blackwell (Figure 2.3). A similar absorption occurred with regard to the creation of the new Hartlepool C.B., though the effect was mainly localised to the two parishes of Seaton and Greatham (Figure 2.4). The new Teesside C.B. had a comparable effect on some parishes in Stockton

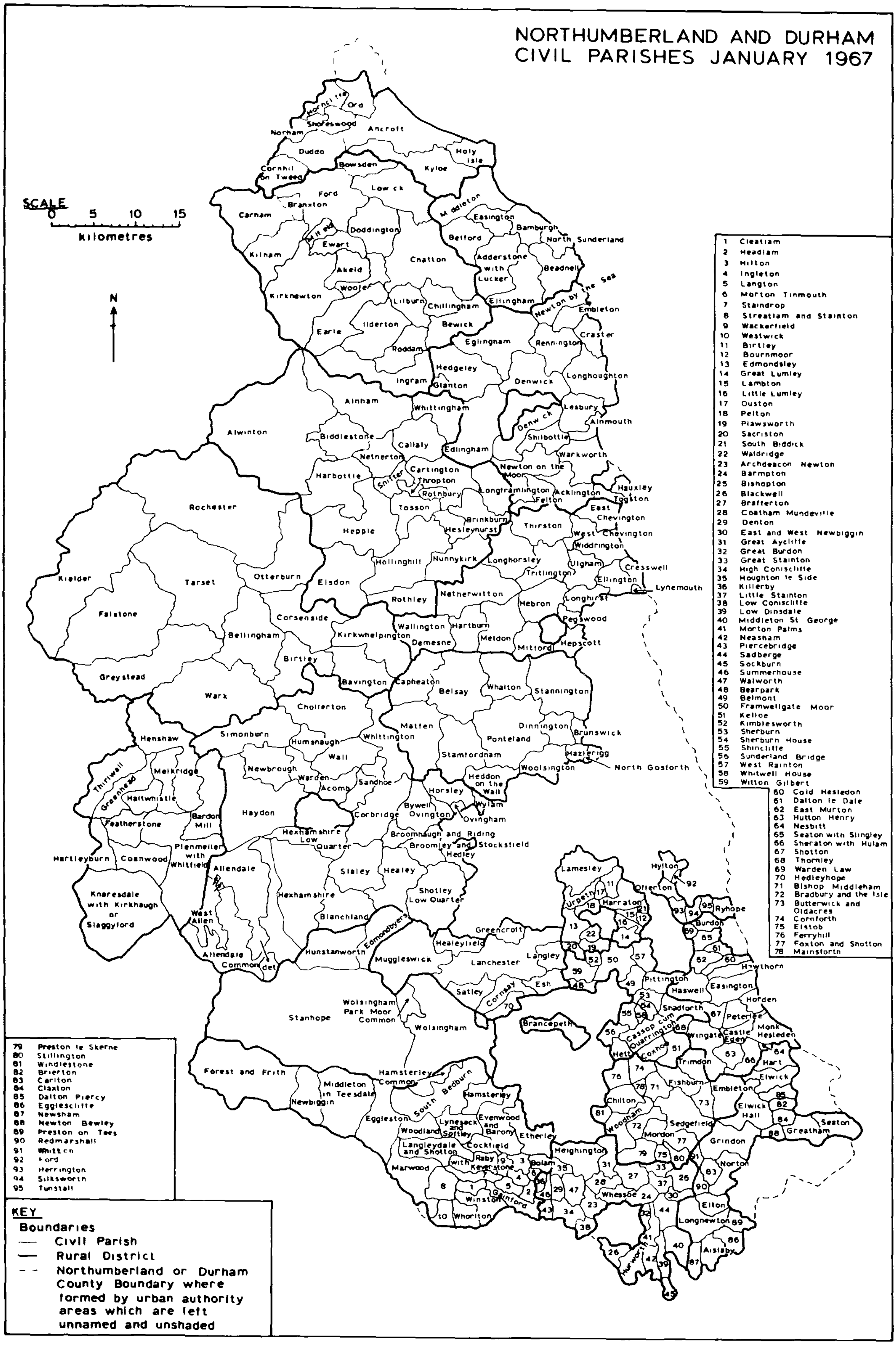
NORTHUMBERLAND AND DURHAM
CIVIL PARISHES JANUARY 1967
SCALE
0 5 10 15
kilometres
N
1 Cleatlam
2 Headlam
3 Hilton
4 Ingleton
5 Langton
6 Morton Tinmouth
7 Staindrop
8 Streatlam and Stainton
9 Wackerfield
10 Westwick
11 Birtley
12 Bournmoor
13 Edmondsley
14 Great Lumley
15 Lambton
16 Little Lumley
17 Ouston
18 Pelton
19 Plawsworth
20 Sacriston
21 South Biddick
22 Waldridge
23 Archdeacon Newton
24 Barmpton
25 Bishopton
26 Blackwell
27 Brafferton
28 Coatham Mundeville
29 Denton
30 East and West Newbiggin
31 Great Aycliffe
32 Great Burdon
33 Great Stainton
34 High Coniscliffe
35 Houghton le Side
36 Killerby
37 Little Stainton
38 Low Coniscliffe
39 Low Dinsdale
40 Middleton St George
41 Morton Palms
42 Neasham
43 Piercebridge
44 Sadberge
45 Sockburn
46 Summerhouse
47 Walworth
48 Bearpark
49 Belmont
50 Framwellgate Moor
51 Kelloe
52 Kimblesworth
53 Sherburn
54 Sherburn House
55 Shincliffe
56 Sunderland Bridge
57 West Rainton
58 Whitwell House
59 Witton Gilbert
60 Cold Hesledon
61 Dalton le Dale
62 East Murton
63 Hutton Henry
64 Nesbitt
65 Seaton with Slingley
66 Sheraton with Hulam
67 Shotton
68 Thornley
69 Warden Law
70 Hedleyhope
71 Bishop Middleham
72 Bradbury and the Isle
73 Butterwick and Oldacres
74 Cornforth
75 Elstob
76 Ferryhill
77 Foxton and Shotton
78 Mainsforth
79 Preston le Skerne
80 Stillington
81 Windlestone
82 Brierton
83 Carlton
84 Claxton
85 Dalton Piercy
86 Egglescliffe
87 Newsham
88 Newton Bewley
89 Preston on Tees
90 Redmarshall
91 Whitton
92 Ford
93 Herrington
94 Silksworth
95 Tunstall
KEY
Boundaries
Civil Parish
Rural District
Northumberland or Durham County Boundary where formed by urban authority areas which are left unnamed and unshaded

Figure 2.2

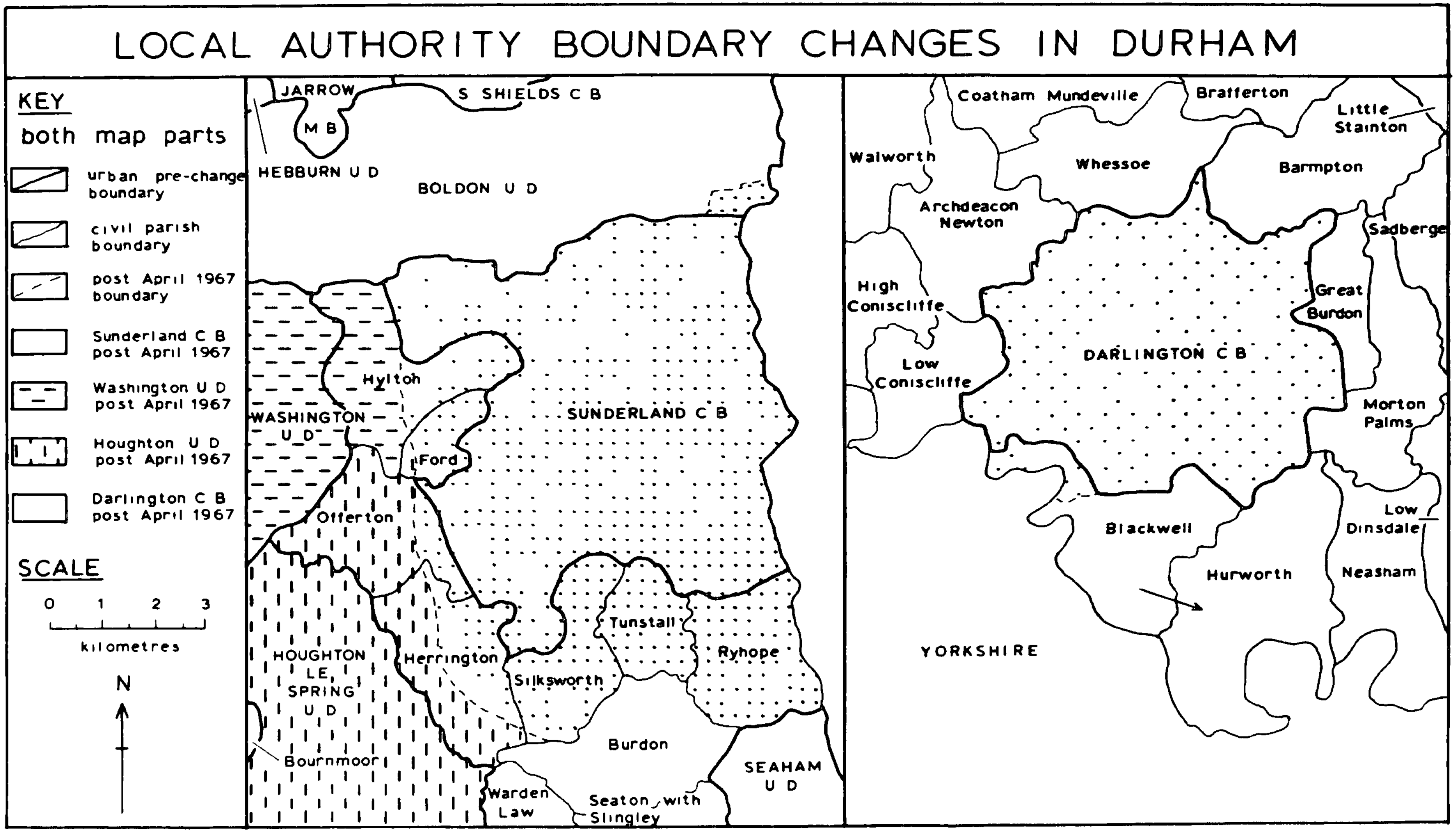
LOCAL AUTHORITY BOUNDARY CHANGES IN DURHAM
KEY
both map parts
urban pre-change boundary
civil parish boundary
post April 1967 boundary
Sunderland C B post April 1967
Washington U D post April 1967
Houghton U D post April 1967
Darlington C B post April 1967
SCALE
0 1 2 3
kilometres
N
JARROW
M B
S SHIELDS C B
HEBBURN U D
BOLDON U D
Hylton
WASHINGTON U D
SUNDERLAND C B
Ford
Offerton
Tunstall
Ryhope
HOUGHTON LE SPRING U D
Herrington
Silksworth
Burdon
Bournmoor
SEAHAM U D
Warden Law
Seaton with Slingley
Coatham Mundeville
Brafferton
Little Stainton
Walworth
Whessoe
Barmpton
Archdeacon Newton
Sadberge
High Coniscliffe
Great Burdon
Low Coniscliffe
DARLINGTON C B
Morton Palms
Low Dinsdale
Blackwell
Hurworth
Neasham
YORKSHIRE

Figure 2.3


BOUNDARY CHANGES IN DURHAM
Nesbitt
Monk Hesleden
Hutton Henry
Hart
HARTLEPOOL M B
Wingate
Sheraton with Hulam
Trimdon
Elwick
WEST HARTLEPOOL C B
Fishburn
Embleton
Dalton Piercy
Butterwick and Oldacres
Elwick Hall
Brierton
Greatham (det)
Claxton
Seaton
Greatham
Sedgefield
Newton Bewley
Foxton and Shotton
Grindon
A
BILLINGHAM U D
Whitton
B
Carlton
Bishopton
Norton
STOCKTON M B
N
Redmarshall
Elton
YORKSHIRE
Preston on Tees
Longnewton
Egglescliffe
SCALE
0 1 2 3
kms
Aislaby
Newsham
KEY
boundaries
urban authority
civil parish
post change
Teesside C B at 1 4 68
Hartlepool C B at 1 4 67
A New Wolviston C P at 1 4 68
B Transfer to Grindon C P on 1 4 68

Figure 2.4

R.D., with the old parish of Norton being completely absorbed, though in unequal return the Rural District did receive a new parish, Wolviston, created from the north-west of Billingham U.D.

In total, however, these were very minor and piecemeal alterations to the nominally rural area, accounting in total for the net urbanisation of slightly over 1,400 hectares and nearly 800 persons enumerated in that area in the 1961 Census. Compared to this, therefore, the division of Sunderland R.D between Sunderland C.B. and the Urban Districts of Houghton-le-Spring, Seaham and Washington, was a relatively major event (Figure 2.3). Nevertheless, looked at in the context of the North-East in general, it is insufficient to more than minimally modify any overall conclusions drawn concerning the area covered by the pre-1967 Rural Districts, especially in so far as, of necessity, nearly all data used in the ensuing study are pre-1967 and so obviously relate to the position before these changes occurred.

How much of the rural North-East is rural? To begin with, the Rural Districts would appear to give far too coarse-grained a coverage, and it is necessary to descend to the smallest unit for which relevant statistics are available. Only at this Civil Parish level is one able to attempt a valid geographical consideration of the abstracts of rurality in terms of the realities of Durham and Northumberland.

2.2 The Density Component of Rurality

Without doubt, some measure of density is a necessity in any consideration of rurality. Though Clarke (1972) is most certainly correct in maintaining that, as the significance of density as a measure is generally inversely related to the size of area over which it is applied, it is possibly best used at something of the order of parish level, where the population and range of environmental conditions is limited, it should nevertheless be noted that even at this micro-level, the use of density as a measure is not without its drawbacks. Indeed, whilst the 'average' conditions over the parish of Stanhope in Weardale R.D. may be considered in terms of 0.2 persons per hectare at the 1961 Census, it must still be remembered that this figure is mainly composed of the population totals of a few villages such as Stanhope, Frosterley and St John's Chapel, and the unpopulated areas which cover the vast majority of the parish's 25,589 hectares.

Nevertheless, at the parish level, density is undoubtedly a significant criterion of rurality. Furthermore, taken together with situation, there is obviously a very strong correlation between it and size of community which is a far more difficult parameter to use and measure. The fact that agriculture is usually important in a rural community means that a considerable area of land per person is necessary, so making large rural communities impossible and a low density of population inevitable (Smith and Zopf 1970). Similarly, it is of fundamental importance that "Population density, in turn, and in particular the change in population density (population concentration) is undoubtedly one of the most important characteristics associated with the process of urbanisation" (Friedlander 1970 p.423). From this basic component of population size/density many other secondary features which differentiate rural from urban communities, are held to stem (Mann 1965).

The necessity for a measurement of density when considering rurality is then clear, even bearing in mind some of its inherent drawbacks as a measure. However, at what level should one consider density as indicative or non-indicative of rurality? Half a century ago, Bowley (1914), whilst admitting that occupation and administrative considerations were not irrelevant took a basic density break point of 0.7 persons per hectare at a Rural District level and one person per hectare at a parish level as being the division between urban-industrial and rural. More recently Stevens (1946) whilst considering rural England and Wales primarily in terms of occupation, held that densities of rural population of between 0.3 and 0.5 persons per hectare are normal in the British context. On the other hand, Edwards (1963) and Ironside (1964) in themselves considering rurality in North-East England, and though the latter did state that other factors such as land use and occupation might be taken into account, both took as their division between rural and urban, a density of one person per hectare at the Rural District level. In so doing they excluded from consideration one-half of the Durham Rural Districts - Chester-le-Street, Durham, Easington, Sedgefield and Sunderland - although, for example, fully eleven out of eighteen parishes in Sedgefield R.D. covering over one-half the area, fell beneath the critical point. Even in Easington R.D., which was considered to be particularly anomalous in its designation, seven of the nineteen parishes had 1961 densities of below one person per hectare.

At the other extreme, R.E. Dickinson (1964) points out that the Ordnance Survey in the graduation of density on its 1:633,600 population map of Great Britain, defined as urban those densities which exceeded 24.7 persons per hectare, the same figure as was earlier noted (section 1.3) to have been used in the special study of the 1951 Census. Dickinson himself, in mapping the urban areas of North-West European lands, considered a density of 1.93 persons per hectare as being the best criterion for the definition of urbanised areas.

To these examples, one could add the views of many other authors, all of whom stress density in this context without agreeing upon the critical level, if any. Certain features may, however, be looked for on a relative scale as being important. As Kurtz and Eicher (1958) have noted, one feature by which the rural-urban fringe may be recognised is that, in so far as its settlement pattern is in transition from a strictly rural to a semi-urban type it will have a density ratio which is intermediate between the rural and urban areas to which the fringe is related, a consequence of rapid population growth through migration.

Figure 2.5 shows density by urban local authority area and rural civil parish in Northumberland and Durham for 1967. For urban areas, the density figures are based upon the Registrar General's estimates of mid-year population for 1967[1] (G.R.O. 1969), and for rural parishes upon estimates derived from electoral roll

1 Minor corrections have necessarily been made to figures for Darlington C.B., Sunderland C.B., Hartlepools C.B., Boldon U.D., Jarrow M.B., Houghton-le-Spring U.D., and Washington U.D. to achieve a figure for the 1967 population discounting the boundary changes of 1st April 1967 (see Appendix A).

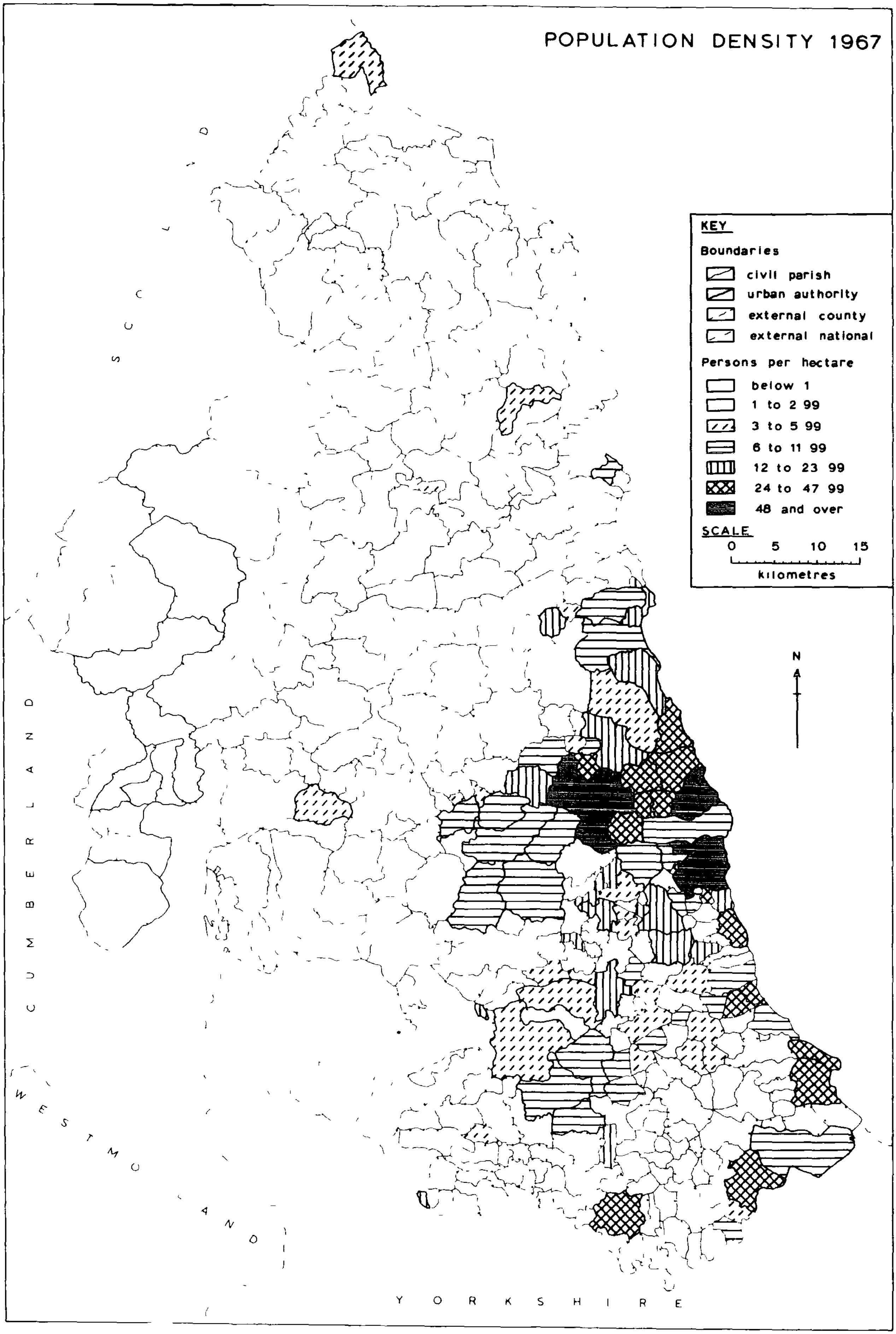
POPULATION DENSITY 1967
KEY
Boundaries
civil parish
urban authority
external county
external national
Persons per hectare
below 1
1 to 2 99
3 to 5 99
6 to 11 99
12 to 23 99
24 to 47 99
48 and over
SCALE
0 5 10 15
kilometres
N
S C O T L A N D
C U M B E R L A N D
W E S T M O R L A N D
Y O R K S H I R E

Figure 2.5

totals (see Appendix A).

If one looks at the resultant map, four main areas stand out by density type. Firstly, a vast tract of Northumberland away from the south-east corner, and the extreme west of Durham away from the urban administrative areas, have a very low density, only rising above the level of one person per hectare in the case of the occasional parish or market town as at Alnwick and Hexham. In the Northumberland Rural Districts excluding Castle Ward and in the two Durham Rural Districts of Barnard Castle and Weardale, out of a total of 177 parishes, no fewer than 143 have densities even below 0.5 persons per hectare and 158 below one person per hectare. In the whole of the enormous Bellingham R.D., the maximum density reached, is that in the parish of Bellingham itself at a mere 0.2 persons per hectare. Of the anomalies, nearly all are situated in the south of Alnwick R.D., the east of Morpeth R.D., the east of Hexham R.D., and the east of Barnard Castle R.D., heralding the transition to a relatively less rural density type (Table 2.1).

Thus, the second density zone that one may recognise, and which must include small parts of the four districts mentioned above, extends in addition over much of Castle Ward and Lanchester R.D.s. In these two districts especially, higher densities tend to predominate with a division of parishes into those bordering on the main urban area of Northumberland and Durham and having over one person per hectare, and those further west with below 0.5 persons per hectare. Relatively few parishes (3 out of 22) have a density between these limits.

Table 2.1

1967 Parish Densities per hectare

Rural District	Number of parishes with density per hectare				
NORTHUMBERLAND	0.5	0.5-0.99	1-1.99	2-3.99	4 and over
Alnwick	10	6	2	1	-
Belford	7	-	-	1	-
Bellingham	12	-	-	-	-
Castle Ward	5	1	3	2	2
Glendale	19	-	1	-	-
Haltwhistle	10	-	-	1	-
Hexham	20	4	1	2	-
Morpeth	14	1	1	1	2
Norham & Islandshires	8	1	-	-	-
Rothbury	18	1	-	-	1
DURHAM					
Barnard Castle	21	2	4	1	-
Chester-le-Street	1	1	4	3	6
Darlington	19	4	2	2	1
Durham	3	2	5	4	4
Easington	4	3	-	4	8
Lanchester	4	2	2	-	1
Sedgefield	10	1	1	2	4
Stockton	13	2	1	2	2
Sunderland	-	1	-	-	6
Weardale	4	-	-	-	-

Thirdly, there is the Northumberland coalfield, Tyneside, Wearside, coastal East Durham and Teesside, where densities are very high, quite often over 24 persons per hectare. With regard to the Rural Districts within this zone, it may be noted that one-third of the parishes in Chester-le-Street R.D. have densities over 6 persons per hectare, reaching 20.1 in Birtley. The latter is a level reached by only just over one-third of the urban administrative areas in Durham, and less than this proportion in

Northumberland. Similarly, though it has some low parish densities, Easington R.D. has some extremely high ones with Horden reaching 25.1 persons per hectare in 1967, a level which it had even exceeded in previous years. Sunderland R.D., as it was before April 1967, however deserves a special mention with three of its seven parishes having densities above twenty persons per hectare, and only Offerton below six.

Finally, a great zone of contrasting density exists, stretching through central and south Durham. Away from the urban area of north Teesside many parishes have densities of the lowest category on the map. A little further north more intermediate and higher densities are found. Thus, whilst in Darlington R.D. only 5 out of 28 parishes reach a density of over one person per hectare, with none but Great Aycliffe at 17.4 being much over two, in Sedgefield R.D. 7 out of 18 have densities which range between 1 and 11.4, and in Durham R.D. 13 out of 18 have similar densities, though most lie below 3. The Urban Districts of this area also have a very contrasting density pattern. Darlington C.B. at 32.2 persons per hectare appears isolated amongst a sea of considerably lower values, but elsewhere densities vary between the 3.8 persons per hectare of Crook and Willington U.D. and the 18.9 of Chester-le-Street U.D.

2.3 The Occupational Component of Rurality

Density, or size of population is not the sole criterion of rurality. Anderson (1960) has pointed out that, for example, rural population and rural occupations are found in the United States in agglomerations far in excess of the national rural/urban division of 2,500 persons, whilst urban population and urban occupations are equally found in places of below 2,500 inhabitants. He concludes:".... the size-of-population yardstick, however, useful for many purposes, is not very helpful in measuring the presence or absence of a rural or an urban way of life"(Anderson 1960 p.6). Indeed, it has been argued that urbanism and ruralism, even outside a narrow sociological sense, do not depend upon a numerical interpretation, but rather a functional one. Bergel (1955) is an extreme exponent of this particular view, holding: "We can neither recognise an area as urban because some people live there nor can we establish a minimum figure of residents for a town. The decision hinges on the question of whether the residents perform an urban function." (p.119). Following from this he concluded that even if a single lighthouse and keeper, whilst performing the urban function of auxiliary transportation services, could not be described as an urban settlement because more than one family is required to form a community, an isolated observatory or remote military base are both decidedly urban in nature.

Whilst one may express doubt as to the geographical validity of this viewpoint, holding that a certain concentration of non-agricultural, urban-type functions are necessary before a settlement may be described as urban (Anderson 1964, Clarke 1972), one may agree with Stevens (1946) who stated: "It is generally implied in geographical analysis that rural population is that which is directly, or at one remove only, maintained by the exploitation of the intrinsic resources of the land. This may be called a functional definition." (p.27). In stating thereafter that such a definition links a rural population with its means of support, which itself exerts some control on population size and density, he does however recognise that occupation is only one element, albeit the most important, in his view of rurality.

Likewise, Friedlander (1970) though recognising the importance of density as a criterion, classifies the counties of England and Wales as urban or rural, solely based upon male agricultural employment. Dickinson (1932 and 1964) operates from a similar though obviously mirror image position to these authors. He concludes that ".... the definition of an urban settlement is fundamentally a question of function, not of population" (Dickinson 1932 p.20). Similarly, Kurtz and Eicher (1958), apart from their density consideration, look at the rural-urban fringe (as distinct from the suburbs where the occupational structure is the same as that of the city) in terms of a mixture of rural and urban occupations, though Pahl (1964) considers the non-agricultural sector to be dominant. Nevertheless, it remains indisputable that cities and urban settlements cannot exist until a differentiation of the agricultural and non-agricultural professions comes into being (Kötter 1964).

It is, then, evident that in addition to density, one must take into consideration occupation or function in any consideration of rurality. Figure 2.6 attempts to do this by

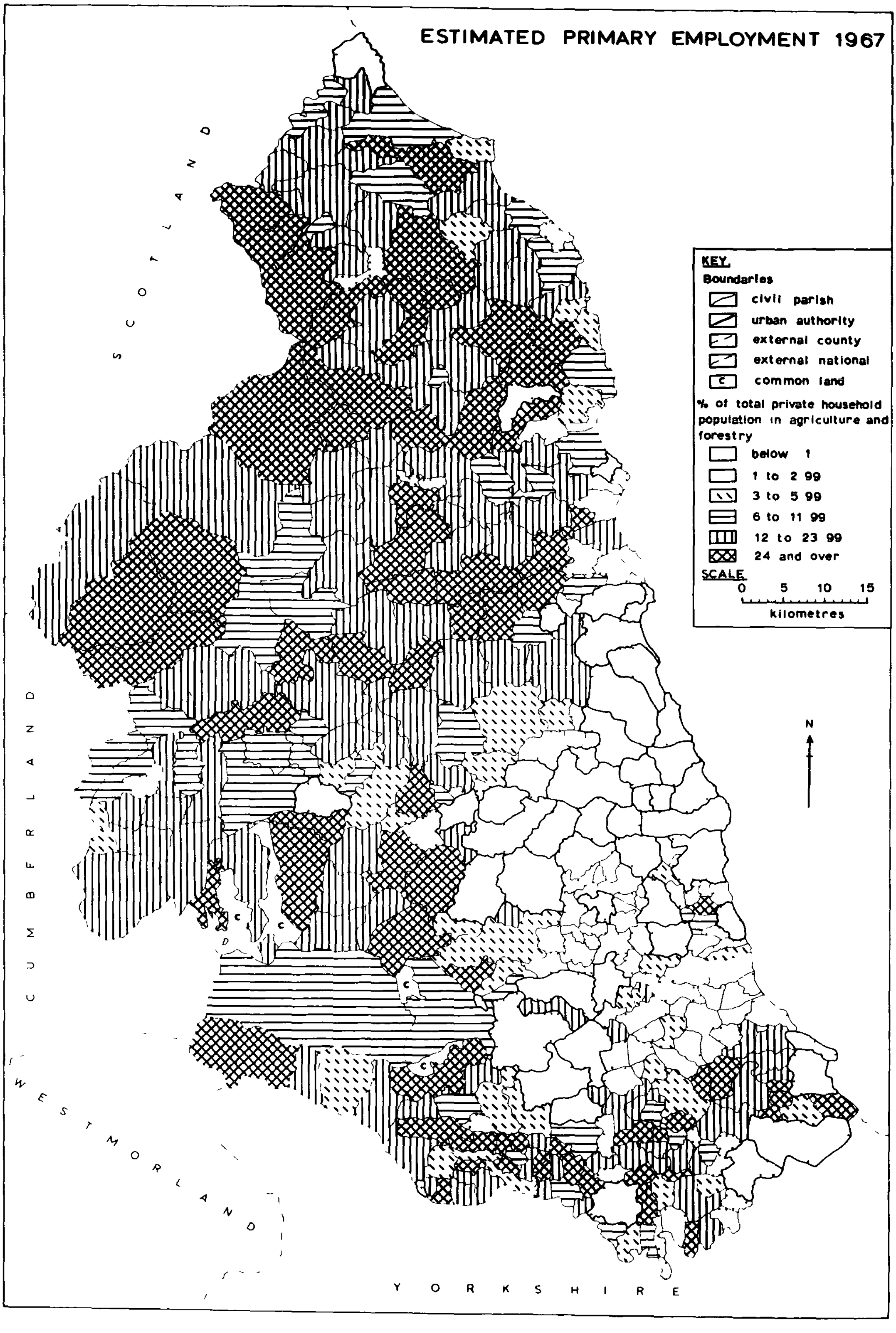
ESTIMATED PRIMARY EMPLOYMENT 1967
KEY
Boundaries
civil parish
urban authority
external county
external national
common land
% of total private household population in agriculture and forestry
below 1
1 to 2 99
3 to 5 99
6 to 11 99
12 to 23 99
24 and over
SCALE
0 5 10 15
kilometres
N
S C O T L A N D
C U M B E R L A N D
W E S T M O R L A N D
Y O R K S H I R E

Figure 2.6

showing the percentage equivalent of the total private household population engaged in agriculture and forestry on a regular basis within Northumberland and Durham at the parish or urban authority level. It is felt that the private household population is a far more realistic denominator here than the total population which also includes (see Appendix A) such institutions as aged persons' homes, hospitals and private schools, a majority of whose populations are obviously unavailable for employment and, whilst in the parish or urban area, in many cases are not of it. Similarly, relating population to the available primary employment within an area, gives a more relevant figure in the present context than would that for the actual percentage of a population in primary employment, even were the latter available, as the former essentially relates a parish or urban authority population to the land as its means of support.[1]

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1 Again, as with density, pre-1967 boundary change areas are taken in all cases, this being facilitated here, and in the following section on land use, by the fact that the 1967 Parish June Returns of the Ministry of Agriculture were for urban authorities and Civil Parishes as they were constituted prior to April 1967. This gives the paradoxical situation that whereas in 1963 the Returns combined Hartlepool M.B. and West Hartlepool C.B., in 1967 following their administrative amalgamation into the single Hartlepools C.B., they actually differentiate between the previously constituent parts.

Leading on from this one point should be borne in mind with regard to Figure 2.6 and the ensuing analysis. The dictates of confidentiality require that certain parishes or urban authorities be amalgamated in the June Agricultural Returns where information might otherwise be gleaned with reference to individual farms. Thus, for the Durham 1967 Returns the following areas were combined: Bolam and Morton Tinmouth (Barnard Castle R.D.); Harraton and South Biddick (Chester-le-Street R.D.); Little Lumley (Chester-le-Street R.D.) and Chester-le-Street U.D.; Low Dinsdale and Sockburn (Darlington R.D.); Framwellgate Moor and Kimblesworth (Durham R.D.); Shincliffe and Whitwell House (Durham R.D.); Castle Eden and Horden (Easington R.D.); Monk Hesleden and Nesbitt (Easington R.D.); Seaton with Slingley and Warden Law (Easington R.D.); Cornforth and Mainsforth (Sedgefield R.D.); Hylton and Ford (Sunderland R.D.).

The definition of the rural primary sector adopted here includes agriculture and forestry but not mining and fishing. Despite the fact that in 1951, 48 percent of employed persons in Easington R.D. were miners with one-half of County Durham's Rural Districts at that date having over 30 percent of their employed population engaged in the mining industry and 39 percent of all miners in the geographical County living in the nominally rural area (Robertson 1961), it is undeniable that much mining is urban and temporary. Whilst mining of itself may not constitute an urban occupation, unlike agriculture or forestry, neither does it constitute a rural one, and hence it is excluded here.

Fishing is excluded from consideration for much the same type of reason. In so far as it is an exploitation of the intrinsic resources of the sea, it may at first appear to have some affinities with the defintion of rural occupations adopted by Stevens (1946). However, like mining, much fishing is undeniably centred on large urban port settlements (Beaujeu-Garnier and Chabot 1967). Furthermore, unlike mining, it is only of very limited and local significance in the area at present under consideration. In 1967 a mere 966 insured persons in Northumberland and Durham Employment Exchanges were recorded as being employed in fishing (Table 2.2).

From Table 2.2 it is apparent that 40 percent of those employed in fishing were exchanging insurance cards within the North Shields Employment Exchange, which corresponded to the administrative area of Tynemouth C.B. Many of the remainder were also similarly of distinctively urban origin, with only Alnwick Employment Exchange which in 1967 covered a huge area from

Table 2.2
Number of Insured Persons Employed in Fishing 1967

Employment Exchange	Number	Employment Exchange	Number
Alnwick	110	North Shields	393
Amble	20	Seaton Delaval	48
Ashington	33	South Shields	7
Bedlington	3	Stockton	13
Berwick	175	Sunderland	13
Blyth	10	Wallsend	2
Hartlepool	138	Whitley Bay	18
Newcastle	3		

Source: Department of Trade and Industry, Newcastle

Bamburgh (Belford R.D.) in the north to the Cheviot and Scottish Border in the west and Newton-on-the-Moor (Alnwick R.D.) in the south, being noteworthy in the rural areas. Here 110 persons were recorded in fishing, and though a knowledge of the Northumberland coast ties most of these down to the parishes of Alnmouth, Beadnell, Craster, Longhoughton and North Sunderland (it should again, however, be remembered that persons exchanging their insurance cards in the Alnwick Employment Exchange may well have been employed elsewhere), the available material does not in any case allow of any greater breakdown. In view of all these factors, fishing, like mining, is here ignored.

The employment statistics used in the construction of Figure 2.6 are based upon parish employment data for regular whole-time and regular part-time agricultural workers as recorded in the

June 1967 Agricultural Census with an addition within each parish and urbanauthority area equal to the number of agricultural holdings in that area. The reason for the latter addition is made clear when one states that in 1965, for example, 164,000 out of 306,000 agricultural holdings in England and Wales were recorded as employing no workers (M.A.F.F. 1965). Thus, as the June Returns at this time do not include any data on farmers or farm managers, it is necessary to make some allowance for them in the subsequent analysis. It is held that a rough index of one employer per holding will not be far from reality especially in so far as any complication introduced by multiple holdings will probably be offset by the non-inclusion of any work done on the holding by the employer's family.

Secondly, where necessary, a further addition to the parish or urban area primary employment total is made with respect to forestry, based upon 1967 forestry employment figures by Employment Exchange areas and Ordnance Survey 1:63,360 Map-derived measurements of woodland (see section 2.4). As no greater breakdown for forestry employment is available than that at the Employment Exchange level, parishes and urban authority areas within an Exchange have been allocated workers in direct correspondence to the proportion of woodland contained. For example, the parish of South Bedburn in Barnard Castle Rural District contained an estimated 2,278 hectares of woodland compared to the 3,206 hectares situated in the whole Employment Exchange area. On this basis, therefore, the parish was assumed to have a capacity for 40 of the 56 workers recorded as being employed in forestry in the Bishop Auckland Employment Exchange area in 1967. Predictably, few parishes were substantial sources of forestry work and estimates involving over ten persons in one parish or urban authority area (a mere seventeen such cases occurred in total), reflect very closely the distribution of such obvious areas as Forestry Commission Plantations. Thus, the parishes of Falstone, Kielder, Rochester, Tarset and Wark in Bellingham R.D. are here estimated in 1967 to have employed 313 forestry workers or nearly 38 percent of the total in all Northumberland and Durham Employment Exchanges, including the salients from the latter into Yorkshire.

Taking into account a then Northern Region activity rate of slightly below 40 percent of the total population, it can be seen that below 3 percent on Figure 2.6, primary employment as here defined is unimportant, by 6 to 12 percent it has assumed some significance, at 12 to 24 percent it is likely to be assuming dominance and at levels above 24 percent it assumes the proportions of a monopoly. Local deviations from the regional activity rate and population age-structure will cause some variations in the precise significance of any figure but these are extremely unlikely to be at all noteworthy.

As Figure 2.6 shows, the few parishes in the top category often tend to be isolated and far removed from urban influence - hence the high values over much of Bellingham, Rothbury and Glendale R.Ds, though especially in south Durham towards the River Tees some exceptions to this do occur as in the parishes of Embleton and Butterwick and Oldacres in Sedgefield R.D. Both of these approach a value of 50 percent, probably revealing a daily net immigration of agricultural workers. Obviously, a complex interaction of factors is represented here including the presence or absence of mining in the vicinity, density of population, proximity of urban centres and land quality.

Three features clearly brought out on Figure 2.6 are, however, worthy of further note. The first is the great expanse of central and north-east Durham and south-east Northumberland where values tend to be uniformly low. No urban administrative area in the two counties has the equivalent of even 2 percent of its population in primary employment with Crook and Willington, and Alnwick Urban Districts being the sole representatives reaching the minimal level of 1 percent. Chester-le-Street R.D. has no value above the 2.6 percent of Edmondsley Civil Parish (Table 2.3), whilst Durham R.D. has isolated high values only. Similarly Easington R.D. exhibits generally low values (though it is not helped by the two parish combinations involving Nesbitt and Castle Eden whose values would be substantially higher had they not been amalgamated here with Monk Hesleden and Horden respectively), whilst Sunderland R.D. is entirely in the first category excepting the parishes of Silksworth (1.1 percent) and Offerton (5.7 percent).

Secondly, one may note that west Durham and Northumberland away from the coalfield and the coast (the latter partially reflecting the influence of fishing but possibly also the occurrence of work related to tourism), have extensive tracts where values are over 12 percent. Thus, the lowest value for any parish in Bellingham R.D. is 8.4 percent.

Finally, it is apparent that south Durham values vary considerably. Nevertheless, there is a substantial extent of high values which tends to dominate the area though broken especially towards the lower Tees by islands of low primary employment percentages.

Overall, the patterns presented through mapping density and occupation, as might be expected from what has already been said, show a fundamental close similarity. However, at the

Table 2.3

Percentage Equivalent of 1967 Parish Populations Employed in Forestry and Agriculture on a Regular Basis

Rural District	Number of Parishes Falling into the Relevant Classes					
NORTHUMBERLAND	<1	1-2.9	3-5.9	6-11.9	12-23.9	24 & over
Alnwick	-	4	3	4	4	4
Belford	-	1	1	2	4	-
Bellingham	-	-	-	3	4	5
Castle Ward	3	1	3	1	4	1
Glendale	-	1	-	2	9	8
Haltwhistle	-	1	1	3	6	-
Hexham	-	3	3	6	8	7
Morpeth	3	3	-	2	5	6
Norham & Islandshires	-	-	1	2	5	1
Rothbury	-	1	1	1	10	7
DURHAM						
Barnard Castle*	-	1	6	2	9	9
Chester-le-Street*	9	5	-	-	-	-
Darlington*	1	2	2	5	9	8
Durham*	4	5	4	-	3	-
Easington*	8	4	1	1	1	1
Lanchester	-	2	3	1	1	2
Sedgefield*	4	1	2	2	3	5
Stockton	-	4	2	2	7	5
Sunderland*	4	1	1	-	-	-
Weardale	-	-	-	2	2	-

*Parish amalgamations (see above) are taken as a single value where they occur in these Rural Districts detailed level there is much variation. One has, for example, the situation where the parish of Stanhope in Weardale R.D. had a 1967 density of 0.19 persons per hectare and a primary employment percentage of 6.7 percent, whilst Headlam in Barnard Castle R.D. had a considerably higher primary employment figure (20 percent) despite an almost identical density. In consequence, one may see that the interaction of parish size, land quality, population total and distribution, together with the nature of available employment are all important here, and emphasize the inadequacy of any single measure of rurality.

2.4 The Land Use Component of Rurality

If a relatively low density and a relatively high primary employment ratio are two points which one would look for in a rural area, there is yet a third, that of extensive land use. This point especially is picked out by Freeman (1968) in his criticism of the urban and rural connotations of local government areas, stating that some Urban and Rural Districts equally administer countrysides dominated by farming though possibly with a far greater proportion of their inhabitants in other occupations. More strikingly, Best and Coppock (1962) have pointed out that even within the borders of many County Boroughs there may be extensive areas of land that are wholly non-urban in character. The example of Bradford is given, this city having had as much as 50 percent of its area under farmland at that time. Thus it is concluded that: "In many cases administrative urban limits consequently overstate the actual urban area by a considerable amount" (Best and Coppock 1962 p.153).

Similarly, if attention is turned to the dynamic and critical area of the rural-urban fringe, land use is a frequently utilised factor of definition. Dickinson (1964) notes that among the features resulting from the development of fringe zones, are the removal of land from agricultural production and the boosting of land values within the zone to levels at which it is no longer profitable to continue agricultural work. Wehrwein (1942) even went so far as to actually define the fringe zone in terms of an area of transitional land use between recognised urban usages and agriculture. A similar sentiment is expressed by Gist and

Fava (1964), who considered that the underlying characteristics of the rural-urban fringe are well expressed in its terminology, with it being neither urban nor rural but exhibiting an amazing variety of people and land uses both of which are not neatly polarized into clusters but rather are seemingly chaotically intermingled. Therefore, as a corollary, Kurtz and Eicher (1958) in their definitive paper, note that amidst the mixed rural and urban land use much farmland still exists. Indeed Pahl (1964) considered that one feature of the fringe zone is that it is more rural than urban in appearance, a point which even the extreme views of Bergel (1955) were willing to concede.

This particular concept of rurality in terms of its application to the rural-urban fringe is especially important with respect to many Rural Districts in North-East England with the frequent importance of coalmining and proximity of obvious urban centres. Whilst developments have been great since Cobbett's perambulation through the Durham countryside, at which time he found the landscape pleasant and little affected by the nascent mining industry (Cobbett 1832), it was still possible for Smailes (1960) in his authoritative text on the region, to look at the coalfield south of Blyth and outside the conurbations and state: "... the manifestations of mining and industry are ubiquitous features of the scene, though they do not occupy the whole terrain. Most of the countryside in fact is still farmed. Farmland has been seriously encroached upon ..... and the farm economy is throughout dominated now by the needs of the industrial communities. Yet many features of the agricultural countryside and its rural settlement pattern that belong to an earlier age show through the texture of the heavy, but not uniformly heavy overlay" (p.189).

The same sentiment is expressed by other writers on the region (e.g. Sharp 1946, House 1959, Creigh 1966) whilst Daysh and Symonds (1953) point out with regard to the old west Durham mining area at a time of greater industrial activity than the present, that though the villages and small towns may individually have a high density of population, the impression gained from a map is that of a predominantly rural area. In addition, it is noted that the inhabitant of the area at this time perceived his environment as being essentially rural.

Nevertheless, others have viewed the same area in a different light. Thus, the Northern Economic Planning Council (1967) in looking at agriculture, horticulture, forestry and fishing in the region, speak of this part of the coalfield as having a semi-urbanised rather than a rural appearance, whilst Thorpe (1970), though noting that the 1958 density of regular agricultural workers over the coalfield as a whole was only surpassed in the richest areas of the South-East, still saw fit to term the area "... a single urbanized region" (p.393).

Whatever the true position may be with regard to this essentially middle section of the geographical rural-urban continuum, some resolution of these seemingly opposing views may possibly be achieved in terms of the scale factor. Consequently, at the subregional level the diversity of the total area would seem to give ample evidence and opportunity to develop the opinion of a predominantly urban or rural landscape. Is it entirely coincidental, for example, that House (1959) was looking at the region mainly from a rural viewpoint whilst Thorpe (1970) approached it essentially as an urban geographer? It ought, therefore, to be the case that a more detailed consideration of land use at the parish or urban authority level will expose clearly those elements of urbanism and ruralism in terms of land use, which are suppressed or lost in taking a general overview.

Consequently, some assessment of land use must be made along with that of density and function/occupation, in considering rurality. Wibberley (1960) has outlined what factors of land use should be given attention in this context in so far as he states that in much of modern society the dominant feature of rural areas in many countries is no longer the high percentage of primary population, but rather extensive land use. Hence he includes in the category of rural communities all those which are dominated by extensive uses of land, irrespective as to whether or not the majority of the inhabitants of such communities actually draw their material support from the extensive land uses.

The acquisition of land use data at anything below regional level is beset with difficulty and the following criticism made of the Census is certainly no less true with reference to land use statistics: "It has been the unhappy experience of most investigators that, in order to reconcile unsuitable classifications and disparate areal units with the problem on hand, they have to adopt lengthy and often indirect procedures"

(Robertson 1969 p.173). With regard to the measurements required in this case, it has been necessary to assess the areal extent of three types of land utilisation: woodland, common land and other agricultural land.

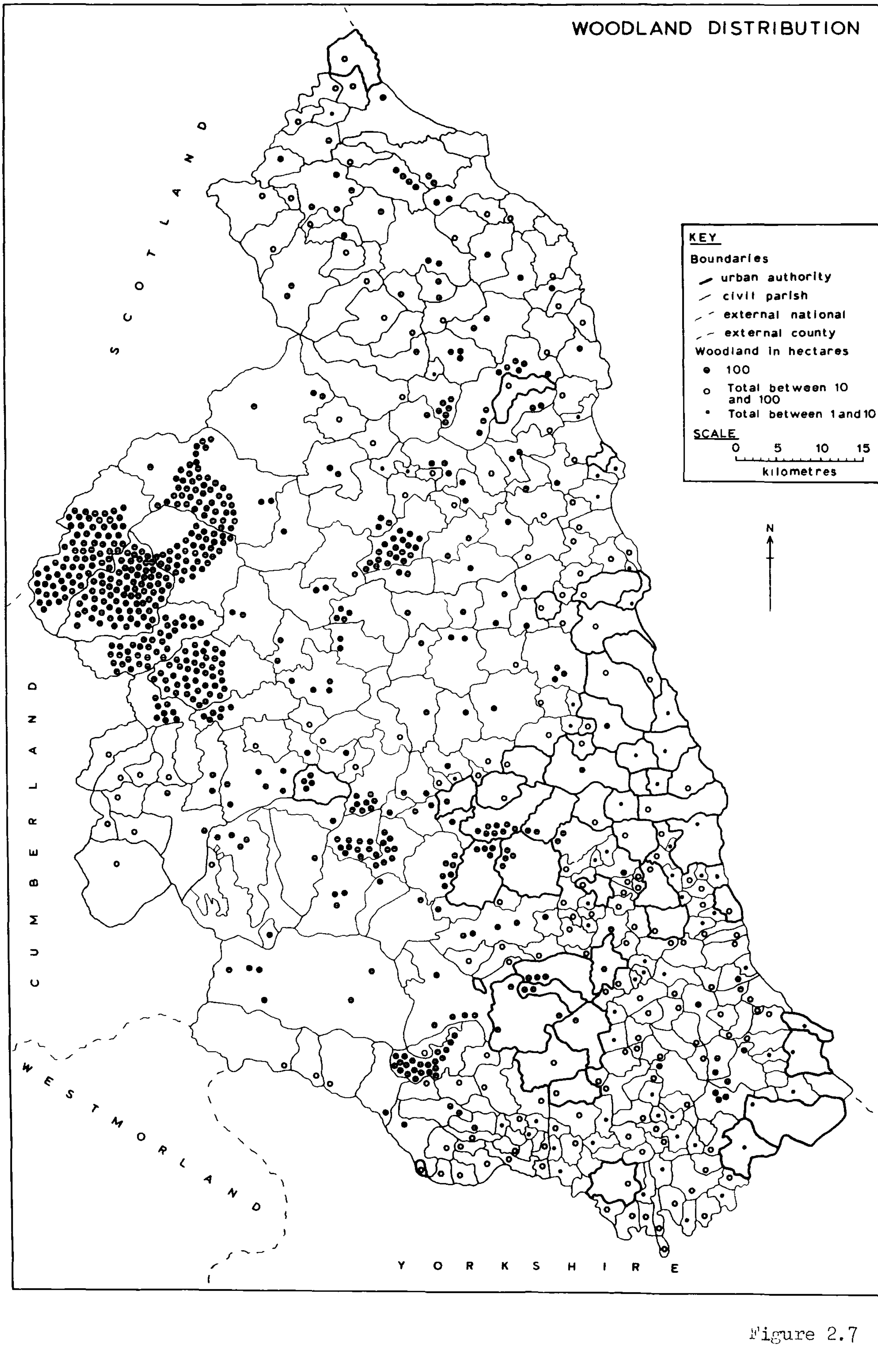
For woodland and forest areas, few records exist to aid one in an assessment of the extent of a parish or urban authority area so covered. The most detailed level at which one may acquire figures on the area of woodland is for Forestry Commission Conservancies, which cover extensive tracts of land, far above Rural District level. Moreover, such data generally refer solely to Forestry Commission woodland, entirely ignoring the private sector which in Northumberland and Durham accounts for approximately 40 percent of the total. Local authorities usually maintain no records of any greater use, and therefore, the closest approximation possible to parish and urban local authority areas of woodland, was made on the basis of Ordnance Survey 1:63,360 maps. The very smallest areas were estimated whilst the remainder were laboriously measured by planimeter.

This procedure has naturally involved several minor problems. Firstly, the scale of the source material at 1:63,360 means that portrayal and measurement cannot be entirely adequate, especially when dealing with the smallest areas. Secondly, the dates of revision for the various map sheets[1]

1 The 1:63,360 Seventh Series Ordnance Survey Sheets used were as follows:
Sheet 64 (revised 1963-4); Sheet 70 (revised 1961-2); Sheet 76 (revised 1961-2); Sheet 77 (revised 1961-2); Sheet 78 (revised 1964); Sheet 84 (revised 1962); Sheet 85 (revised 1958); Sheet 86 (revised 1963).

which cover Northumberland and Durham differ slightly, therefore reducing comparability, and all are for a period prior to 1967, though the areas measured have necessarily been related to this date in the subsequent analysis. Thirdly, whilst the transverse Mercator Projection of the maps themselves is of little consequence, some distorting influence is introduced by sloped surfaces being portrayed in two dimensions only. Thus, any slope of the ground will mean that the area measured on the map is somewhat less than the actual to the extent of 1.5 percent for a 10 degree slope and 15.5 percent for one of 30 degrees. The effect, however, is only pronounced in very hilly areas and the usual practice (Dickinson 1969) has been adopted here in ignoring it in measuring the extent of woodland.

Despite these obvious shortcomings of the method, the results (Figure 2.7) appear to be realistic. The vast majority of parishes can be seen to possess a small quantity, between one and ten hectares, of woodland, but in relatively few is it a major component of land use. Such cases are restricted to three main areas. In the western part of Bellingham R.D. approximately 70 percent of Falstone and proportions varying from one-quarter to one-half of the parishes of Greystead, Kielder, Rochester, Tarset and Wark are estimated to be covered by woodland. In County Durham the parish of South Bedburn in Barnard Castle R.D. is over 50 percent forest covered, whilst some parishes and even urban local authority areas between Consett and Hexham (Blaydon U.D. at 22 percent forest covered being the most notable of these) also possess much woodland.



WOODLAND DISTRIBUTION
KEY
Boundaries
urban authority
civil parish
external national
external county
Woodland in hectares
100
Total between 10 and 100
Total between 1 and 10
SCALE
0 5 10 15
kilometres
N
SCOTLAND
CUMBERLAND
WESTMORLAND
YORKSHIRE

Figure 2.7

To be added to the area of woodland is that of common land. Whilst in many cases such areas consist of no more than small village greens, of which a substantial proportion perform no function which could be designated as extensive use of land, some being completely unused, the importance of the few large, and rather more frequent medium-sized areas of common land, is sufficient to merit attention. Indeed, a considerable proportion of mountain moorland in some of the highland areas is grazed as common land.

Following from the unsuccessful attempts of the interwar Land Use Survey to specifically document common land (see Stamp 1962) and the plea of the Royal Commission on Common Land (H.M.S.O. 1958 Cmnd 462) that a detailed registration of commons was necessary, the 1965 Commons Registration Act sought to rectify matters. Through the Act, County Borough and County Councils were required to compile a register of any land within their boundaries held to be common.[1] Figures for the areas of such pieces of land within individual parishes and urban authority areas were thus obtained from the relevant Registration Authorities,[2]

1 For the purposes of the Act, Common Land was defined as land which was subject to rights of common and the waste land of a manor not subject to rights of common. Town and village greens were to be recorded in a separate register, these being defined as land allotted under any Act for the recreation of the inhabitants, or any land on which the inhabitants had a customary right to indulge in lawful sports and pastimes or had done so as of right for at least twenty years. Recreation grounds, however, were not normally to be included.

2 For Allendale Common, Wolsingham Park Moor and Hamsterley Common, the areas were taken as being those given in the relevant volumes of the 1961 Census of England and Wales, County Reports for Durham and Northumberland (.G.R.O. 1963a and b).

though for the County of Northumberland in the absence of these and availability only of maps and written descriptions, it was necessary over the course of several days to carefully measure by planimeter, the commons and greens as shown on the registration maps. With the proviso that a subsequent legal enquiry may remove a few small tracts of land from the registers, Figure 2.8 may be regarded as a final statement on the subject, as any land not registered under the 1965 Act, and registration ceased on the first day of 1970, will normally cease to be common or green, even if so previously.

As Figure 2.8 shows, the distribution of common land (including greens) is sporadic and uneven, though in south-east Durham many parishes have a small amount. Of the medium and large-size areas, however, the vast majority outside the three interparish commons (Hamsterley Common, Wolsingham Park Moor and Allendale Common, as shown on Figure 2.2) is restricted to the dales parishes of County Durham. Indeed, of the author's provisional estimate of nearly 34,000 hectares of common land in the two counties, the Durham proportion is nearly 70 percent of the whole, nearly all of this outside the County's two inter-parish areas, being in the parishes of Forest and Frith, Eggleston, Wolsingham, Stanhope and Muggleswick. Over 60 percent of the parishes of Muggleswick and Eggleston is composed of common land, whilst the vast Stanhope parish contains the astonishing total of 12,468 hectares, over one-third of the total in the two counties. On the other hand, Northumberland, excluding the massive Allendale Common (7,328 hectares), contains a mere 3,231 hectares, over 60 percent of which is accounted for by a tract of slightly under 2,000 hectares in Hexhamshire

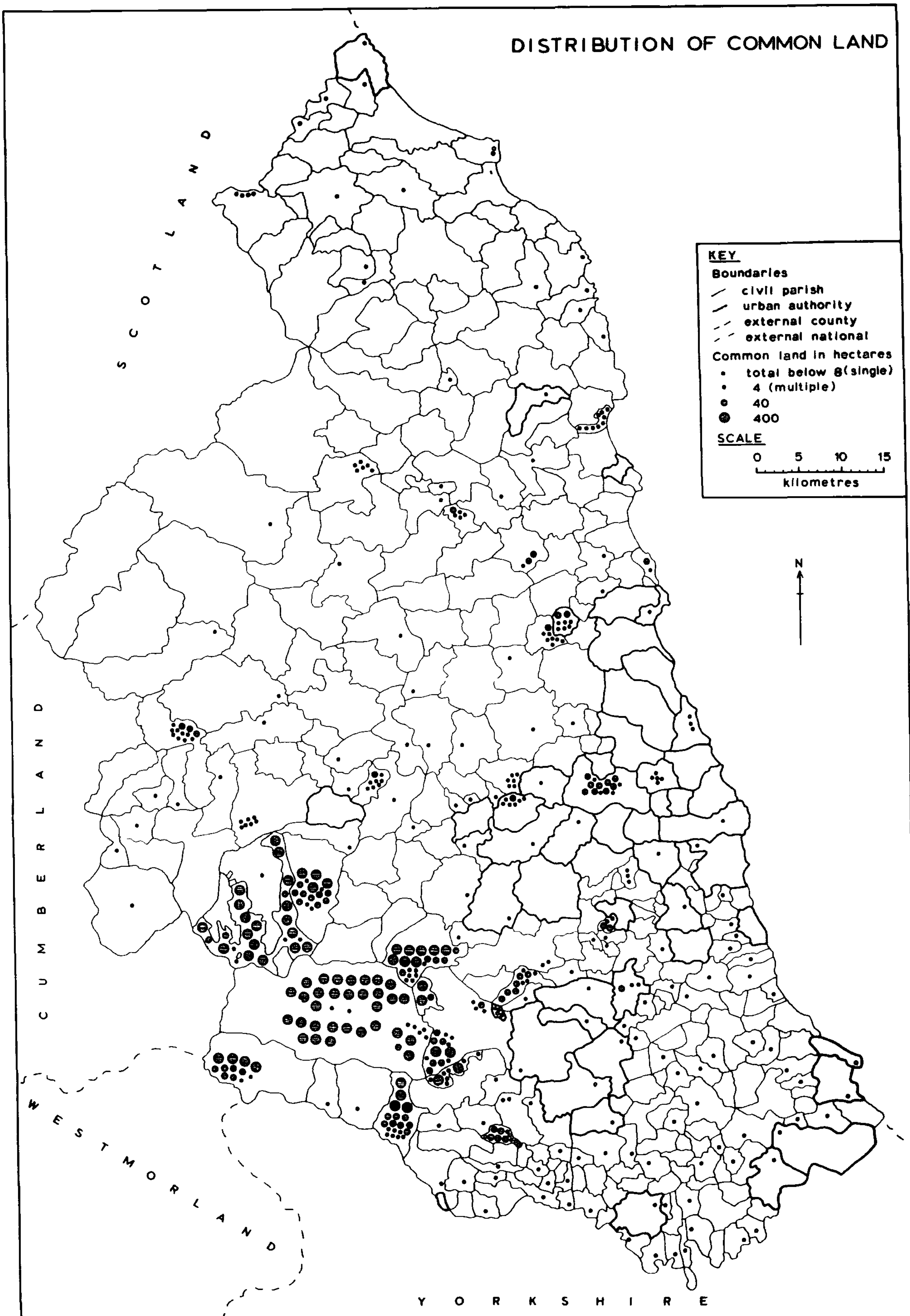

DISTRIBUTION OF COMMON LAND
KEY
Boundaries
civil parish
urban authority
external county
external national
Common land in hectares
total below 8(single)
4 (multiple)
40
400
SCALE
0 5 10 15
kilometres
N
SCOTLAND
CUMBERLAND
WESTMORLAND
YORKSHIRE

Figure 2.8

parish.

It is interesting to compare these rather more definitive figures with those estimates given in the Report of the Royal Commission on Common Land (H.M.S.O. 1958 Cmnd 462), this being a telling commentary on the state of some land use statistics, which is only tardily being remedied. Whilst the Commission estimated the area of common in Durham at 28,883 hectares (here 23,346) and in Northumberland at 10,216 hectares (here 10,558), individual estimates varied considerably from present totals, by well over 10 percent in such cases as Burnhope Moor, Kilhope Moor, Stanhope Common, Edmondbyers Common and Eggleston Common.

Finally, to ascertain by far the most important element overall in land use, that of agricultural land, reference was once again made to the annual June Returns kept by the Ministry of Agriculture, these excluding both common and woodland. Perhaps not surprisingly these returns also provide some problems of usage. As Best and Coppock (1962) point out, there is no way in which the accuracy of individual returns may be measured, and whilst there is no reason to hold that deliberate errors are common, it is noted that nearly one-half of the occupiers to whom schedules are sent need at least one reminder to return them. Moreover, fields are often held by a reputed acreage which may only be very approximate and the extent of rough grazing is frequently only very imperfectly known. Indeed, with reference to the study area, Best and Coppock point out that a recent investigation showed that over 300 hectares at the summit of one Northumberland hill were unclaimed by either of the surrounding farms.

The most serious problem in using these returns as representing land use at the present level of consideration is, however, little realised. Though the returns are at a parish level they record land use without regard to the parish boundary but rather according to the parish (or urban authority area) within which the farmhouse is situated. It might at first be thought that consequent additions and losses of land relating to a single parish would generally nearly balance, but in very many cases this does not appear to be so and, quite often, the result of comparing the agricultural area and a corresponding parish area is to find that the latter is far exceeded by the former. Therefore, in considering the total primary land use in each parish or urban unit, to minimise these data failures, a running mean solution applied in two-dimensional space is adopted, whereby the sum of primary land use (agricultural land plus common and woodland) in a parish and all contiguous parishes, or urban authority areas, is expressed as a percentage of the corresponding total land area. Figures for the latter are derived from the appropriate County Reports of the 1961 Census (G.R.O. 1963a and b). Consequently whilst Figure 2.9[1] appears to have produced a generally eminently reasonable result, more credence should be given to the overall pattern rather than to individual figures which in the case of occasional small units may be somewhat distorted, if the latter are surrounded by large contrasting areas.

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1 As with occupation, where the Ministry of Agriculture June Returns amalgamate parishes for 1967 (Section 2.3), the practice has necessarily been followed in calculating land use percentages here.

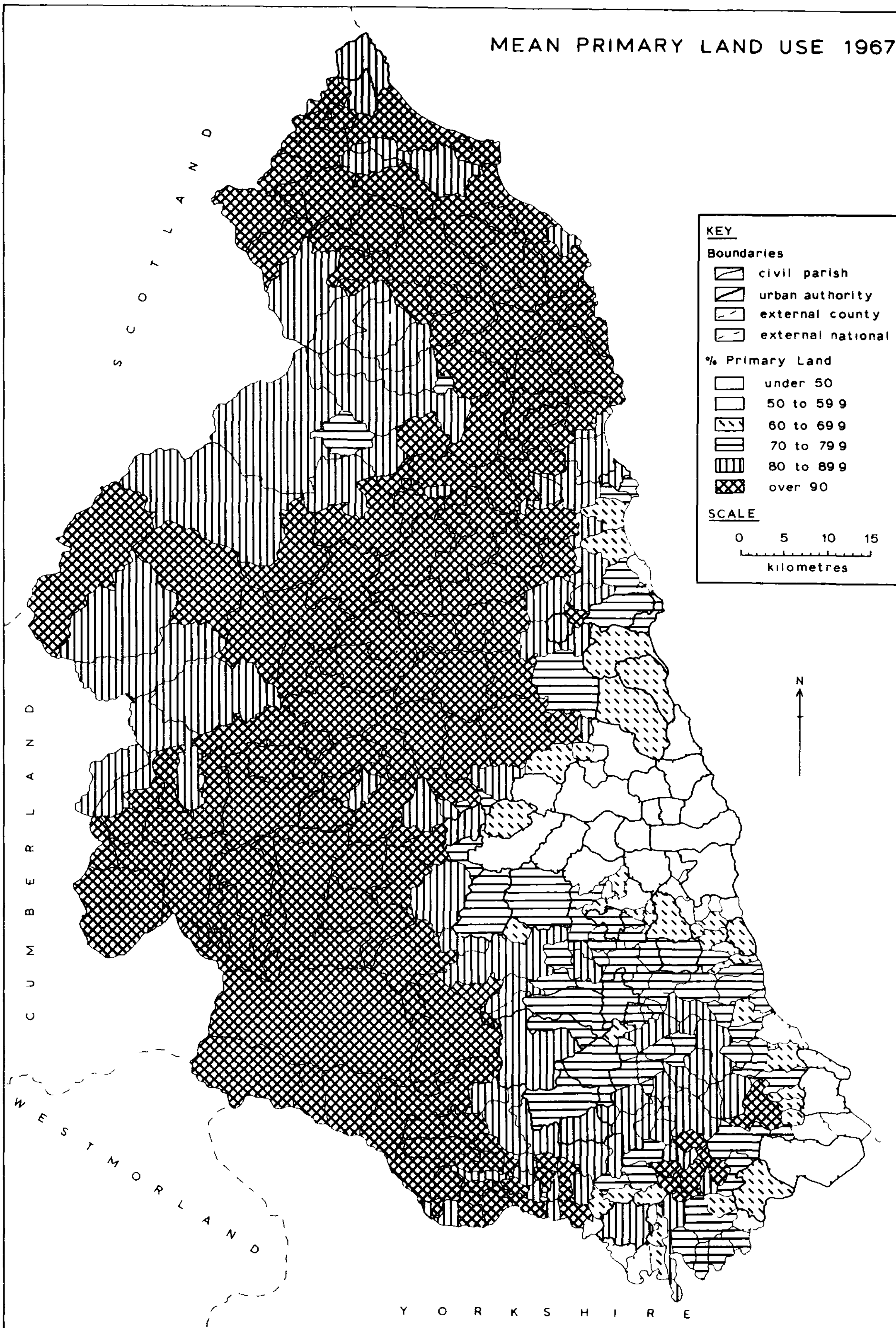
MEAN PRIMARY LAND USE 1967
KEY
Boundaries
civil parish
urban authority
external county
external national
% Primary Land
under 50
50 to 59 9
60 to 69 9
70 to 79 9
80 to 89 9
over 90
SCALE
0 5 10 15
kilometres
N
SCOTLAND
CUMBERLAND
WESTMORLAND
YORKSHIRE

Figure 2.9

Three main features stand out from Figure 2.9. First, there is a wide belt surrounding lower Tyneside and Wearside, extending over Sunderland and parts of Chester-le-Street and Castle Ward R.D.s where values rarely rise above the low level of 60 percent. Secondly, before the lower values on north Teesside are reached, an extensive belt in central and south-east Durham has only moderate values but with isolated cores of high value in Sedgefield, Stockton and Darlington R.D.s. The importance of these core areas should perhaps be stressed in so far as the running mean method will, in widening the area of relevance for a single parish or urban authority smooth peaks and troughs into generally more moderate totals. Consequently, amidst the lower values of this area, these parishes of near maximum percentages truly represent a core area of rural land use.

Finally, one may note the great belt of maximum values from west Durham continuing on through the whole length of Northumberland. The two tracts of slightly lower values in the west of the latter county may possibly be explained in the following terms. The rough high moorland in the north of Haltwhistle R.D. and the much forested uplands in the south of Bellingham R.D. may exhibit these slightly lower values as a result of some land, neither common nor wood, not being recorded for the purposes of the Ministry of Agriculture as being under agricultural land usage. The transition period between the acquisition of hill sheep farming land and afforestation, especially bearing in mind the dates of the maps used in calculating the area of woodland, would have this effect on land purchased by the Forest Commission. Similarly the statements made above on the general deficiencies of the June Returns are also pertinent here. Secondly, one has the slightly lower values in the highlands surrounding the Cheviot. Much the same may be said of this area as of the former whilst the occurrence of some military land use here, will obviously have escaped account in assessing the primary land use percentages. The particularly low value associated with the parish of Biddlestone (slightly below 80 percent) is particularly pertinent here, being augmented by contiguity to the large upland parish of Alwinton where approximately one-third of the area is not ac counted for by the June Returns (plus woodland) for this parish alone.

2.5 The Situational Component of Rurality

There would also appear to be a fourth factor to be taken into account with regard to rurality. Nearly always stated, at least implicitly, is the concept of a situational aspect. Exemplification of this has already been given (Section 1.5) whilst further strength to the case for situation to be fully taken into account is added by other workers. Stirling (1953) divides rural areas into those relatively near towns and those considerably further away - the remoter rural areas. He looks at the rural areas between six and ten miles from a town and its urbanized fringe as being areas of compromise between urban society and economy and those of a more truly rural nature. It is further considered that the villages in this zone possess a vastly different function, the tendency being towards dormitory development, from those in the remoter rural areas. Similarly, Zelinsky (1962) speaks of rural population that is "locationally urban" (p.494), whilst Bowley (1914) is typical of many modern writers in so far as, though in his introductory discussion as to what constitutes a rural population he does not explicitly consider a situational component to rurality, this idea still frequently enters his subsequent analysis, stating: "... however thoroughly we purify the population of urban and mining influences, we still find that the remaining population falls less or increases more in the neighbourhood of industry or residence" (p.607).

Indeed, if one considers the nature of the problematic rural-urban fringe, the locational criterion must obviously be of extreme importance. Consequently, Pahl (1964) defines the fringe in relation to the city whilst Kurtz and Eicher (1958) remark upon the predominance of locational factors in its definition, regarding it themselves in terms of proximity to, but being outside the limits of the city.

Hence, some consideration of location with regard to obvious urban centres or zones is a required factor in an assessment of rurality. To some extent the situational component was incorporated in looking at land use, in so far as all contiguous areas to a central unit were also taken into account, thus, for example, increasing some urban primary land use percentages by including surrounding Rural District parishes, and conversely decreasing some parish values, though the precise nature of this depended on the degree of overlapping exhibited by the land use returns and the relative sizes of central and surrounding units. Such a consideration is far too restricted in nature in present terms and it would appear more useful to consider proximity with regard to the aggregate population of the region. The measure adopted here is that of population potential which Warntz (1964) described as defining "... a demographic gravitational field that is a useful concept for the understanding of certain features of the geographical patterns of economic and sociological activities" (p.170).

The value of the population potential for a single parish or local authority area is the summation of the calculations whereby the estimated populations of all other units are individually divided by their distance from the first unit. To this must be added the result whereby the population of a parish or urban area is itself divided by a 'within' distance, which is approximately one-quarter of the length of the longest axis across the same area (Cole and King 1968). This computation is then repeated for each of the other parishes and urban authority areas in turn, giving a total of over 140,000 individual calculations for the study area. Fortunately these, together with much of the repetetive calculation required elsewhere, were done by use of Standard Statistical Programmes and programmes written by the author, on the I.B.M.360(67) Computer jointly owned by the Universities of Durham and Newcastle.

The nature of population potential is such that every person within the considered areal unit is given a weighting of one and every person outside ignored. Consequently, the calculated values are strongly influenced by the boundaries used (Craig 1972). To make the south Durham totals especially more realistic the heavily populated areas to the south of the River Tees which were incorporated into Teesside C.B. in 1968 were included in the calculations here. Elsewhere the boundaries of the geographical counties of Durham and Northumberland were taken, the remainder of the region being bounded by sea or relatively sparse rural population. In all cases, the centre of a parish or urban local authority area[1] for distance purposes, was taken as being the centre of the village or built-up area, or the geographical centre

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1 With the areas to the south of the River Tees which are included in the analysis, local authority units were here taken as the basis. Where possible, the population estimates used were those given as the Registrar General's mid-year totals for 1967(G.R.O. 1969). In those cases in which the area subsequently incorporated into Teesside C.B. was only part of a pre-existing local authority area, as with Guisborough U.D. for example, the estimate of population taken was a proportion of the total population estimate for 1967 equal to the ratio of the 1961 Census population subsequently included in the 1968 boundary change to the 1961 local authority Census population.

of a parish where no nucleated settlement appeared on the relevant 1:63,360 Ordnance Survey Seventh Series Map. Resultant potentials are thus applicable to these points, and so, for example, the value taken in subsequent analysis for the parish of Stanhope in Weardale R.D. is the relatively high 66,000 persons per Kilometre despite the fact that, at the head of the dale potentials fall beneath 50,000. This obviously results from taking for calculation the population centre of the parish as being slightly to the west of the predominant settlement, the village of Stanhope, which is situated very close to the eastern boundary of the parish. Similarly, a straight line distance between centres was used, this being easily calculable by Pythagoras Theorem from grid references fed into the computer. It was naturally impractical to hope to measure road distances between parish centres as this would have required over 70,000 laborious measurements!

Figure 2.10 shows the results of these calculations for 1967 in an isopleth form, giving some idea of the relationship of each parish and urban authority to the aggregate population of Northumberland, Durham and south Teesside. To a great extent the pattern shown on the map is self-explantory. Everything may be seen to hinge around Tyneside whilst Sunderland, Darlington and the Hartlepools, of the other major urban areas, cause their own localised peaks. Five less obvious features are, however, worthy of note. Firstly, there are the consistently low values over the majority of Northumberland and west Durham with, excepting Berwick, the isolated market settlements and administrative Urban Districts showing their inability to

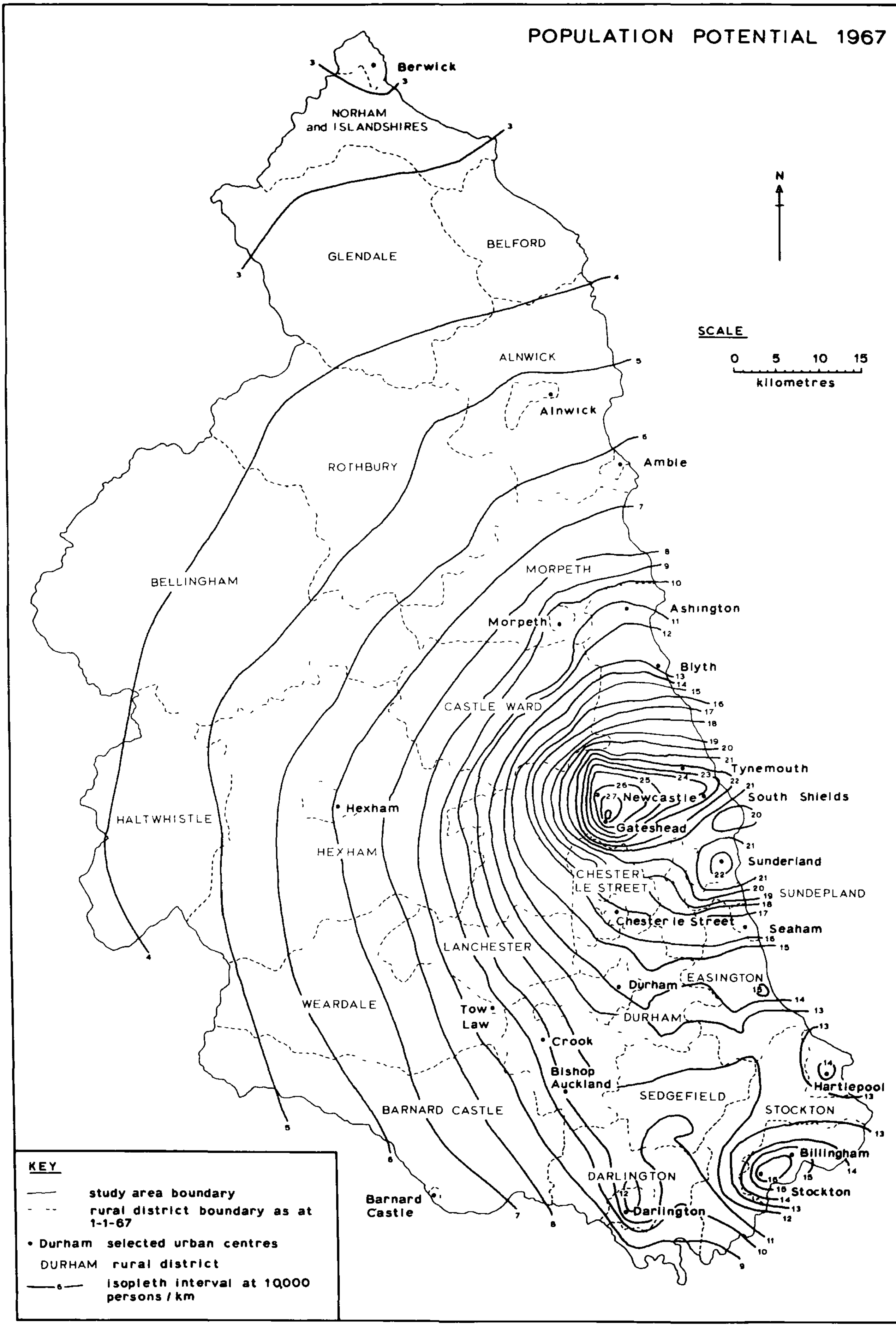
POPULATION POTENTIAL 1967
Berwick
NORHAM and ISLANDSHIRES
GLENDALE
BELFORD
ALNWICK
Alnwick
Amble
ROTHBURY
BELLINGHAM
MORPETH
Morpeth
Ashington
Blyth
CASTLE WARD
Tynemouth
Newcastle
South Shields
Gateshead
Hexham
HEXHAM
HALTWHISTLE
Sunderland
CHESTER LE STREET
SUNDERLAND
Chester le Street
Seaham
LANCHESTER
EASINGTON
Durham
DURHAM
WEARDALE
Tow Law
Crook
Bishop Auckland
SEDGEFIELD
Hartlepool
STOCKTON
BARNARD CASTLE
Billingham
Stockton
DARLINGTON
Darlington
Barnard Castle
N
SCALE
0 5 10 15
kilometres
KEY
study area boundary
rural district boundary as at 1-1-67
• Durham selected urban centres
DURHAM rural district
isopleth interval at 10,000 persons / km

Figure 2.10

influence the wider rural scene. Indeed, Morpeth and Alnwick are unable to do any more than slightly bend an isopleth.

Secondly, in Northumberland, the substantial effect of lower Tyneside upon values in the south-east of Castle Ward R.D., despite the fairly rapid northwesterly decline, is noteworthy, emphasising the proximity of this area to the peaks of potential situated in the Conurbation. Thirdly, in Durham, a similar subservience to urban influence may be noted over much of Chester-le-Street and Sunderland R.D.s. In Easington R.D., where potentials are sufficiently large to lessen the isopleth gradient away from the twin Tyne-Wear peaks, the 150,000 persons per kilometre isopleth is actually caused to reappear at Horden.

In contrast to the last point, it is apparent that the urban areas bordering on Hexham and Lanchester R.D.s, and in south-west Durham, have no noticeable effect upon the orderly decline of potential values. This reflects the influence of the contiguous rural areas as well as the Urban Districts' own relatively small populations in what are often large areas consequent upon the piecemeal additions to the administrative urban area made by successive boundary changes earlier this century (see Section 1.3). Finally, it may be appreciated that whilst the otherwise isolated Darlington C.B. is sufficiently populous to cause a spur of high value in south Durham, potentials decline quickly to the west. To the east, Darlington R.D. and, again significantly, much of Sedgefield R.D., are in a depression. Much of Stockton R.D. too, appears to be an area of relatively low values though the pervading effect of the larger populations in County Durham means that potentials here, are still at least twice the maximum reached in seven out of the ten Northumberland Rural Districts.

2.6 Rurality in Northumberland and Durham - A Geographical View

As components of rurality, density, function/occupation, land use and situation would appear to be of the first order of importance. To gain a total view of rurality, therefore, an aggregation of these factors would seem to serve well. As a concept, rurality contains elements both of the relative and absolute. The term 'absolute rurality' appears quite reasonably to designate one end of the rural-urban continuum, though one may well ask whether it can ever be adequately defined. For, at the same time rurality is relative, both to itself and to the concept of urbanism. Thus, the west Durham inhabitant mentioned by Daysh and Symonds (1953), perceived his environment as rural, but only in relation to Tyneside.

Consequently, Figure 2.11 has attempted to incorporate the four facets of rurality into a single index which allows a relative comparison of one area with another. The index was simply calculated as follows. For each of the four factors, the figures for the parishes and urban authority areas were expressed as a proportion of the maximum value found in the region. In the case of primary land use this was taken as being 100 percent, whilst for primary employment the level of 40 percent was taken as the theoretical maximum as, at this level, any parish is likely to be entirely rural in terms of the relationship between its population and primary employment needs. With regard to density and population potential the 1963 (to allow the comparison made in Section 2.7) Tyneside maxima were taken, the former being that of Newcastle C.B. which at 58 persons per hectare was slightly

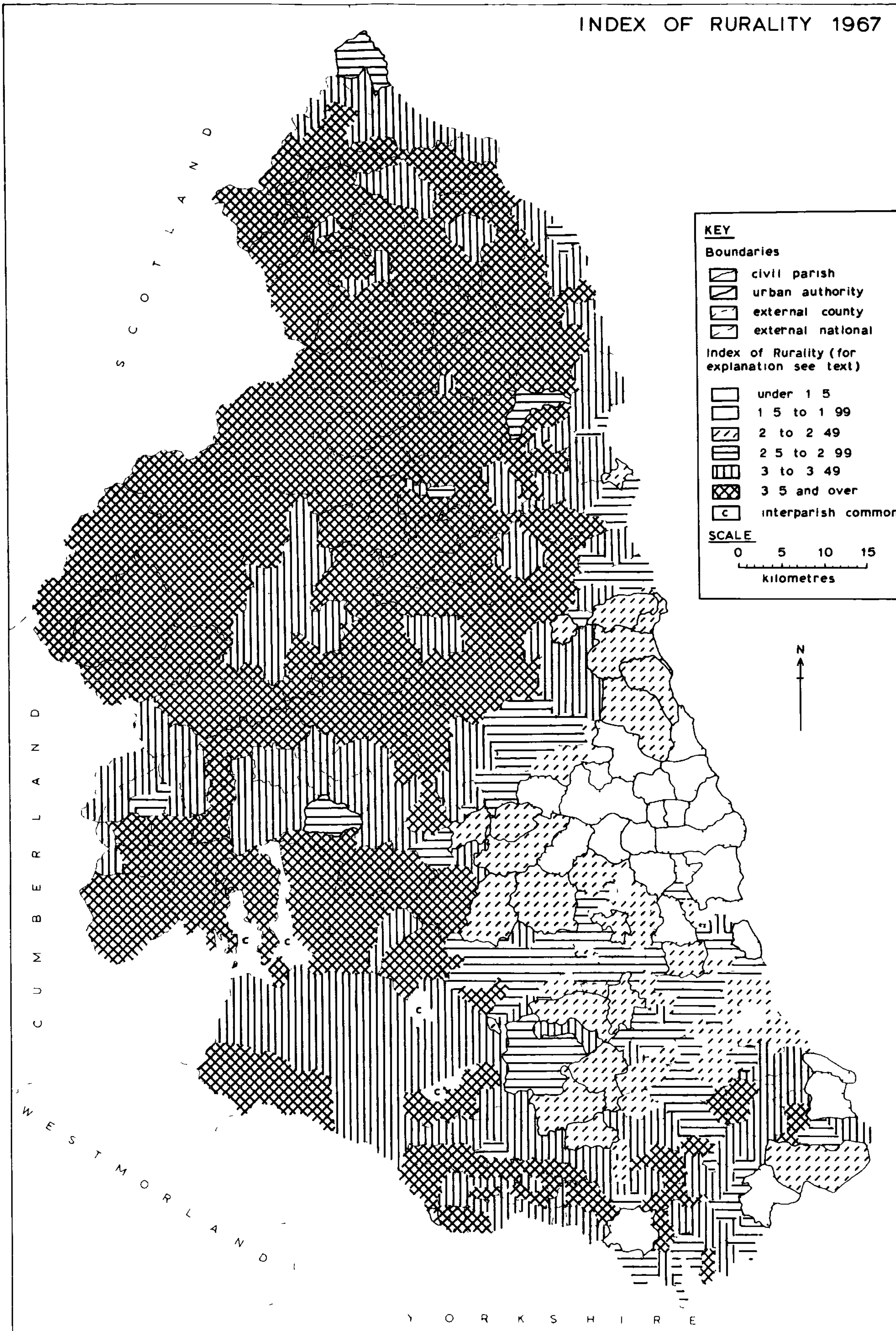
INDEX OF RURALITY 1967
KEY
Boundaries
civil parish
urban authority
external county
external national
Index of Rurality (for explanation see text)
under 1 5
1 5 to 1 99
2 to 2 49
2 5 to 2 99
3 to 3 49
3 5 and over
interparish common
SCALE
0 5 10 15
kilometres
N
S C O T L A N D
C U M B E R L A N D
W E S T M O R L A N D
Y O R K S H I R E

Figure 2.11

above the corresponding levels for the Durham County Boroughs of Gateshead, Sunderland and South Shields. These proportions were then converted in terms of a scale which had the value of one at its most urban end and ten at its most rural.

At the same time, it is obviously true that certain ranges in each of the four factors are more important than others. For example, with regard to primary employment the range between 5 and 10 percent of the population is more critical in terms of an increase of one unit than is that between 35 and 40 percent. In consequence, each of the four separate index values, prior to summation, was transformed to a common (base 10) logarithmic value to give some effect to this differential. For primary employment, land use and population potential the resultant weighting was applied to differentiate further the less rural end of the scale, the opposite being done in the case of population density.

With respect to land use, the form of weighting used will have the effect of differentiating more amongst the values which appear to be representative of the rural-urban fringe zone. Moreover, it is possibly an advantage that, as the majority of land use values, partly consequent upon the moving average method of calculation adopted lie above 60 percent, the weighting will also have the effect of further reducing the range of values in most cases. For, as has already been pointed out (Section 2.4), the primary land use value is the least satisfactory element of the four and too much should not be read into minor variations amongst individual areas. Nevertheless, in the vast majority of cases the values appear to be completely realistic and certainly far more would be lost by excluding a consideration of land use in this context.

The population potential figure has similarly been weighted to differentiate further at its more urban end, so that this might act to distinguish to a greater degree amongst areas which in terms of this part of the index might be termed of a fringe nature. Thus, the interval between an isopleth in Castle Ward R.D. is given more weighting that a similar interval in Rothbury R.D. Moreover, when the lower potential values are reached, further declines tend to have little consequence, with the locational remoteness of such areas from any significant urban influence being undoubted.

Finally, with regard to density, the weighting was applied to progressively favour those areas of lower values. Obviously, the fall from 5 to 0.5 persons per hectare, for example, is of far greater consequence in terms of rurality than that from 25 to 20 persons per hectare.

In looking at the final summed index value as shown on Figure 2.11, one may go some way towards interpretation by regarding anything under 2.5 as urban and anything over 3.0 as rural. In between, is the rurban, rururban or rural-urban zone. From Figure 2.11 and Table 2.4 the following points stand out clearly. Firstly, few of the urban administrative areas can be said to be anything but urban. Of the seven County Boroughs existing in Northumberland and Durham at the beginning of 1967 only one, Darlington, is not in the lowest index value class, in consequence of its lower density figure, its situation outside the major urban core areas of the North-East and its relatively high primary land use value, although this last was certainly inflated somewhat by the moving average method of calculation on account of the town's isolation.

Although some of the other urban administrative areas especially those with a low population and/or a large area approach a value of 2.5, for example, Amble, Barnard Castle, Prudhoe and Tow Law, only four reach this level - Berwick, Hexham, Alnwick and Crook and Willington. The first three of these settlements are obvious rural market centres and achieve such high index values in consequence of their rural situations and low densities. This also applies to Crook and Willington U.D. to a less marked extent for, at the edge of an urban tract, its density because of the large area of non-built on land in the administrative area, is low, and primary land use correspondingly high. Similarly, population potential is only moderate whilst the 1967 primary employment percentage was the highest for all urban local authority areas in the two counties. One may here see stressed the unsatisfactory geographical nature of an Urban District which has grown in a piecemeal fashion, much of it being nothing more than a loose administrative agglomeration of once mining villages.

Secondly, much of nominally rural Northumberland falls into the most rural category, and a majority of the remainder, which perhaps significantly includes much of the north Northumberland coast and North and South Tyne valleys, into the obviously rural class. Of the Northumberland Rural Districts, Castle Ward and Morpeth are the only two where a substantial proportion of parishes fall below an index value of 3.0. In the latter, to the north-

Number of Parishes or Urban Authority Areas
Falling within each Division of the Rurality Index

Administrative Division	Scores on Index of Rurality					
NORTHUMBERLAND	<1.5	1.5-1.99	2-2.49	2.5-2.99	3-3.49	>3.49
Alnwick R.D.	–	–	–	3	9	7
Belford R.D.	–	–	–	1	3	4
Bellingham R.D.	–	–	–	–	3	9
Castle Ward R.D.	–	1	3	3	2	4
Glendale R.D.	–	–	–	–	3	17
Haltwhistle R.D.	–	–	–	1	5	5
Hexham R.D.	–	–	–	3	12	12
Morpeth R.D.	–	–	1	5	6	7
Norham & Islandshires R.D.	–	–	–	–	5	4
Rothbury R.D.	–	–	–	1	2	17
DURHAM						
Barnard Castle R.D.*	–	–	–	1	12	14
Chester-le-Street R.D.*	–	3	7	4	–	–
Darlington R.D.*	–	–	1	5	10	11
Durham R.D.*	–	–	4	9	3	–
Easington R.D.*	–	1	7	6	2	–
Lanchester R.D.	–	–	1	4	2	2
Sedgefield R.D.	–	–	4	4	5	5
Stockton R.D.	–	–	–	6	10	4
Sunderland R.D.*	2	2	1	1	–	–
Weardale R.D.	–	–	–	–	3	1
Urban areas (both counties)	10	11	21	4	–	–

*Where the Ministry of Agriculture has aggregated two parishes in the 1967 June Returns (see Section 2.3) and it has, in consequence, been necessary to follow the practice with regard to occupation and land use in the foregoing analysis, the same procedure has been adopted in this section with combined density etc. values used in deriving the Index.

west of the town, six parishes have an index value beneath this level, mainly owing to the influence of mining, with Lynemouth only reaching 2.2. In Castle Ward R.D., the effects of overspill and commuter outmovement from Tyneside are paramount in causing the low indices of several parishes notably North Gosforth (1.8) and Woolsington (2.2), with the additional influence of mining elsewhere as in Brunswick (2.5) and Hazlerigg (2.4). Elsewhere, in the remaining Rural Districts there is little which detracts from an obviously rural nature. Such rural growth points as Haltwhistle and Rothbury are only sufficient to cause the index value to fall slightly below 3.0, whilst the parish of Wooler despite its containing the main settlement of Glendale R.D., and a population of nearly 2,000, is unable to even achieve this.

In County Durham, the picture is considerably more complex. Of the ten pre-April 1967 Rural Districts only Barnard Castle and Weardale hardly deviate below an index value of 3.0, though in the latter case three of the four parishes fail to reach the level of 3.5, mainly consequent upon the large non-agricultural component in their labour forces. Darlington R.D. also has the great majority of its parishes classed as obviously rural, but some such as Middleton St George, Hurworth and Whessoe fall into the intermediate category, whilst the predominantly urban nature of Great Aycliffe is beyond doubt. A similar pattern presents itself in Stockton R.D. though urban influence is strongly reflected in the fringe category rating given to the parishes surrounding the former Stockton M.B. Sedgefield R.D. has ten of its eighteen parishes above an index value of 3.0 and though the influence of mining especially has caused the low rating of several northern parishes such as Trimdon (2.5) and Ferryhill (2.3), this together with the evidence of a rural core already adduced with reference to the individual factors considered, suggests that most of the area is truly rural, despite the fact that at the administrative Rural District level this tends to be almost completely obscured.

On the other hand, the indeterminate nature of much of Durham R.D. is clear both from Figure 2.11 and Table 2.4, with a majority of the constituent parishes falling into the fourth class. This pattern persists into Lanchester R.D. though here the higher values on average do herald the transition towards a more rural type. To the east of Durham R.D., however, one is dealing with an area which tends towards urban land use, economic, locational and density features. Though one may agree with Dewdney (1970) that outside the major urban areas, the typical pattern of settlement over the coalfield is of clusters of population generally of between 2,000 and 10,000 persons, only a few of which can legitimately be defined as towns, it is with the proviso that many of the settlements in, for example, Easington R.D. exhibit characteristics in relation to the four factors considered, which are significantly more urban than rural.

Chester-le-Street R.D. similarly appears as a largely misnamed area and the urban rather than rural affinities of such parishes as Birtley and Harraton are undoubted. Indeed, though the parish of South Biddick would have shown a significantly higher value had it not necessarily been combined with Harraton, the highest index value reached by any parish in this Rural District is the 2.7 of Edmondsley, still well within the rururban category.

Finally, the demise of Sunderland R.D. in April 1967 does at least illustrate the belated recognition of some of the changes which have occurred since the Local Government Acts of 1888 and 1894 and the inter-war County Review Orders.

In an attempt to synthesise the preceding analysis, Figure 2.12 has been drawn grouping the parishes and urban authority areas into one of the three main categories recognised above. One might go still further and eliminate the rururban category entirely but this would certainly lose more than it would gain. For, against the doubtful value of choosing some point at which 'urban' changed to 'rural' would have to be set the fact that there is undoubtedly a zone within the rural-urban continuum of a transitional nature, in which there is still sufficient affinity with some aspects of ~~rurality~~ as here defined to merit recognition. However, this rururban belt is essentially complex and does not merely consist of mining and industrialised villages lying amidst neglected fields (Thorpe 196[4]), but also includes overgrown villages such as Preston-on-Tees (Stockton R.D.) or Ponteland (Castle Ward R.D.) in which commuting and urban residential overspill development may be prime features. Similarly, such market towns as Berwick and Alnwick are towns of a kind but only in so far as the large surrounding rural tracts give them their raison d'etre. Their affinity with the rural area is indisputable.

Figure 2.12 also serves to emphasise the complex and often internally contrasting nature of the south Durham Rural Districts (Darlington, Stockton and Sedgefield) whilst Durham and Lanchester

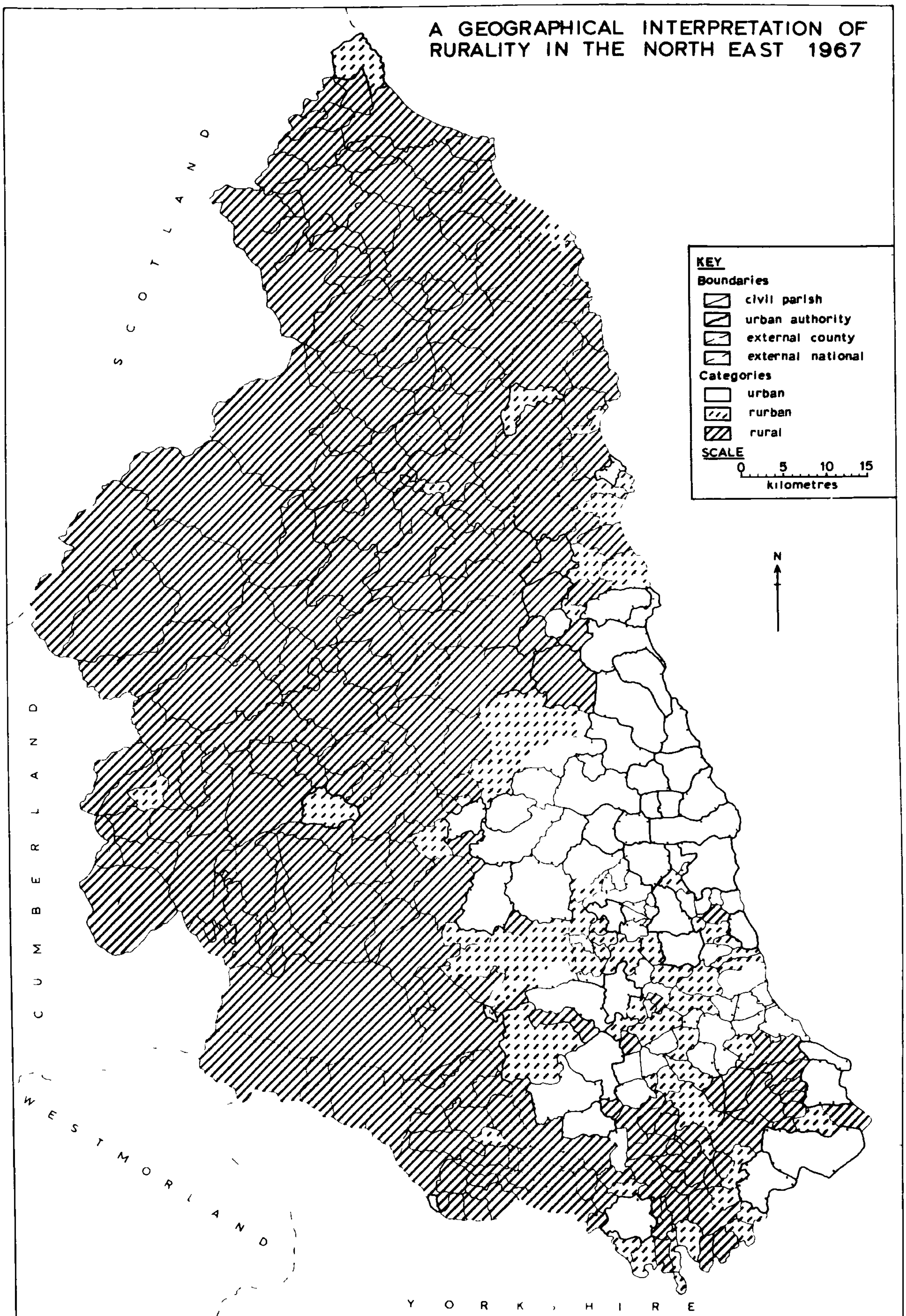
A GEOGRAPHICAL INTERPRETATION OF RURALITY IN THE NORTH EAST 1967
KEY
Boundaries
civil parish
urban authority
external county
external national
Categories
urban
rurban
rural
SCALE
0 5 10 15
kilometres
N
SCOTLAND
CUMBERLAND
WESTMORLAND
YORKSHIRE

Figure 2.12

R.D.'s provide good examples of the rururban type. Overall, the vast majority of the area covered by the twenty Rural Districts (95.2 percent in Northumberland, 66.8 percent in Durham and 87.0 percent in both) is rural in the defined sense although in population terms[1] only slightly over 10 percent is undoubtedly so in County Durham compared to 53.2 percent in Northumberland, and 21.5 percent in total. At the other extreme, 4.2 percent of the total area is most certainly not rural nor even transitional in nature in the present analysis (0.6 percent in Northumberland and 13.0 percent in Durham) though in population terms the Durham experience (67.1 percent) makes the proportion substantially higher at 53.2 percent (Northumberland 16.7 percent). The very inequality of these area and population percentages shows the vast gulf which separates the rural from the urbanised areas of North-East Rural Districts.

The subsequent analysis of demographic, social and economic characteristics of the populations within these contrasting Rural Districts will be approached from this point of view bringing into the analysis the obviously rural areas which cover much of Northumberland and west Durham and, in complete contrast, the rather misnamed Rural Districts of Chester-le-Street, Easington and Sunderland. If the present study has so far somewhat clarified the term 'rural' with regard especially to the Rural Districts of Northumberland and Durham, it is hoped that Part 2 in analysing the nature of variation in a wide variety of demographic and socio-economic variables will give a greater understanding of the geographical character of these differing populations, pointing out

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1 1967 estimated figures

their contrasts and similarities as well as exposing some of the processes recently and presently at work.

2.7 Change in Rurality 1963-1967

Finally with regard to this analysis of the concept of rurality, it was decided to investigate the nature of relative changes in rurality over a recent short period of years in order to ascertain whether or not these bore any relationship to ruralism as measured by the index developed here or geographical location. Thus, the index was calculated for 1963 in a manner identical to that described for 1967. To achieve comparability parishes which had been combined by the Ministry of Agriculture in either the 1963 or 1967 June Returns were similarly combined but in both years.[1]

It was found that between 1963 and 1967 most areas showed a decrease in the index value (a mean of -0.04 or -1.46 percent with one standard deviation of 0.06 or 2.07 percent), this reflecting the decline both relatively and absolutely of agricultural employment in the intervening period. Thereafter, a relationship was sought between the change in the index, expressed in either relative or absolute terms and the 1963 index value. For this, a standard least squares linear regression method was used, the 1963 index value in both cases being the independant variable and firstly, the absolute change, and secondly, the percentage change in the index of rurality 1963-7, the dependant variables. The dependant variables had previously been tested for statistical normality, this being unnecessary for the distribution of the

1 In addition to those already mentioned in section 2.3, to achieve a comparable index value for both 1963 and 1967 a further amalgamation of parishes or urban authority areas was necessary in three cases: Hartlepool M.B. and West Hartlepool C.B.; Acklington and Togston (Alnwick R.D.), and Hilton, Bolam and Morton Tinmouth (Barnard Castle R.D.). The Index for 1967 was naturally recalculated for these larger areas.

the independant variable (Bliss 1967).

In both cases a slight inverse relationship occurred:

(i) Index 1963 (x) against absolute change in the index 1963-7 (y) gave:

$$y = -0.2 - 0.01x$$

(ii) Index 1963(x) against percentage change in the index 1963-7 (y) gave:

$$y = -2.44 + 0.32x$$

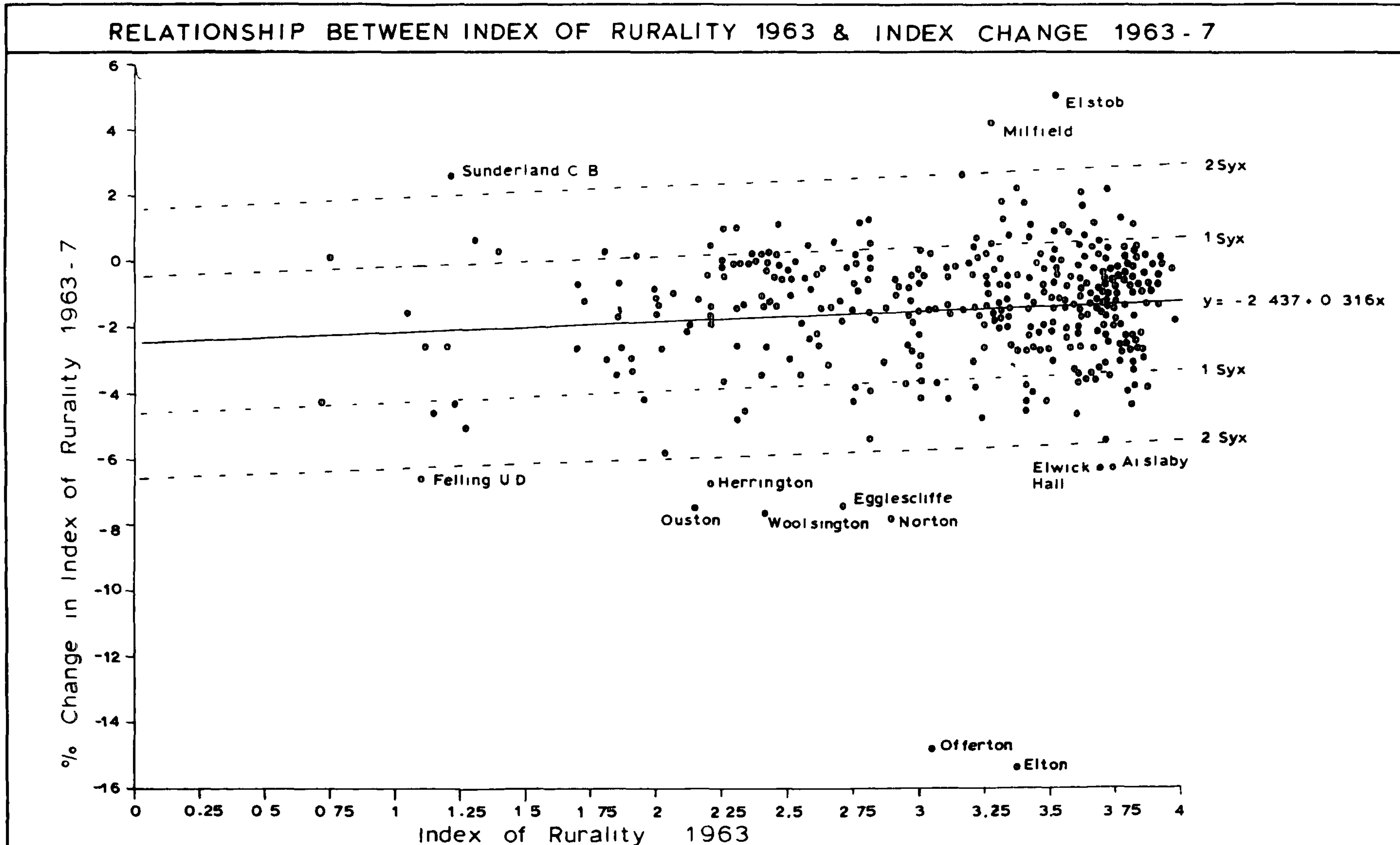
In the former case, however, the regression equation based on the relevant F-statistic was found to be insignificant at the 5 percent point, even taking the relative degrees of freedom to be the maximum possible in this case of $2(v_1)$ and $356(v_2)$. In fact, the v_2 degrees of freedom will be somewhat lower than 356 consequent upon autocorrelation (Curry 1966) which has the effect in spatial relationships of this nature of effectively reducing the sample size upon which the analysis was based (here 356 areas).

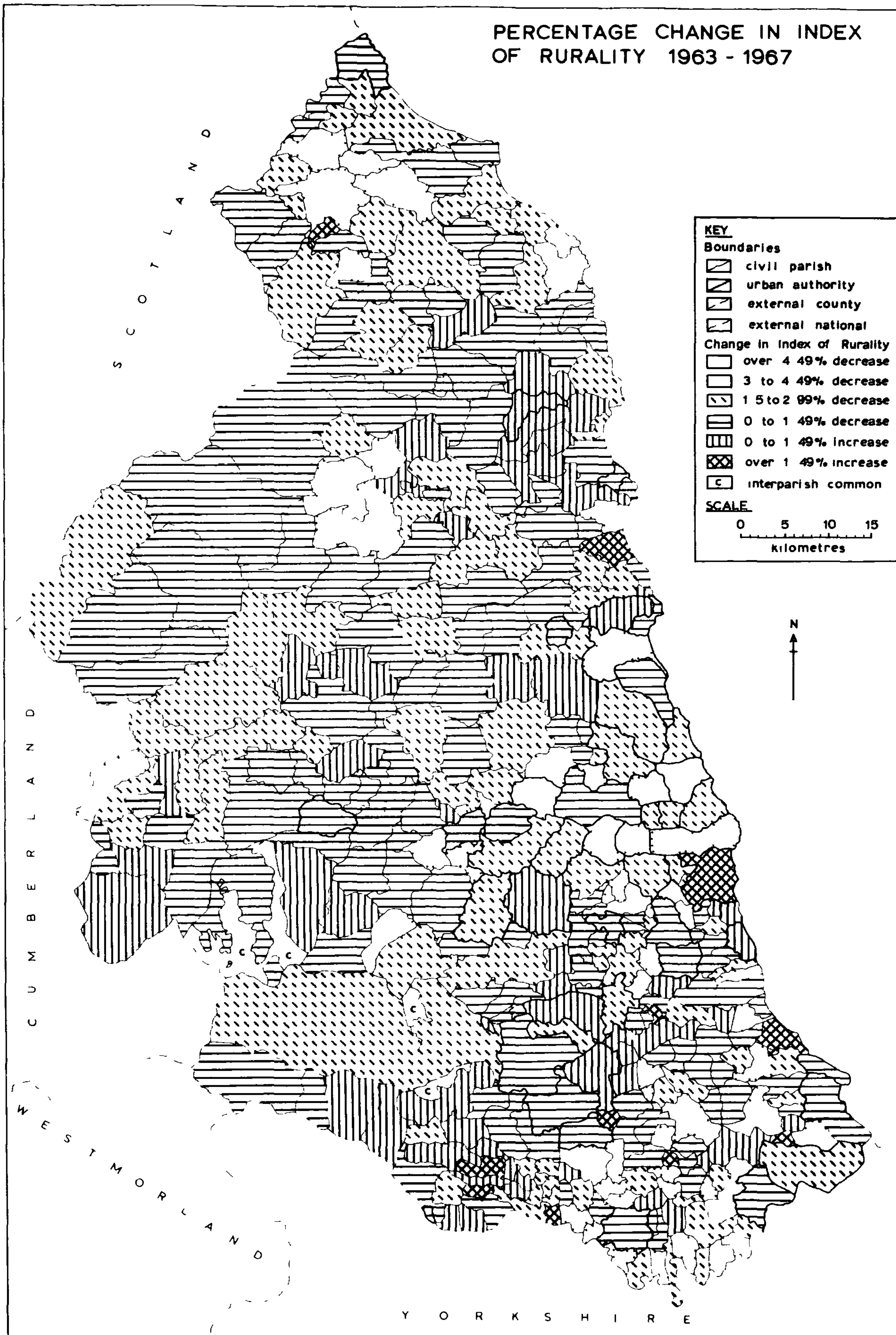
The second regression equation, however, was significant at the 2.5 percent point though not at the 1 percent point. Despite the effects of autocorrelation, which cannot be assessed accurately, there would therefore seem to be some small but significant relationship between the 1963 index of rurality and the percentage change over the subsequent four years. In other words, relatively speaking, there is a tendency for the more urban areas to become proportionately more urban, the converse holding true for the rural areas.

Figures 2.13 and 2.14 show the percentage change in the index both in terms of the scatter of areas around the regression line (Figure 2.13) and of their location (Figure 2.14). The former diagram emphasises clearly two main points, First, there is a very marked scatter around the regression line which exposes the general relationship noted above as being relatively weak. Second, the points which deviate from the predicted line by more than two standard errors of the estimate where 1 Syx = $\bar{O}y(1-r^2)^{\frac{1}{2}}$, nevertheless do bear out this general relationship with few exceptions and, additionally, throw further light upon it.

The ten parishes or urban administrative areas which fall further than 2Syx below the regression line are nearly all areas which were experiencing rapid suburbanisation during this period. Thus, the parishes of Elton, Norton and Egglescliffe all saw a rapid increase in population with the resultant effects of diminishing primary land use and primary employment percentages as the built up area associated with the then Municipal Borough of Stockton continued its outward spread. Similar points may be made with regard to the parishes of Herrington and Offerton as Sunderland C.B. overspilled, and Woolsington as a virtual outlying suburb of Newcastle-upon-Tyne. One other parish, Ouston in Chester-le-Street R.D., though more distant from the major population nodes, saw comparable housing development at this time.

Of the three remaining areas, two, the parishes of Aislaby and Elwick Hall in Stockton R.D., saw such a dramatic fall in the index as a result of a substantial drop in agricultural employment. The remaining area, Felling U.D., already with the low


RELATIONSHIP BETWEEN INDEX OF RURALITY 1963 & INDEX CHANGE 1963 - 7
% Change in Index of Rurality 1963 - 7
Index of Rurality 1963
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
0
0.25
0 5
0 75
1
1.25
1 5
1 75
2
2 25
2.5
2 75
3
3,25
3.5
3 75
4
Elstob
Milfield
Sunderland C B
2 Syx
1 Syx
y = -2 437 + 0 316x
1 Syx
2 Syx
Felling U D
Herrington
Ouston
Woolsington
Egglescliffe
Norton
Elwick Hall
Aislaby
Offerton
Elton


PERCENTAGE CHANGE IN INDEX OF RURALITY 1963 - 1967
KEY
Boundaries
civil parish
urban authority
external county
external national
Change in Index of Rurality
over 4 49% decrease
3 to 4 49% decrease
1 5 to 2 99% decrease
0 to 1 49% decrease
0 to 1 49% increase
over 1 49% increase
interparish common
SCALE
0 5 10 15
kilometres
N
SCOTLAND
CUMBERLAND
WESTMORLAND
YORKSHIRE
C

index value of 1.11 in 1963 fell to 1.04 in 1967 as a result of increasing density and decreasing primary land use.

Of the three areas which appear at the other extreme, the parishes of Elstob (Sedgefield R.D.) and Milfield (Glendale R.D.), already with high indices in 1963, ran sufficiently against the general trend of decrease in the primary labour force to experience a noticeable increase in the index by 1967. Sunderland C.B. however, forms a most marked exception to what one might expect from the preceding analysis, having an index value of 1.21 in 1963 and 1.23 in 1967. However, this small absolute but quite large percentage change may be explained by a marked reduction in density from 54.9 to 52.0 persons per hectare within the area of the County Borough between the two dates.

Figure 2.14 puts the percentage change in the index into spatial terms. To aid interpretation a class interval of a 1.5 percent change by 1967 on the 1963 index is taken, this representing $\pm$ 0.75σ. As one would expect, the vast majority of parishes and local authority areas fall within one class interval to either side of the mean percentage change in the index. Some isolated exceptions and a few larger anomalous areas do, however, stand out.

Of these, one of the most obvious is the large and irregular but continuous area in Barnard Castle R.D. where the constituent parishes saw increases in the index. Indeed, no parish in the Rural District experienced a decrease greater than the 2.3 percent of Woodland. The reason for this may mainly be found in the comparative levels of agricultural employment. Hence, whilst the 1967 regular agricultural employment was 91 percent of that in 1963 taking the Rural District as a whole, in Darlington R.D. the corresponding figure was 82 percent and in Glendale R.D. 78 percent. Moreover, primary land use percentages tended to increase in more cases than decrease in Barnard Castle R.D.

In contrast, to the east, many of the parishes in Darlington R.D. can be seen to have experienced a substantially greater than average decrease. Though the decline in the agricultural labour force mentioned above certainly accounted for the fall in some parishes such as Neasham where it fell by nearly one-quarter, it will be noticed that a number of the areas exhibiting such a decrease in the index are relatively large parishes in population terms, for example Middleton-St-George, Heighington and Great Aycliffe. During the period under review, each of these parishes experienced a significant increase in population amounting to over 15 percent in the last two cases. Similarly, the large falls in the index in some parishes around Stockton M.B. and to the north of Chester-le-Street U.D. may be correlated with the housing developments and population increases occurring in these locationally, and now characteristically, urban fringe areas.

Elsewhere, two other noticeable areas of increase in the index occur in County Durham. Firstly there is an irregular area stretching from Brandon in the east to Thornley in the west and from Spennymoor in the south to Langley in the north. A variety of casual factors operated here. Thus, in the Urban Districts of Spennymoor and Brandon and in the parishes of Thornley and Langley, the effects of population density decline between 1963 and 1967 were by far the most important. At Ferryhill, however, the increase in the mean primary land use figure was sufficient, when combined with a slight density decrease, to offset the effects of a slight rise in population potential and the fall in primary employment. Elsewhere factors combined more equally to produce the rise in the index. In the parish of Sunderland Bridge whilst population potential increased very slightly, density, land use and even primary employment all combined to produce a more rural result for 1967 than 1963. The second main belt of increase noted extends southwards from Sunderland. Here it results from the effects of decreasing population density and potential. In absolute terms, however, the increases recorded in the index are small: Sunderland C.B. 1.21 to 1.23, Seaham U.D. 1.80 to 1.81, Tunstall C.P. 1.30 to 1.31, Ryhope C.P. 1.39 to 1.40.

In Northumberland, three main areas of great falls in the index may be noted. The first which borders Newcastle, is obviously similar in nature to that on Teesside in Durham, though in Wallsend M.B. the fall in primary land use replaced increasing population density. The two other major areas of decrease (the parishes of Harbottle, Hepple and Netherton in Rothbury R.D., and of Ford, Bowsden, Lowick and Duddo in the extreme north of the County), may both be related to considerably greater than average falls in the agricultural labour force between 1963 and 1967.

On the other hand, the major belt of increase in Alnwick R.D. stretching from Denwick in the north to the combined Acklington and Togston parishes in the south, is mainly related to increasing primary land use percentages, though slightly decreasing population densities and even increases in the primary employment percentage in such parishes as Acklington/Togston and Newton-on-the-Moor emphasised this change in some cases.

Other more isolated areas of marked increase or decrease may be similarly explained. Thus, the parish of Widdrington in Morpeth R.D. increased its index value in consequence of a decreasing population and an increasing primary employment percentage, whilst the decrease in the indices of the parishes of Belmont and West Rainton to the north-east of Durham City may be attributed mainly to the effects of population increase. Overall therefore, there is no single factor which accounts for the nature or location of all areas experiencing a marked increase or decrease in the index value. Rather, a single factor, or more commonly a combination of factors, has a locally dominant influence. Two points do, however, stand out as being worthy of emphasis. First, there is the recurring theme of the great effect of population growth in urban fringe areas, especially evident around Teesside. Second, in the locationally and characteristically more truly rural areas, the predominance of changes in agricultural employment over the other factors is undeniable within most of the area, though such changes are modified and occasionally dominated by population density and primary land use changes.

2.8 Conclusion to Chapter 2

Part 1 set out to examine the concept of rurality, ultimately applying an analysis of this to the study area and its urban counterparts. It has examined the various ways in which rurality may be defined, especially that by which it was distinguished in England and Wales at the time this work was undertaken with the obvious ramifications which this has throughout a whole range of official statistics. Rejecting administrative and sociological approaches, by which most definitions of rural and urban are made, it was considered necessary for geographical purposes, to adopt an approach at the most detailed level possible, based upon the factors of population density, occupation, land use and situation. From an analysis of these four elements of rurality, a composite index has been compiled and the resultant spatial variations considered in terms of Rural District parishes. The contrasting nature of populations contained within the boundaries of the twenty pre-April 1967 Rural Districts was thus demonstrated, as was finally the complex nature of changes in the index between 1963 and 1967. The expression of this heterogeneity of population with regard to other social, economic and demographic variables will form the major concern of the second part of this study.

Overall, therefore, away from the obvious extremes of the rural-urban continuum, it is hoped that the preceding study of the nature of rurality has more than anything else, adequately demonstrated the lack of geographical validity in administrative rural and urban definition with reference to the North-East, and also given a more valid assessment of rurality than is inherent, for example, in a single arbitrary density measure. One can but hope, and perhaps the increasing acceptance of a grid square basis for future Census statistics (Robertson 1969) is here some encouragement, that the time is near ending when the population geographer must generally accept as rural anything which is not officially classified as urban. Indeed, in these terms, the adoption of geocoding in the 1971 Census has been a major innovation with, subject to confidentiality constraints, data to be made available firstly on a 100 metre or 1 Kilometre square basis but thereafter for specific areas defined by the intending purchaser (Lawton 1971). Furthermore, the reorganisation of local government areas which at the time of writing is well under way may with advantage, act as a catalyst here.

PART 2 - RURAL DISTRICT POPULATIONS IN NORTH-EAST ENGLAND.

CHAPTER 3

AN ANALYSIS OF SOCIAL ECONOMIC AND DEMOGRAPHIC CHARACTERISTICS

3.1 INTRODUCTION

Having considered the rurality of the twenty pre-April 1967 Rural Districts in Northumberland and Durham from a geographical point of view, one can already appreciate the heterogeneity of population at the parish level. To equate such parish populations as those of Peterlee and Alwinton, North Gosforth and Edmondbyers or Lynemouth and Cresswell under the blanket administrative term 'rural' is to broaden the meaning of that word so much as to minimise any significance it may have. If, however, one has established something of the geographical heterogeneity of such civil parishes in terms of their population density, occupational structure, land use and situation, a logical and relevant continuation of such a line of enquiry is to consider the application of the categorisation already made in terms of other factors and to see how these other factors are distributed at various levels of intensity.

In this second and major section of the present study, the parishes of the area will be considered from the point of view of their similarities and differences with regard to a wide variety of social, economic and demographic characteristics. Do the truly rural parishes, for instance, have the high dependency ratio and high fertility which many authors such as Bogue (1969), Duncan and Reiss (1956) and Smith and Zopf (1970) note as characteristic, or in a modern and relatively crowded society such as exists in Britain today, are such differences relatively unimportant or even entirely absent? Alternatively, do other differences occur which separate Rural District parish populations into categories and, if so, are these coincident or completely opposed to the classification of rurality already obtained? It is towards answering such questions as these that this section will turn.

Again, to preserve the detail of coverage the parish level approach is maintained wherever possible[1]. In some cases, however, this has not been so and it has been necessary to combine parishes for the purpose of analysis. In consequence of some of the available data used being that collected on a 10 percent sample basis for the 1961 and 1966 Censuses (a more detailed investigation into the nature of this material will be pursued in Section 3. 5), it was decided to aggregate parishes up to a total base population of at least 1,000 where this proved to be necessary. Whilst Robson (1969) in a statistical study of Sunderland took 300 as being significant in these terms, it was considered here that this would not be sufficiently high. Quite aberrant values might result from some sample populations at this level, especially where a ratio of two variables was concerned, possibly from employment data, neither of which contained anywhere near the full sample size as its denominator. An arbitrary limit of 1,000 was, however, felt to be reasonable whilst at the same time retaining a close affinity to a parish level approach, as well as having procedural advantages with regard to a more homogeneous unit population size for multivariate analysis (see Section 3. 6).

Parishes containing fewer than 1,000 persons in 1961 were amalgamated until this population level was reached (Figure 3. 1). Such combinations as were necessary were effectively made with regard to a number of considerations. Firstly, where Ministry of Agriculture practice relating to the June Agricultural Census Returns was to combine areas, a similar procedure has been adopted

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[1] The necessity of descending to a parish level consideration has been particularly stressed by Jackson (1968) " ..... it is evident that analysis at the local authority level may conceal opposing trends in population movement. Further, it has been shown that significant numerical growth is likely to be concentrated in larger settlements and smaller parishes may be declining, absolutely or relatively, while the local authority shows expansion" (p.80)

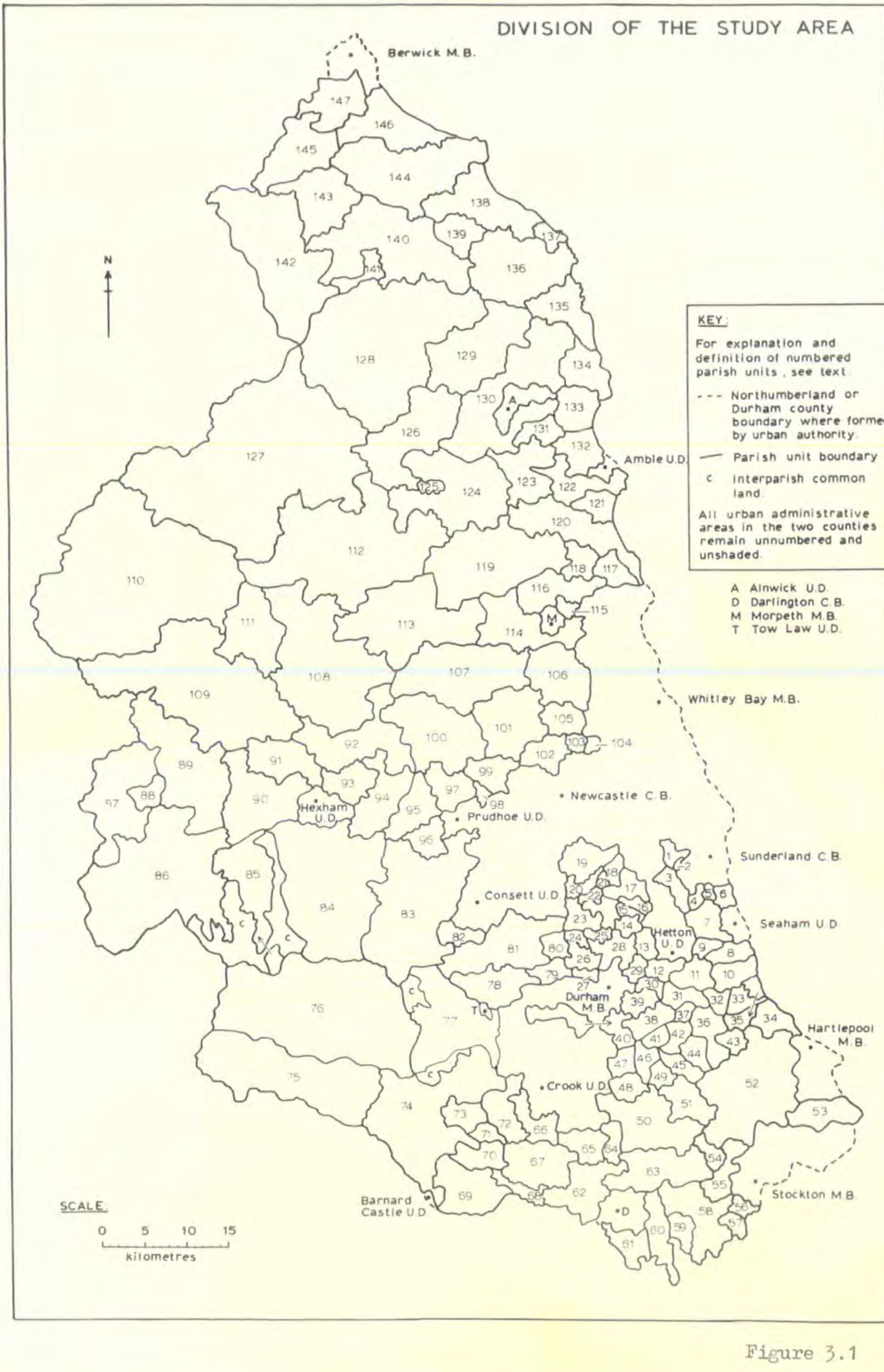
DIVISION OF THE STUDY AREA
Berwick M.B.
N
KEY:
For explanation and definition of numbered parish units, see text.
Northumberland or Durham county boundary where formed by urban authority.
Parish unit boundary
c Interparish common land.
All urban administrative areas in the two counties remain unnumbered and unshaded.
A Alnwick U.D.
D Darlington C.B.
M Morpeth M.B.
T Tow Law U.D.
Amble U.D.
Whitley Bay M.B.
Newcastle C.B.
Prudhoe U.D.
Hexham U.D.
Sunderland C.B.
Consett U.D.
Seaham U.D.
Hetton U.D.
Durham M.B.
Hartlepool M.B.
Crook U.D.
Stockton M.B.
Barnard Castle U.D.
SCALE:
0 5 10 15
kilometres

Figure 3.1

here as part of the data used was from this source. Thus, the parishes of Low Dinsdale and Sockburn in Darlington R.D., are included in the same unit as are those of Seaton with Slingley and Warden Law in Easington R.D. Regrettably this has resulted in suboptimal situations in some cases. Nesbitt (1961 population 12) was necessarily combined with Monk Hesleden (1961 population 7,775). Fortunately this was only so with very few pairs of parishes of which one in each case, excepting the combinations of Castle Eden and Horden (Easington R.D.) and Lynemouth and Ellington (Morpeth R.D.)[1], was both of extremely small area and restricted population. In two cases single parish units have been maintained despite the Ministry of Agriculture Returns combining them with other areas. Little Lumley in Chester-le-Street R.D., is thus treated as a single parish though the June Returns combine it with Chester-le-Street U.D. Similarly Hylton and Ford in Sunderland R.D., are maintained as separate entities. In this case both parishes had a 1961 population in excess of 3,000 and although combined in the 1967 June Returns were not so in 1963, from which year part of the agricultural data are taken.

The main process of amalgamation was done from the point of view of acquiring more regularly shaped areal units to ease the subsequent process of the spatial interpretation of results though this was not always possible especially where, for example, all contiguous parishes but one already had a population of over 1,000. At the same time, parishes of a more similar nature, based upon the analysis in Part I were combined where possible. Consequently, whilst from the population point of view, the parish of Hamsterley in Barnard Castle R.D., might just as easily have been combined with

[1] This latter amalgamation was of a unique nature, for the parish of Lynemouth in both 1963 and 1967 had no recorded agricultural holdings. Any agricultural land in the parish was presumably included within that of surrounding parishes. Whereas this was of little consequence in the preceding Section with both primary land use and employment for the parish itself (the former subsequently increased by the moving average calculation) being simply recorded as nil, a similar approach to the agricultural parameters used here especially those reflecting intensity and efficiency would be both misleading and unworkable. Therefore, it was considered desirable to combine Lynemouth with Ellington. The latter, in being a fairly heavily populated mining parish has an obvious similarity with Lynemouth.

that of Lynesack (1961 population 1,465) as with the remainder of the unit to which it was finally allocated (1961 population excluding Hamsterley 1,475) it would obviously appear to have a greater affinity with the parishes of the latter unit (Eggleston, South Bedburn, Woodland, Langleydale and Shotton, and Marwood) than it would with the former (see Section 2.11). Similarly an attempt was made to comply, where other things were equal with the known geography of an area. As a result, along the north-western border of Rothbury R.D., parishes are combined in a predominantly north-east to south-west direction, so that high sparsely settled parishes form a study unit. In a like manner, in Norham and Islandshires R.D., one 'trend' of combination is quite reasonably along the English side of the River Tweed.

Where parishes already possessed a population of 1,000, no additions were made, except in those cases where circumstances directed otherwise. Thus, the parish of Offerton in Sunderland R.D., with a 1961 population of 133 had to be amalgamated with a parish containing over 2,000 persons in 1961. Here the combination was made with Herrington which had the lowest 1961 population of all contiguous parishes, the most similar 1967 Index of Rurality, and also had a similar history during the later 1960's in experiencing housing estate development. Similarly, Waldridge C.P. in Chester-le-Street R.D., is isolated amongst parishes of over 1,000 persons. For the first two reasons mentioned in the preceding example, this parish was combined with that of Edmondsley. Those cases where a combination of this nature was dictated by the Ministry of Agriculture's June Returns, have already been referred to above.

In only five cases were final units created which in 1961 had a population of below 1,000. In Northumberland, that unit comprising the parishes of Middleton, Easington and Bamburgh had a Census population of 990 in that year, and that comprising Thirston, West Chevington, Widdrington and Cresswell, one of 994. In both cases, however, any further amalgamation would have produced more problems than it would have solved. Any addition in the former would have created a unit of far greater areal extent as well as of a less satisfactory shape and would have caused major problems in the formation of surrounding units. Moreover by the mid-1960s mainly consequent upon development at Bamburgh, the population of the unit had risen to over 1,000. Any further addition in the latter case due to the unit's situation between heavily populated parishes, would have caused the creation of a unit of a considerably more unsatisfactory shape and size as well as creating problems in the formation of contiguous units to the west. Hence, this unit was considered to be viable especially as its 1961 population so nearly approached the required level.

The three cases in County Durham where the final unit created had a 1961 population of below 1,000 were as follows. Firstly in Stockton R.D. the parishes of Elton and Norton had only 666 persons within their boundaries at the Census of that date. Nevertheless, by 1967 the estimated population had risen to over 3,000. Both parishes during these years were experiencing rapid suburbanization emanating from the overspill requirements of Stockton M.B. and most of their area and population was included in Teesside C.B. in 1968 (Figure 2.4). As no other contiguous parishes experience similar developments at this time and as the 10 percent sample data which is used from the 1961 Census is only a small part of the whole, it was felt that such a unit was quite valid.

Both the remaining units were in Durham R.D. Firstly, Kelloe with a 1961 population of 806 was not amalgamated with any of the surrounding parishes in consequence of their considerably different nature - Fishburn had a 1961 population of 2,853, Trimdon 6,052, Thornley 4,535, Wingate 11,442, Coxhoe 5,037 and Cassop-cum-Quarrington 5,305. Especially, in view of this being the only case of its type it was decided, therefore, to leave this parish separate for the purposes of the ensuing analysis, rather than to attempt to include it within any other. Finally, the unit containing the parishes of Sherburn House, Shincliffe and Whitwell House, had a 1961 population of 925. Again, because of the situation of this group of parishes any further amalgamation would have been most unsatisfactory, whilst the increase in population at Shincliffe subsequently carried the total population above the 1,000 mark.

In all cases but two[1] the parish units created are areally continuous. First, the combination of Horden and Castle Eden, which was necessitated by the nature of the Ministry of Agriculture June Returns means that, unfortunately but necessarily, two parishes separated by part of the narrow extension of Peterlee C.P. along the course of the Castle Eden Dene have been placed in the same unit. Second, the parish of Brancepeth in Durham R.D. is entirely isolated from the remainder of the Rural District by surrounding urban areas. In consequence, the still obvious combination with the parishes of Hett and Sunderland Bridge was made.

By these means, therefore, the situation of 147 separate study units, as depicted in Figure 3.1. was created. The units shown are those which are used in the remainder of the study. Their composition in terms of individual parishes (prior to 1967 and subsequent boundary changes) and 1961 Census population is shown in Table 3.1.

These combinations are in no way unique and, moreover, often represent a compromise to achieve the least of several evils. Thus the shape of unit 74 in Barnard Castle R.D. resulted from the need to gain a satisfactory base population size and where possible to combine parishes which resembled each other in terms of the four factors already analysed, at the cost of a slightly less regular shape than might have resulted had the parishes of Hamsterley and South Bedburn been included in either of units 72 or 73. However, it is quite debatable whether this particular group of parishes, or that in Northumberland to the east of Wooler is of a less satisfactory shape than are, for example, the single parishes of Evenwood and Barony (unit 72)

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[1] Excluding the small lightly populated portions of the detached parts of Allendale and West Allen C.Ps in Northumberland and the insignificant detached part of Greatham C.P. in Durham.

TABLE 3.1

The Composition of Study Units

Unit Number on Fig.3.1.	Civil Parishes[1] Comprising the Unit 1958 - 1967	Unit Census Population 1961
1	Hylton (Sd)	3850
2	Ford (Sd)	3071
3	Offerton (Sd) Herrington (Sd)	2286
4	Silksworth (Sd)	2799
5	Tunstall (Sd)	6566
6	Ryhope (Sd)	9796
7	Dalton-le-Dale (E) Seaton with Slingley (E), Burdon (E) Warden Law (E)	1392
8	Hawthorn (E), Cold Hesledon (E)	1346
9	East Murton (E)	8615
10	Easington (E)	9953
11	Haswell (E)	5661
12	Pittington (Dh)	1260
13	West Rainton (Dh)	2205
14	Great Lumley (Ch)	2426
15	Little Lumley (Ch)	1183
16	Bournmoor (Ch) Lambton (Ch)	1893
17	Harraton (Ch) South Biddick (Ch)	3594
18	Birtley (Ch)	10880
19	Lamesley (Ch)	4206
20	Urpeth (Ch)	1694
21	Ouston (Ch)	1181
22	Pelton (Ch)	5880
23	Edmondsley (Ch) Waldridge (Ch)	1791
24	Sacriston (Ch)	4871
25	Plawsworth (Ch)	1570
26	Witton Gilbert (Dh)	2137
27	Bearpark (Dh)	2229
28	Framwellgate Moor (Dh) Kimblesworth (Dh)	4117
29	Belmont (Dh)	4488

Table 3. 1. cont.

30	Sherburn (Dh)	3127
31	Shadforth (Dh)	2010
32	Shotton (E)	6015
33	Peterlee (E)	12974
34	Monk Hesleden (E), Nesbitt (E)	7787
35	Horden (E), Castle Eden (E)	12887
36	Wingate (E)	11442
37	Thornley (E)	4535
38	Cassop-cum-Quarrington (Dh)	5305
39	Sherburn House (Dh), Shincliffe (Dh),Whitwell House (Dh)	925
40	Brancepeth (Dh) Hett (Dh) Sunderland Bridge (Dh)	1397
41	Coxhoe (Dh)	5037
42	Kelloe (Dh)	806
43	Hutton Henry (E)	2461
44	Trimdon (Sf)	6052
45	Fishburn (Sf)	2853
46	Cornforth (Sf) Mainsforth (Sf)	4235
47	Ferryhill (Sf)	10562
48	Chilton (Sf)	6242
49	Bishop Middleham (Sf)	1078
50	Woodham (Sf) Windlestone (Sf) Mordon (Sf) Elstob (Sf) Bradbury and the Isle (Sf) Stillington (Sf) Foxton and Shotton (Sf) Preston-le-Skerne (Sf),	1135
51	Sedgefield (Sf)	4605
52	Butterwick and Oldacres (Sf) Sheraton with Hulam (E) Grindon (St) Hart (St) Elwick (St) Elwick Hall (St) Brierton (St) Newton Bewley (St) Dalton Piercy (St) Claxton (St) Embleton (Sf)	1838
53	Greatham (St) Seaton (St)	1514
54	Carlton (St) Whitton (St)	1260
55	Elton (St) Norton (St)	666
56	Preston-on-Tees (St)	1885
57	Egglescliffe (St)	2113

Table 3.1. cont.

58	Aislaby (St) Longnewton (St) Newsham (St) Sadberge (Dl)	1127
59	Middleton St. George (Dl)	2337
60	Great Burdon (Dl) Morton Palms (Dl) Low Dinsdale (Dl) Neasham (Dl) Sockburn (Dl)	1273
61	Hurworth (Dl), Blackwell (Dl)	2458
62	Piercebridge (Dl) Archdeacon Newton (Dl) High Coniscliffe (Dl) Walworth (Dl) Low Coniscliffe (Dl) Coatham Mundeville (Dl)	1160
63	Barmpton (Dl) Bishopton (Dl) Brafferton (Dl) East and West Newbiggin (Dl) Great Stainton (Dl) Little Stainton (Dl) Whessoe (Dl) Redmarshall (St)	1267
64	Great Aycliffe (Dl)	12868
65	Heighington (Dl)	1758
66	Etherley (BC)	1801
67	Bolam (BC), Hilton (BC) Morton Tinmouth (BC) Wackerfield (BC) Ingleton (BC) Headlam (BC) Langton (BC) Denton (Dl) Killerby (Dl) Summerhouse (Dl) Houghton-le-Side (Gl)	1023
68	Gainford (BC)	1130
69	Winston (BC) Cleatlam (BC) Streatlam and Stainton (BC) Westwick (BC) Whorlton (BC)	1372
70	Raby with Keverstone (BC), Staindrop (BC)	1418
71	Cockfield (BC)	2121
72	Evenwood and Barony (BC)	3156
73	Lynesack and Softley (BC)	1465
74	Eggleston (BC) South Bedburn (BC) Hamsterley (BC) Woodland (BC) Langleydale and Shotton (BC) Marwood (BC)	1818
75	Forest and Frith (BC) Newbiggin (BC) Middleton-in-Teesdale (BC)	2002
76	Stanhope (W)	5121
77	Wolsingham (W)	3005

Table 3.1. cont.

78	Cornsay (L) Hedleyhope (L) Satley (L)	1828
79	Esh (L)	5278
80	Langley (L)	1526
81	Greencroft (L) Lanchester (L)	4126
82	Healeyfield (L)	1218
83	Hedley (Hx) Healey (Hx) Shotley Low Quarter (Hx) Edmondbyers (W) Muggleswick (L)	1244
84	Hexhamshire Low Quarter (Hx) Hexhamshire (Hx) Slaley (Hx) Blanchland (Hx) Hunstanworth (W)	1535
85	Allendale (Hx)	1704
86	West Allen (Hx) Coanwood (Hw) Slaggyford (Hw) Plenmeller with Whitfield (Hw)	1069
87	Greenhead (Hw) Thirlwall (Hw) Featherstone (Hw) Hartleyburn (Hw)	1264
88	Haltwhistle (Hw)	3475
89	Henshaw (Hw) Melkridge (Hw) Bardon Mill (Hw)	1275
90	Haydon Bridge (Hx)	2151
91	Newbrough (Hx) Warden (Hx)	1158
92	Humshaugh (Hx) Wall (Hx) Whittington (Hx)	1340
93	Acomb (Hx) Sandhoe (Hx)	1521
94	Corbridge (Hx)	2869
95	Bywell (Hx) Broomhaugh and Riding (Hx)	1067
96	Broomley and Stocksfield (Hx)	2035
97	Ovingham (Hx) Ovington (Hx) Horsley (Hx)	1380
98	Wylam (Hx)	1495
99	Heddon-on-the-Wall (CW)	1331
100	Matfen (CW) Stamfordham (CW)	1618
101	Ponteland (CW)	6050
102	Woolsington (CW)	4089

Table 3. 1. cont.

103	Hazlerigg (CW)	1543
104	North Gosforth (CW)	3694
105	Dinnington (CW) Brunswick (CW)	2482
106	Stannington (CW)	2902
107	Capheaton (CW) Belsay (CW) Whalton (CW)	1147
108	Corsenside (Bg) Birtley (Bg) Bavington (Bg) Chollerton (Hx)	1612
109	Greystead (Bg) Wark (Bg) Simonburn (Hx)	1018
110	Kielder (Bg) Falstone (Bg) Tarset (Bg)	1043
111	Bellingham (Bg)	1224
112	Hepple (R) Hollinghill (R) Elsdon (R) Otterburn (Bg)	1073
113	Rothley (R) Hartburn (M) Wallington Demesne (M) Kirkwhelpington (Bg)	1032
114	Meldon (M) Mitford (M) Hepscott (M)	1071
115	Pegswood (M)	2590
116	Hebron (M) Longhirst (M)	1156
117	Ellington (M) Lynemouth (M)	3815
118	Ulgham (M)	2288
119	Nunnykirk (R) Longhorsley (M) Tritlington (M) Netherwitton (M)	1139
120	Thirston (M) West Chevington (M) Widdrington (M) Cresswell (M)	994
121	East Chevington (M)	3570
122	Acklington (A) Togston (A) Hauxley (A)	1520
123	Newton-on-the-Moor (A) Felton (A)	1210
124	Hesleyhurst (R) Tosson (R) Cartington (R) Longframlington (R) Brinkburn (R)	1110
125	Rothbury (R)	1784
126	Callaly (R) Netherton (R) Thropton (R) Whittingham (R)	1154
127	Alwinton (R) Biddlestone (R) Harbottle (R) Rochester (Bg)	1011
128	Alnham (R) Ingram (G) Roddam (G) Ilderton (G) Earle (G) Lilburn (G) Bewick (G) Chillingham (G)	1091

Table 3. 1. cont.

129	Eglingham (A) Glanton (A) Hedgeley (A)	1032
130	Denwick (A) Edlingham (A) Rennington (A)	1098
131	Shilbottle (A)	1862
132	Warkworth (A)	1246
133	Alnmouth (A) Lesbury (A)	1598
134	Longhoughton (A)	1116
135	Craster (A) Embleton (A) Newton-by-the Sea (A)	1466
136	Adderstone with Lucker (Bf) Beadnell (Bf) Ellingham (Bf)	1319
137	North Sunderland (Bf)	1625
138	Bamburgh (Bf) Easington (Bf) Middleton (Bf)	990
139	Belford (Bf)	1070
140	Akeld (G) Chatton (G) Doddington (G) Ewart (G)	1142
141	Wooler (G)	1976
142	Branxton (G) Carham (G) Kilham (G) Kirknewton (G)	1115
143	Ford (G) Milfield (G)	1043
144	Bowsden (G) Lowick (G) Kyloe (N) Holy Isle (N)	1430
145	Duddo (N) Norham (N) Cornhill-on-Tweed (N)	1222
146	Ancroft (N)	1012
147	Horncliffe (N) Ord (N) Shoreswood (N)	1022

[1] The Rural District in which each parish was situated is given in parentheses:

(A)	Alnwick	(Hw)	Haltwhistle
(Bf)	Belford	(Hx)	Hexham
(Bg)	Bellingham	(L)	Lanchester
(BC)	Barnard Castle	(M)	Morpeth
(Ch)	Chester-le-Street	(N)	Norham and Islandshires
(CW)	Castle Ward	(R)	Rothbury
(Dl)	Darlington	(Sf)	Sedgefield
(Dh)	Durham	(St)	Stockton
(E)	Easington	(Sd)	Sunderland
(G)	Glendale	(W)	Weardale

Etherley (unit 66) or Wooler (unit 141). Similarly to have one unit entirely surrounding Alwick U.D. may well be less satisfactory than having units which bound it. However, as the parish of Denwick is effectively in two halves to the north and south of the urban administrative area, all data for the parish referring to the entire area, unit 130 is the most satisfactory possible in the circumstances.

Consequently, the units adopted in the subsequent study are by no means perfect but it is hoped and felt that they form a reasonable and workable basis. Certainly, though one may remark on the desirability, were it possible, of more homogeneous units both in size and population, the necessary compromise effected here does not affect the validity of the measures subsequently used as reflecting conditions in those areas to which they relate.

3. 2. Simplification of the Problem: the Search for a Multivariate Solution.

The main purpose in the remainder of the chapter is to examine a number of demographic, social and economic characteristics from two points of view. First, it is hoped to establish the existence of interrelationships between relevant variables and to see which characteristics alone or in combination provide the major similarities and differences, between parishes in the rural areas. Second, this problem will be approached from the complementary viewpoint. Instead of primarily looking at the relationship between variables, the emphasis will be altered to a consideration of the parish units and groupings suggested by any spatial pattern in the main dimensions of their similarity and differences.

Essentially, therefore, one is presented here with a problem common in geographical research. Relating to the geographical characteristics of nominally rural populations in North - East England, there exists a large body of data which is to be simplified by the extraction of fundamental influences to be used in the establishment of causal relationships and to be made the basis for categorisation and further study. Indeed Johnston (1966) has commented upon the complexity of seemingly simple relationships between such variables as the primary population ratio (agricultural : total population), change in this ratio and total population change. Ahmad (1965) in wishing to consider the basic kinds of difference existing among Indian cities and the main dimensions shaping the urban system noted that it was necessary to "boil down" many variables relating to population, housing, social, occupational, migration, spatial and other characteristics of the cities in order to answer the preliminary questions which he posed. As was found by the last named author, so too in the present case : "The study of the co-variance of economic, social and demographic characteristics .... is a problem of a multivariate nature. The multiplicity of variables found ...... makes for a vast complexity of relationships that required simplification in order to discover both the common and contrasting element of the various groups" (Ahmad 1965 p.22). Likewise, the problem attacked by Gittus (1963) was to identify within each of the conurbations or towns covered by the 1961 Census, groupings of enumeration districts based upon similarities in the demographic structures of their populations and in the quality of their housing.

In such situations one is faced with a problem of a multivariate nature and it is necessary to turn to some form of statistical analysis to unravel the maze of interrelationships and to develop an understanding of the meaning of a large data mass. Hence, the search for a multivariate solution in an attempt to answer the questions posed above is felt to be necessary. Although to some, the increasing adoption of such refined quantitative techniques by geographers may be seen as nothing more than a current flight of fancy, there is no doubt that the information explosion in the whole field of the social sciences has made imperative the adoption of statistical methods. It has been said that, "Given the complexity of most geographic problems with regard to the number of intercorrelated variables that have to be considered it is not surprising that multivariate procedures increasingly are being favoured in geographic analysis" (King 1969 p.165). Moreover, three points made by Pesonen (1969) are particularly relevant in the present context. Firstly, he points out that areal variations and co-variations can be described less ambiguously by means of parameters than by means of words. For, by combining statistics and map analysis one has an excellent chance of finding cause and effect relationships that might otherwise remain undiscovered. This point is echoed by Robson (1969) who states that in studying certain kinds of social and economic variables, it is often valid to take a spatial pattern as reflecting functional processes. Secondly, Pesonen notes that one fundamental purpose of a statistical treatment is to integrate the observations as components of wider systems and consequently allow for comparison and generalisation. Finally, he states: "In handling observation material gathered from actual environments in which mutually correlating variables compose a complicated structure, it would be natural to attempt to outline some of the basic dimensions by means of factor analysis or some other multivariate analysis" (Pesonen 1969 p.7).

3.3 Factor and Principal Component Analysis

The related techniques of factor and principal component analysis have become increasingly used in geographical research dealing with large data matrices. The causal reasons have been strongly yet simply stated: "Factor analysis provides one of the most powerful tools in the statistical analysis of multi-component problems. It attacks the problem at the very point where standardization fails and recognizes that all measurements are not of equal weight but that many of them may overlap and tell us the same story about .... pattern of variation, we intuitively suspect that some are redundant and that a more basic pattern lies beneath ..." (Haggett 1965 p.223). Matalas and Reiher (1968) looking at research in the field of hydrology comment on the use of regression and its use to establish relations amongst a set of variates noting that prediction is the primary purpose with any attempt to extract cause and effect connections being perilous if not entirely erroneous. On the other hand they hold "... factor analysis purports to explain observed relations among several variates in terms of simple relations that provide insight into the underlying structure of the variates" (p.213)

As such, therefore, factor and principal component analysis seem to offer many attractive qualities for the social scientist in general. Though such techniques were originally developed to analyse results in the behavioural sciences, first being used by Spearman in 1904 to test a theory of human intelligence, their wide ranging applicability in geography has received much favourable comment both in terms of utility for data simplification and organisation and classification (Mather &Doornkamp 1970, Cole and King 1969). Consequently the authors mentioned in Section 3.2. all found the solution to their problem in such multivariate techniques whilst usage has elsewhere varied between such widely disparate geographical problems as a regionalization of Western Malaysia based on a principal components analysis of rainfall characteristics (Morgan 1971); the establishment of functional regions within Central London based upon a factor analysis of taxi flows (Goddard 1970) and a factor analysis of telephone traffic to determine central places and functional regions in Denmark (Illeris and Pedersen 1968).

The most frequent geographical application of these analytical methods would, however, appear to be in an urban context, in terms of the establishment of the interrelationships within and between city areas and the classification of the latter based upon the dimensions of variability extracted from the relevant data matrix. The problems considered in such analyses, whilst in an urban context, are extremely similar to those which are to be faced in the present study. Indeed, if the introduction to one of the first geographical applications of multivariate technique in Britain is considered, many of the points raised are common to the present analysis notwithstanding the change in direction from an urban to a nominally rural environment: "The central idea of this study ... (is) ... to unravel the relationships between a great number of urban characteristics, and measure them precisely ... In spite of the notable diversity between the towns, it is obvious that many of them have features in common and that they could be grouped into rough categories" (Moser and Scott 1961 p.2). In this way one may at the very least expect simplification of the problem to its common roots and, if no more, an objective statistical confirmation of subjective regionalisation.

Nevertheless, a relatively large number of techniques are subsumed under the blanket heading of factor and principal component analysis, and prior to briefly considering the ones used here, a fundamental differentiation must first be made between the two main branches. Hautmäki (1969) has distinguished simply between factor and principal component analysis stating that whereas component analysis attempts to explain as much as possible of the variance inherent in the original data, factor analysis is co-variance oriented only transferring that part of the variance to factors which is characteristic of two or more variables. Looked at in another way, this means that component analysis aims at explaining the maximum variation in each dimension transforming the original variables into an equal number of uncorrelated components, only a few of which may be needed to summarize the total variation, whilst factor analysis seeks to minimise the number of factors (Robson 1969).

Much confusion and argument has arisen in geographical literature over the meaning of these two distinct terms and many authors appear to use the two words 'factor' and 'component' and the two terms 'principal component analysis' and 'factor analysis' interchangeably without comment (e.g. Illeris and Pedersen 1968, Goddard 1969, Costello 1971) although recent heated discussion may well have one welcome by-product in clarifying future terminology (Davies 1971 a and b, Mather 1971 and 1972), despite its oversimplification in differentiating between the two techniques (see Section 3.7). As here one of the primary objectives of analysis is to identify common patterns of variation in the data, then the advice of Mather (1971) is followed and one type of factor model will be employed.

At the same time, whilst making this basic differentiation between factor and principal component analysis, the similarity of the two methods must be remembered. The fact that both techniques extract the diagnostic variables from a data matrix and isolate basic patterns existing within the data has been noted by several workers (e.g. Robson 1969, Davies 1971 b), whilst one (Hautmäki 1969) has given valuable insight into this. In studying an area of South Finland by both methods he reached a general conclusion that both methods give approximately the same solution though as might be expected, the component solution explained 77 percent of the variance, the factor solution only 66 percent. On the other hand, as the last factor in the factor analysis obtained a smaller eigenvalue (see Section 3.6), it may be said to have achieved a more effective combination of variables. He concludes: "In view of the above it may be claimed that both analytical methods seem equally good in an application of this kind, except that factor analysis seems more effective in the combination of variables" (Hautmäki 1969 p.16).

3. 4 Factor Analysis : Q - mode and R - mode Techniques.

Having decided (see Section 3.3) to adopt the factor model, one must next decide which of the two main branches of this method will be adopted: Q-mode or R-mode. The former is essentially a classification technique by which areas may be classified according as to how they load on the basic dimensions of variation extracted from a data matrix. Correspondingly the latter has been described as " ... a multivariate method used to resolve an array of correlation coefficients, or other product-moment measures of association into a form that can be interpreted more easily in terms of processes thought to have been responsible for the correlations" (Miesch 1969 p.172). Thus, in Q-mode analysis the major concern is with similarities between areas whilst in R-mode the relations between variables are paramount. To the present most geographical work appears to have utilised the latter method which is surprising for, as Davies (1968) has pointed out: "Given the constant geographic concern with areas and regions this is rather paradoxical, one would have expected more attention to be paid to a Q-mode analysis in which the areas (rows) are correlated, and factor scores consist of variables" (p.14).

Indeed, as Davies further notes, examples of geographers using the Q-mode technique, with the one mentioned exception of Goddard (1970), are few and far between. Even where regionalisation appears a primary object of concern (e.g. Hautmäki 1969), the R-mode approach has generally been adopted. It is somewhat startling to note that the computer programme to be utilised in this study - a Q-mode factor analysis - has, to the present author's knowledge, been utilised less as a Q-mode programme (Hill 1969) than actually adapted for use as an R-mode technique (Costello 1971, Elahi 1971).

It will be apparent from Section 3.2 that this analysis seeks to deal with a variety of demographic, economic and social characteristics in rural North-East England from both the above viewpoints - the interrelationship of variables (the R-mode technique) and the similarity of areas (the Q-mode technique). Consequently, both approaches will be adopted. Firstly, an R-mode analysis will be performed to isolate meaningful groupings of variables and the basic dimensions of these. Thereafter the Q-mode method will be utilised to consider the grouping of parish units along the basic dimensions extracted from the input variables. Following this a classification of the parish units will be made.

3. 5 Variable Selection and Data Sources

At this point it becomes necessary to determine the variables which are to be used in the subsequent multivariate analysis. This is one of the most critical steps in both factor and principal component analysis, for many authors have stressed that the results obtained by such techniques are directly dependent upon the input (Moser and Scott 1961, Pocock and Wishart 1969). Indeed, it is difficult to place too much emphasis upon the careful selection of the input variables. Robson (1969) recommends that variables be selected with an eye to their possible theoretical importance, with a sufficient cross-section being taken so as not to give undue weight to any one aspect, whilst Gittus (1963) points out ..."the output of the whole process is entirely dependent on the input. There is nothing magical about component analysis. It sorts and sifts the input data with reference to the pattern of the intercorrelations between the variables. If the input variables are irrelevant to the classification that it is hoped to achieve, the output of the analysis will be irrelevant too. If the input variables are almost all slightly different measures of one attribute, the final result will indicate little more than the distribution of the same attribute. It is important, therefore, to choose the initial indices carefully" (p.116).

Consequently, there is some degree of subjectivity involved here, and a careful consideration of the method of variable selection is necessary. One must indeed beware of using factor analysis as an easy way of doing something with a large amount of data. There is, for example, a substantial grain of truth in a mathematician's criticism of some geographers' use of factor analysis : ..."people go out and collect data so that they can do something with it (i.e., a factor analysis) so by using factor analysis to get rid of unwanted data the result is to generate a hell of a lot more" (Williams 1971 p.229).

For the present analysis over 100 variables were considered for inclusion. A Spearman Rank Correlation Matrix was produced from a programme written by the present author and following

Gittus (1963), two points were considered. First, one of a pair of indices was eliminated if they were highly correlated, obviously directly related and if thebalance of the input (see Section 3.6) could be noticeably improved thereby. For example, the figures for the percentage employment in mining in 1961 and 1966 had a correlation coefficient of 0.93 and, therefore, only the latter date was used. It was seldom difficult to decide which of a pair of indices to reject. Where the figures related to two dates, the latter was taken except if the data for the former were felt to be more reliable. Hence with regard to sex ratio, 1961 figures were taken rather than 1966 as the former are based upon a 100 percent coverage, the latter only 10 percent. In cases where it was desired to use a change element (for example, population potential change 1951 to 1967), any data inclusion with respect to the actual variable was restricted to the first date. This arises from the fact that if there was a significant correlation between population potential 1951 and the percentage change between 1951 and 1967, the relationship would be overstated by a correlation of the change and 1967 potential when any process operating was already completed.

The second main point considered when eliminating certain potential variables was whether a particular index appeared to be fully part of the organic rural scene here analysed. This assessment was based upon two criteria. Firstly, where a variable had extremely low correlation coefficients with the remainder of the matrix its inclusion was questioned. Secondly, a preliminary R-mode factor analysis was run using 111 variables. When the variance of a particular index in question was noted to have been absorbed far less than the average as shown by the communality (see Section 3.7), the variable was eliminated. This procedure did not affect many variables and in all cases their inclusion in the analysis had often been questionable throughout. One variable removed from the factor analysis in consequence was that of persons aged 60 and over (as a percentage of the total population) who had moved into the parish unit from outside the Local Authority area between 1961 and 1966. This variable was based upon 10 percent sample data and, generally consisting of small totals, was of debatable validity at the outset. Moreover, the correlations with other factors were extremely low, only one out of 114 reaching above 0.4 (0.53 with percentage of enumerated population aged 60 and over in 1966). Similarly, whilst the vast majority of indices included in the preliminary factor analysis had a communality exceeding 0.9, this old-age inmovement index did not quite reach 0.73.

At the same time, this preliminary study was useful when making the choice of variables to eliminate in order to achieve a better input balance. Of the many indices relating directly to agricultural intensity which were considered for inclusion, the two main ones related to Standard Man Day requirements and Standard Net Output (see Section 6.4). Though figures for the latter were rather more difficult to calculate, the respective communalities indicated it to have been far better integrated into the factor model whilst both, whether on a per hectare or per holding basis, were clearly highly intercorrelated (in both cases $r_s = 0.92$).

Finally, 74 variables were chosen for inclusion in the main factor analyses. These, together with the data sources where relevant, are given in Table 3.2 under five main headings. Some of the data sources have been used already in Part 1 and require no further comment at this stage, as a full discussion of the relevant variables will be entered into at the appropriate points in succeeding chapters. Likewise, data utilised from the County Reports of the 1961 Census of England and Wales (G.R.O 1963 a and b) require no justification here. On the other hand, the utilisation of data at the 10 percent sample level from the 1961 Census (4 variables) and data from the 10 percent 1966 Census (41 variables) raised rather more fundamental questions as to the validity of this source.

The 1961 Census had two unique qualities. Firstly, it used 10 percent sampling techniques to extend the range of information available whilst not increasing the cost proportionately, and, secondly, records at a parish level, which included much of this 10 percent data, were made generally available. In 1966, the first Census to be held between the normal decennial ones was taken, this being entirely on a 10 percent basis. For both years, it was

Table 3. 2

The Variables used in R-Mode and Q-Mode Factor Analysis and their Data Sources

Density, Stability and Distribution of Population:

a) Density

1. Density per hectare in 1951 (1951 Census)
2. Density per hectare in 1961 (1961 Census)
3. 1967 density as percentage of 1951 (Censuses of Population 1951 and 1961 and 1967 Electoral Registers).
4. 1967 density as percentage of 1961 (1961 Census, 1967 Electoral Register).

b) Stability

5. Ratio (percentage) of maximum to minimum electoral population 1958 - 1967 (Electoral Registers 1958 - 1967).
6. Persons having changed residence in 12 months prior to Census as a percentage of total resident population (1961 Census).
7. Persons having changed residence in 5 years prior to Census as a percentage of total resident population (1966 Census)
8. Persons having changed residence in 5 years prior to Census, but moving within same local authority area, as a percentage of total resident population (1966 Census).
9. Persons having entered parish unit in 5 years prior to Census from another local authority area, as a percentage of unit resident population (1966 Census).

c) Distribution

10. Distance in kilometres from nearest settlement of 7000.
11. Distance in kilometres from nearest settlement of 24,000.
12. Distance in kilometres from nearest settlement of 70,000.
13. Distance in kilometres from regional centre of population potential.
14. Population potential 1951 (1951 Census).
15. 1967 population potential as a percentage of that in 1951 (1951 and 1961 Censuses, 1967 Electoral Register.)

Table 3. 2. cont.

Demographic Characteristics of the Population

a) Age and Sex Structure

16. Percentage of population aged under 15 (1966 Census)
17. Percentage of population aged 15 to 44 (1966 Census)
18. Percentage of population aged 45 to 59 (1966 Census)
19. Percentage of population aged 60 and over (1966 Census).
20. Dependency Ratio 1966 (1966 Census).
21. Sex Ratio 1961 (1961 Census).

b) Fertility and Mortality

22. Crude Birth Rate 1964-5 (County Health Department Records).
23. Fertility Ratio 1966; children 0 - 5: women 15 - 49 (1966 Census).
24. Modified Fertility Ratio 1966; children 0 - 14: women 15 - 49 (1966 Census).
25. Crude Death Rate 1967-8 (County Health Department Records).
26. Average Age at Death 1967-8 (County Health Department Records).
27. Ratio of deaths at age under 65 to those at and above (County Health Department Records).

c) Other Population Structures.

28. Percentage of Population married (Census 1966)
29. Percentage of Population single (Census 1966).
30. Percentage of Population resident in Great Britain, born outside Great Britain (Census 1966).

d) Family Characteristics

31. Percentage of Households with no families (Census 1966).
32. Percentage of Households with one family (Census 1966).
33. Percentage of Households with two or more families (Census 1966).
34. Percentage of Households of one or two persons of whom at least one is of pensionable age (Census 1966).

Table 3. 2. cont.

Economic Characteristics

a) Employment

35. Primary employment within parish unit as percentage of 1963 parish population (Census 1961, Electoral Register 1961 and 1963, M.A.F.F. June Census Returns 1963).

36. 1967 primary employment within the parish unit as a percentage of that in 1963 (Census 1961, Electoral Registers 1961, 1963 and 1967, M.A.F.F. June Census Returns 1963, 1967).

37. Percentage of workforce employed in agriculture, (1966 Census).

38. Percentage of workforce employed in mining (1966 Census).

39. Percentage of workforce employed in production (1966 Census).

40. Percentage of workforce employed in services (1966 Census).

41. Percentage of workforce employed in defence (1961 Census).

42. Percentage of workforce unemployed 1961 (1961 Census).

43. Percentage of workforce unemployed 1966 (1966 Census).

44. Percentage of workforce aged 15 to 44 (1966 Census).

b) Journey to Work

45. Percentage of resident workforce in parish unit employed outside parish of residence (1966 Census).

46. Persons travelling to work in a unit parish from outside that parish, as a percentage of total unit employed population (1966 Census).

47. Total journey to work movement crossing parish boundaries within, into or out of a unit as a percentage of unit employed population (1966 Census).

48. Composite Job Ratio for parish unit (1966 Census).

Table 3. 2. cont.

c) Agriculture : Characteristcs, Intensity and Efficiency

49. Ratio of theoretical Standard Man Day (S.M.D.) requirements to estimated actual usage, 1967 (M.A.F.F. June Census Returns 1967).

50. Standard Net Output (S.N.O) per hectare of agricultural land 1967 (M.A.F.F. June Census Returns 1967).

51. S.N.O. Per agricultural holding (M.A.F.F. June Census Returns 1967).

52. Percentage of agricultural land in rough grazing and common (M.A.F.F. June Census Returns 1967, Registers of Common Land).

53. Average size in hectares of parish unit agricultural holdings (M.A.F.F. June census Returns 1967).

54. Percentage of agricultural workers in regular whole-time employment (M.A.F.F. June Census Returns 1967).

55. Regular agricultural workers per hectare of agricultural land (M.A.F.F. June Census Returns 1967).

Social Characteristics

56. Persons per household (1961 Census)[1]

57. Persons per room (1961 Census).

58. Persons living at over $1\frac{1}{2}$ per room (1961 Census).

59. Percentage of unit population living in private households (1961 Census).

60. Percentage of owner-occupying households (1966 census).

61. Percentage of households renting from Local Authority (1966 Census).

62. Percentage of households with exclusive use of 3 basic facilities (1966 Census).

63. Percentage of households of 2 or less persons (1966 Census).

64. Percentage of households of 6 or more persons (1966 Census).

65. Percentage of persons living at below 0.5 per room (1966 Census).

66. Percentage of persons living at or above 1 per room (1966 Census).

67. Percentage of persons with household access to one car (1966 Census).

68. Percentage of persons with household access to two cars (1966 Census).

Table 3. 2 cont.

69. Percentage of persons aged 15 or over who were students or whose terminal education age was over 15 (1961 Census).

Socio-Economic Characteristics [2]

70. Percentage of economically active and retired males in Social Class 1 (1966 Census).

71. Percentage of economically active and retired males in Social Classes 1, 2 and 3 (1966 Census)

72. Percentage of economically active and retired males in Socio-Economic Groups 1,2,3,4 and 13 (1966 Census).

73. Percentage of economically active and retired males in Socio-economic Groups 8,9,12 and 14 (1966 Census).

74. Percentage of economically active and retired males in Socio-Economic Groups 1,2,3,4,8,9,12,13 and 14 (1966 Census).

[1] The 1961 Census gives certain totals at the parish level for population and housing data. Whilst those referring to household features (e.g. numbers of dwellings or rooms) include an estimate for households which were absent on Census night, the population totals do not. Hence, the effect of applying private household population to the given number of occupied rooms and private households respectively, will be to give lower figures for both these characteristics than would otherwise be the case. It is, however, possible, as has been done here, to exclude rooms unoccupied on Census night from consideration by multiplying the resident population by the given persons per room ratio and using the resultant total for occupied rooms in any subsequent aggregation and calculation. The importance of temporarily unoccupied dwellings is, however, so small that the Spearman Rank Correlation between resident persons per room in households present on Census night and resident persons per occupiable room is only very slightly below 0.99. Consequently any effect of the above on the persons per private household variable where no correction for temporarily absent households can be made, is likely to be extremely small and entirely insignificant in the present analysis.

[2] Variables relating to high and skilled manual social status were chosen in consequence of their potential relevance to the present study, especially in terms of the processes operating in commuter hinterlands leading to the establishment of dormitory villages largely composed of adventitious population.

aimed to include 10 percent of the population at large by covering 10 percent of all private households and institutional populations (Jackson 1968). Consequently the sample is not a simple random sample of persons but rather a cluster sample where persons are selected in complete households.

Although the selection of households for inclusion in the samples was theoretically undertaken on a random basis, certain sources of bias have since been discovered especially relating to 1966. In 1961 there appears to have been an underenumeration of persons who might have had difficulty with the more detailed questions of the extended Census form whilst in 1966 it would seem that certain enumerators did not keep strictly to the random sample selection but rather tended to pass on to another household if they had difficulty in contacting one which was to be included. In both cases there would appear to have been an understatement of older persons and low status households though it is impossible to gauge the precise extent of this. Indeed, Robson (1969) has stated that the task of calculating and applying regional correcting factors at the Enumeration District level would probably introduce as many errors as it would solve. He further notes a division of opinion on the advisability of using the 10 percent sample data in a study but concludes as would seem appropriate here: "The Centre for Urban Studies ... has included 10 percent data in its analysis of London, trusting that the sampling errors will come out in the statistical wash. In incorporating data from the 10 percent sample, one can merely note that local knowledge does not suggest any major inaccuracies in the data and that its exclusion would have severely emasculated much of the analysis" (p. 159).

One process by which potential errors in the data have been reduced, the creation of parish units with a minimum population of approximately 1,000, has already been mentioned (Section 3.1) and should go some considerable way to removing doubts as to the validity of using the sample material. As Herbert (1968) has stated: "A data problem ... has been whether or not to include variables derived from the 10 percent sample census, the objections being that this section of the data is statistically suspect ..... Certain safeguards can be adopted, such as setting a lower limit to the population of any Enumeration District which will be regarded as acceptable, and the argument has been made that the potential fallabilities of this data are no greater than others involved in the Census, including the process of Census-taking itself" (p.107). Bearing this in mind together with the absence of any practical alternative[1], the use of this data in the present study is felt to be entirely justifiable.

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[1] One may indeed speculate on the accuracy of data used in other surveys as to the comparability with 10 percent Census material. Are conclusions drawn from the Census of a developing country (e.g. Hartley 1968) likely to have a more secure statistical foundation than similar drawn from 10 percent data derived from the well-established Census of England and Wales? The perspective of the matter may be seen in a truer light when one considers the seeming lack of methodological criticism levelled at processes whereby conclusions have been drawn from mediocre or poor response rates to 10 percent (or less) postal surveys (e.g. Edwards 1963, Ironside 1964) where it would appear that respondants would be heavily biased towards persons with a greater level of education and higher social status.

3. 6. Preconditions for Analysis

Having now determined the techniques and variables to be used in analysis, there still remain a number of preconditions and points to note if the maximum use is to be extracted from the ensuing factor analyses. Five such considerations appear relevant here.

a) Normality

Factor analysis is a parametric statistical technique and, as such, it presupposes the variables used are derived from a normal distribution. In many cases, however, it appears that little or no attempt has been made by workers to ensure this precondition was fulfilled prior to analysis. Davies (1968) notes: "The possibility of distortion due to the use of a closed number statistic such as percentages is rarely commented upon, whilst even more important is the fact that few attempts have been made to ensure linearity" (p.12). This is a particularly pertinent comment when it is appreciated that percentages are one of the most commonly used scales of measurement in much geographical research forming the vast majority of variables in the present study and having been similarly prepond- erant in such analyses as that by Robson (1969) of Sunderland, Hartley (1968) of population change in Libya and Hill (1969)[1] of the urban development of Kuwait.

Some doubt has nevertheless been cast upon the absolute necessity of having normalised variables. Moser and Scott (1961) noted that on average, log transformed data gave similar results to untransformed material and this conclusion has since been widely noted and used (e.g. Herbert 1968, Robson 1969). To this one may add the conclusions of another author who attempted to examine the effects of normalisation and weighting (see below) of

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[1] Indeed Hill even went so far as to state that: "All variables were transformed into percentage distributions to obtain normal or near-normal distributions in every instance" (p. 194).

variables with respect to multivariate analysis. He held: "The simulation showed that .... the transformation that was made on the basis of the observation material to meet the requirement of normality was of no use. Although subsequently some of the correlations describing the relationships were higher the overall picture interpreted by factor analysis was distorted" (Pesonen 1969 p.57).

Despite this rather surprising conclusion it still remains true that factor analysis, as a parametric statistical method, assumes normalised data in the analysis and one is on somewhat less sure methodological ground if this precondition is ignored. The programme used here (see Section 3.7) is able to row-normalise data in the course of its execution and this would seem to be a relevant and valid property, obviating the necessity of any further concern with the normalisation of the 74 input variables.

b) <u>The Weighting of Variables and Areas</u>

Robson (1969) has pointed out that it has been known for some years that the size of the areal units used in correlation analysis (this forming the basis of the factor technique) affects the size of the correlations obtained. The first real concern by geographers for the importance of this was shown by Robinson (1956) who stated: "When the areal units to which the values relate are not of the same size, as is unfortunately usually the case, significant discrepancies in size should be taken into account, otherwise the results of computations may be meaningless" (p.233). Whilst Robinson's corrective method has been subsequently criticised (Thomas and Anderson 1965, Curry 1966) and shown to refer only to special cases rather than generally, the discussion on the whole subject has led some geographers to conclude that the principle of weighting is sound (Robson 1969), though more often than not based upon the population sample size involved rather than any areal considerations.

The most definite statement on the subject is, however, again given by Pesonen (1969). Where an areal weighting is in order he concludes: "As large areal units are in general likely to be of a more heterogeneous structure than are small ones, it would consequently be consistent to weight the observations not with the size of the area but with the inverted value thereof" (p33). On the other hand, where variables are based upon population he considers that the size of population may be regarded as the natural weight factor. "A choice would then have to be made as to which is the objective of the investigation, the description of the area or the description of the population" (Pesonen 1969 p.33). He concludes that as the reliability of a population sample is dependent upon the square root of the number of observations, the square root of the size of the population would be the logical weighting coefficient in such cases. Applying such a weight factor to his Finnish model, he found several points of interest.

Firstly, it was noted that such population weighting has only a relatively slight effect upon correlations, though this was favourable insofar as the correlations were generally higher. On the other hand weighting by size of area had a greater effect, though in more cases it lowered a correlation rather than increased it, even perhaps altering the entire structure of the correlation matrix. Secondly, he found that in the subsequent factor analysis the effect of the population weighting meant that a greater proportion of the variation in the variables was related to the population factor than in the unweighted material. In combination, however, the factors did have an improved explanatory capacity. With areal weighting the reverse again appeared to be the case. Perhaps of more importance was the fact that it appeared that the weighting had no effect upon the interpretation of the factors.

In consequence, where variables related to population are being dealt with a population weighting factor would appear as possibly giving a slightly favourable, though by no means fundamental effect. Such a weighting is, however, not adopted in the present study for two reasons. On the one hand it will be recognised that by no means all the 74 variables used are related to population directly, and certain of the agricultural measures are predominantly areal. Therefore, any one weighting would ignore such differences. Alternatively, despite Pesonan's qualified acceptance of population weighting in certain cases, other recent conclusions have been less favourable. Thus Herbert (1968), though he does not go into any detail, holds that weighting in multivariate analysis is unusual, concluding: ... "there is some justification in the literature for not doing this" (p.108). Further research in this direction would obviously appear necessary.

c) <u>Wavelength Effects</u>

Although there would appear little that can be done in amelioration, a problem similar in nature to that previously discussed should be appreciated. The problem of spatial autocorrelation has already been briefly mentioned (see Section 2.7) and this has its importance from a slightly different aspect here. Areal differentiation may be regarded as comprising a spectrum of scales with different aspects having different scales or wavelengths (Curry 1966). As a result, administrative units such as are used here represent a filtering out of wavelengths less than their size, only allowing a discussion of differences of a scale greater than this size.

The practical nature and effects of this were investigated in the study by Pesonen (1969) which has already been mentioned above. In his work he compared correlations calculated from material based on regular equal hexagonal areas and those from irregular communes shaped out of them. He concluded: "As both the hexagon and the commune material are the results of the same relationships, it would be assumed that the correlations in them would be by and large the same. This, however, is not the case for all the variables. In many cases, for instance, the correlations calculated from the commune material are higher than those calculated from the hexagons. One of the reasons for this is the decreased random variation ... when larger units are employed the random variation cancels out to a relatively greater extent than it does when smaller groups are employed" (p.43). Nevertheless, as he then notes, whilst evenness of observation might be a theoretical supposition, it is difficult to achieve, for even if the areal units are of regular shape (unlike the British administrative experience) there is still usually some variation in population size. Consequently, whilst one may weight observations by the square root of the population involved, this can actually have a distorting effect on the overall picture, for not all randomness will be associated with one weight factor. This may be cited as a further reason why weighting is not undertaken in the present study.

d) The Standardization of Data in Q-Mode Analysis

One particular problem, albeit of easy solution occurs with regard to Q-mode factor analysis alone. The ability of the programme used (see Section 3.7) to row-normalise data is sufficient if an R-mode type analysis is attempted. In Q-mode analysis, where the variation between areas, rather than variables, is examined, such a normalisation process is equally important but not sufficient. For, where variables of different magnitude, even if they be of the same measurement scale, are concerned, they will still in Q-mode analysis retain the same relative magnitudes after row normalisation. For example, sex ratio (number of females per 1,000 males) with a mean of slightly over 1,000 and a correspondingly high variance, will be given a relative weighting approximately 1,000 times that of a variable, possibly persons per room, with a mean of 1, whatever the comparative diagnostic nature of the two variables.

To overcome this it is necessary to transform the Q-mode data matrix so that each column has a similar range in order that equal weighting be given to each variable. A simple transformation previously adopted by Miesch (1969) was thus written into the programme. By this, each column was scaled from 0.0 to 1.0 using the standard formula $X_{ij} = (X_{ij} - X_{j\,min}) / (X_{j\,max} - X_{j\,min})$.

The necessity for including such a transformation cannot be overstressed as the results of a Q-mode analysis are entirely dependent upon it. Indeed, a preliminary Q-mode run was attempted without any such standardization and the results of this may profitably be compared with those extracted in Sections 3.8 and 3.9. Although a mere six factors were found to account for over 99 percent of the total variance, eight variables[1] in various combinations were the main constituents of these factors, each significantly occurring

[1] These eight were: distance from nearest settlement of 24,000; distance from nearest settlement of 70,000; distance from regional population potential centre, sex ratio; fertility ratio; modified fertility ratio; standard net output per hectare, and standard net output per holding.

in at least three. It is not surprising that these variables had the eight highest means and variances of all 74 inputs. Similarly, such variables as persons per room failed to score above 0.01 on any of the six factors extracted solely because of the relative magnitudes involved. It is interesting to note that a similar if less extreme result may occur even where the variables are almost if not all measured on the same scale. Thus, Hill (1969) whilst converting his 38 variables to percentages would not appear to have standardized the values. In consequence, he predictably found that the most diagnostic variables in his factors consisted of such things as the two most important industries, the percentage of the sample population formed by the national group and the percentage of persons aged under 15 (the Kuwait population being one of the youngest in the world) whilst such variables as did not appear important included the percentage of persons aged over 64, the percentage of British persons in the population, and employment in administration, all of which had low absolute values though if given equal weighting may well have had important diagnostic properties.

e) The Balance of Variables

Reference has already been made in section 3.5. as to the means by which variables were selected for inclusion in the analysis. In briefly reviewing the main preconditions for analysis the question of balance in variables should be noted. This appears a logical extension of the fact that what comes out of a factor analysis is directly related to the input. Therefore, whilst the absence or presence of agriculture is of obvious fundamental importance in determining the rurality of an area, the number of input variables relating directly to the intensity, efficiency and characteristics of agriculture was reduced to seven from over twice that number in an attempt not to disproportionately favour this aspect at the expense of others. It is hoped that the balance achieved between distribution, demographic, social and economic factors is a reasonable one, whilst it is felt that every variable included has a significant contribution to the purpose in hand: "A Geographical Study of Post-War Rural Populations in North-East England."

3.7 Factor Analysis and the Programme Used

Whilst a full understanding of the complex mathematical nature of factor analysis would appear unnecessary in using the technique and rather a matter for the statistician and mathematician (see Harman 1960), the general nature of the method merits a brief consideration. Factor analysis employs a statistical model which regards part of the information in the data as being error, part as a response to forces affecting one specific variable and the remainder (common variance) as the response of the variables to the influences termed common factors. It is usual to analyse only this common variance in factor analysis, partly because it allows the user to admit his inability to identify all the influences acting on the system under study due to sampling difficulties (Mather 1971).

The particular programme for factor analysis which was adopted here, was a Q-mode programme[1] written in Fortran IV for small computers by J. E. Klovan (Klovan 1968), already having had frequent use in research (Hill 1969, Costello 1971, Elahi 1971). Used as a Q-mode programme, with the addition of the standardization procedure mentioned in Section 3.6 the variables are fed into the computer by area (adaptation for use as an R-mode programme requires that the variables be fed in as rows and areas as columns), thereafter generally following the outline given by Cole and King (1969 p.155).

i) The means, standard deviation and variance of the samples (areas) are obtained;
ii) The samples are then cross-correlated by a product-moment measure of association to give a correlation matrix. Here the matrix is in angular terms being a cos θ matrix;
iii) Factors are then calculated in response to the cos θ matrix;
iv) The interpretability of the factors is theoretically improved by the varimax rotation procedure;

---

1 The programme may more correctly be termed a principal axes factor analysis in the terms specified by King (1969) with, seemingly, the communalities which appear along the principal diagonal of the correlation matrix being set to 1.0 at the start of the analysis. Here there is an overlap with principal components analysis but both in terms of model conceptualisation (i.e. there are basic dimensions attributable to certain characteristics of rural population underlying the data matrix), and procedural aspects including rotation and the actual nomenclature of the programme itself, the term factor analysis would appear more logical (see King 1969 pp. 165-186).

v) The association of individual factors with the samples are then given by factor loadings of factors on samples;

vi) Finally, the association of the variables with the factors is shown through a table of factor scores.

Factors derived from the correlation matrix are based on the length of the axes necessary to define the scatter of points in multi-dimensional space. These axes are known as eigenvectors and each vector absorbs a certain amount of the total variance (this value being termed the eigenvalue), as it attempts to reduce to a minimum the distance between the points and itself. The iterative process is described as follows: "The first factor is determined by the degree of inter-correlation of the variables. If they are all closely associated the axis of the hyperellipsoid will be long and most of the points will fall near it. This will give a high factor value on the first factor ..... The position of the second factor is fixed in such a way that the distance to those points which lie furthest from the first axis lie close to the second factor axis. For this reason the second factor shows different loadings from the first. The length of the second factor axis is normally shorter than the first factor axis and this is increasingly true as the values of the correlation coefficients in the matrix increase" (Cole and King 1969 p.157). Subsequent factors are produced by a continuation of the procedure. The extent to which the variance of a sample has been accounted for by the factors is shown in the table of factor loadings by the communality, a communality of one showing total absorption. One may thus assess which of the samples (Q-mode) or variables (R-mode) have been highly integrated into the factor model.

The present programme terminates the extraction of eigenvalues when ten have been extracted or when any eigenvalue is less than 0.01. Though such arbitrary cut-off points have been criticised (Davies 1968), the limits taken here are sufficiently low (indeed the customary threshold is an eigenvalue of 1.0) as to meet the criticism.

In the light of recent argument (Davies 1971 a and b, Mather 1971 and 1972) some explanation of the varimax rotation procedure may be considered necessary. The aim of varimax has been simply stated as being to distribute the large variance explained by the major factors among others, in order to ease the problem of explanation, ensuring where possible that each one or the original variables is highly correlated with only one factor (Herbert 1968, Pocock and Wishart 1969). This technique has, however, been criticised by Davies (1968, 1971 a, 1971 b) in terms of simplifying the factors at the expense of the generality shown by the original factor solution. Indeed, he describes the varimax technique as ....."cutting up the body of generality into a set of unrelated fragments without ever realising that these fragments can ever be considered as part of a larger entity" (1968 p.117). By way of reply, however, Mather (1971 and 1972) has stated that as the position of the primary factor axes can be considered accidental, there being no reason why they should coincide with basic influences simply because several computational criteria are satisfied, rotations are generally considered to be essential to factor analysis in the search for a solution which is meaningful in terms of the variables included in the analysis. It is hoped that the validity of the varimax rotations in the present case will be apparent in the results to be discussed in Sections 3.8 and 3.9, with the original factor solution having aggregated well over 90 percent of the total variance in the Q-mode and 77.2 percent in the R-mode analysis into the first factor. Here it would seem that these totals are broken down from a meaningless generality into a rotated solution which certainly has obvious meaning in terms of the variables involved.

3.8 Results of the R-Mode Analysis

The 74 variables were first subjected to an R-mode type analysis in order to ascertain the nature of significant relationships between them. The Klovan programme was accordingly modified for use as an R-mode rather than Q-mode technique by reversing the process of data input, variables being fed in as samples (i.e. rows) and areas as variables (i.e. columns). The maximum ten factors were extracted and these accounted for 94.31 percent of the variance, an excellent result when compared for example, to the 75.5 percent explanation extracted by ten rotated components when Ahmad (1965) considered the variation of 68 variables across Indian cities.

After rotation three main factors emerged accounting for 76.91 percent of the variance. The remaining seven accounted for 17.40 percent but will, nevertheless, also be considered as to a greater or lesser degree they are interpretable meaningfully in terms of the input variables. Consequently it would seem unsatisfactory to ignore them as they all do contribute to the overall explanation and have at least one factor loading which is considerably higher than the majority of insignificant values. With regard to the communalities of individual variables, 60 had over 90 percent of their variance explained and only one (percentage of two family households at 78.76 percent) below 80 percent. This again would appear entirely satisfactory with many of the communalities being over 0.95[1].

Factor 1

This factor explained 35.62 percent of the total variance and, therefore, in the context of the study area, is a most significant explanatory combination of variables. Fully 17 variables (see Table 3.3.) have a loading of 0.7 or over on this factor and, as the square of a factor loading on a factor gives the percentage of variance of a variable explained by the factor (Davies 1968) this means that all these variables have approximately half or more of their variance accounted for by this factor.

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1 The results of the factor analyses are given in Appendix B

Table 3.3

Variables Loading 0.7 or over on Factor 1

No. in Table 3.2	Variable	Factor Loading
38	Employment in mining, 1966	0.8741
66	Persons living at or above 1 per room, 1966	0.8095
61	Households renting from Local Authority, 1966	0.8008
73	Persons in skilled manual S.E.Gs	0.7768
8	Within Local Authority Movement, 1961-6	0.7695
45	Journey to work outside parish, 1966	0.7625
14	Population potential, 1951	0.7565
27	Age at death $< 65 : > 64$, 1967/8	0.7455
57	Persons per room, 1961	0.7336
58	Overcrowding, 1961	0.7284
50	Standard Net Output per hectare, 1967	0.7256
39	Production employment, 1966	0.7192
42	Unemployment, 1961	0.7088
33	Percentage of 2 or more family households, 1966	0.7078
44	Percentage of workforce aged 15-44, 1966	0.7041
16	Percentage of population aged under 15, 1966	0.7032
43	Unemployment, 1966	0.7009

Whilst the intercorrelation of variables as shown by the correlation matrix will not be considered in depth until a more detailed discussion of individual variables is undertaken in subsequent chapters, in the light of results from the factor analyses, the nature of this important dimension in the rural areas is readily apparent. Quite reasonably the factor has extracted mining and associated aspects. Grouped with mining are variables relating to overcrowding, Local Authority housing, short distance residential movement and high outmovement from the parish of residence to work. The last named is particularly significant in terms of the rationalisation of the mining industry, the inclusion of employment in production (note also the skilled manual workers S.E.Gs) and the proximity to large population agglomerations (population potential). At the same time it is relevant that two young-age indices group with these variables. This, together with the loadings on the two fertility ratios (0.6938 and 0.6895) and Crude Birth Rate (0.6664) suggests that these variables have some logical connection with those already mentioned. The inclusion of unemployment variables must be significant in terms of the employment structure, whilst the occurrence of the agricultural intensity measure (Standard Net Output) is a natural extension of what was noted in Section 2.4 with land values and market demand in areas close to population agglomerations causing intensive land use.

The inclusion of two other variables in Table 3.3 would appear particularly interesting. The high loading on the variable representing the ratio of deaths at an age below 65 to those at age 65 and over suggests the probability of a relatively young age at death being associated with mining and related attributes. In Section 5.2 it is hoped to verify this in rather more detail. Also relevant in this context is the fact that the Crude Death Rate variable at 0.684 only narrowly misses inclusion in the above table.

Finally, in relation to Factor 1, three variables with scores which narrowly fail to reach 0.7 should be noted. Persons per household 1961 at 0.6996 and the percentage of households having six or more inhabitants at 0.6898 are extensions of the above argument. On the other hand, the 0.6921 loading of the 1961 persons in private households index is a little more complex. Two complementary explanations for this high loading may be advanced. Firstly, as one is dealing here with a nominally rural area, it might well be expected that such vital services of an institutional character as hospitals would rather tend to be found in nearby urban settlements. Alternatively, such consumer oriented services which would include 'institutional population' for Census purposes such as hotels, holiday homes and even most old persons' homes, are less likely to be attracted to areas of supposedly low environmental and social status as Factor 1 would here seem to represent. Rather would they seek urban or more 'desirable' rural surroundings. Consequently a high percentage of persons living in private households appears a valid constituent in the above grouping.

Turning to the varimax factor score matrix, some idea of the relevance of this factor to individual parish units may be obtained (Figure 3.2). A value of zero indicates that the area contains approximately an average amount of the factor and one of 1.0 shows a content of approximately one standard deviation above the average (Klovan 1968). The pattern presented is most interesting, revealing north and east Durham as almost entirely covered by areas scoring at least 0.76 on this factor. The reasons for such uncharacteristically low scores as that of the unit which includes the parish of Shincliffe to the east of Durham City, will become apparent in the discussion of other factors. Towards south Durham, where agriculture is more important, scores fall though the Low Dinsdale and Whessoe units score quite highly consequent on their proximity to Darlington and high outmovement of workers especially to manufacturing work in the County Borough. In west Durham, excluding Lanchester R.D. which scores highly on this factor, scores are again low although the area of some mining activity in the east of Barnard Castle R.D. stands clearly out. In Northumberland the picture is much as one might expect in the remoter agricultural areas of the region, with the north and west scoring lowly, even negatively, except where, for instance, mining or quarrying achieve local significance (as in the Newbrough-Warden and Thirlwall units). In the south-east of the county, however, two areas appear especially important from their scores on Factor 1. Predictably, the areas north-east of Morpeth, with the Shilbottle unit just south of Alnwick U.D. the northernmost outlier score highly on account of their mining activity with the other related variables combining also. Additionally, in Castle Ward R.D. to the north of Newcastle, a curious dual picture appears of some units such as Brunswick-Dinnington and Hazlerigg scoring highly whilst other heavily populated areas such as the Woolsington unit score quite lowly. Again the combination of variables forming Factor 1 is particularly important, for those units scoring highly are indeed, typical mining parishes, whilst those scoring lowly are those for which, even if relatively densely populated, this

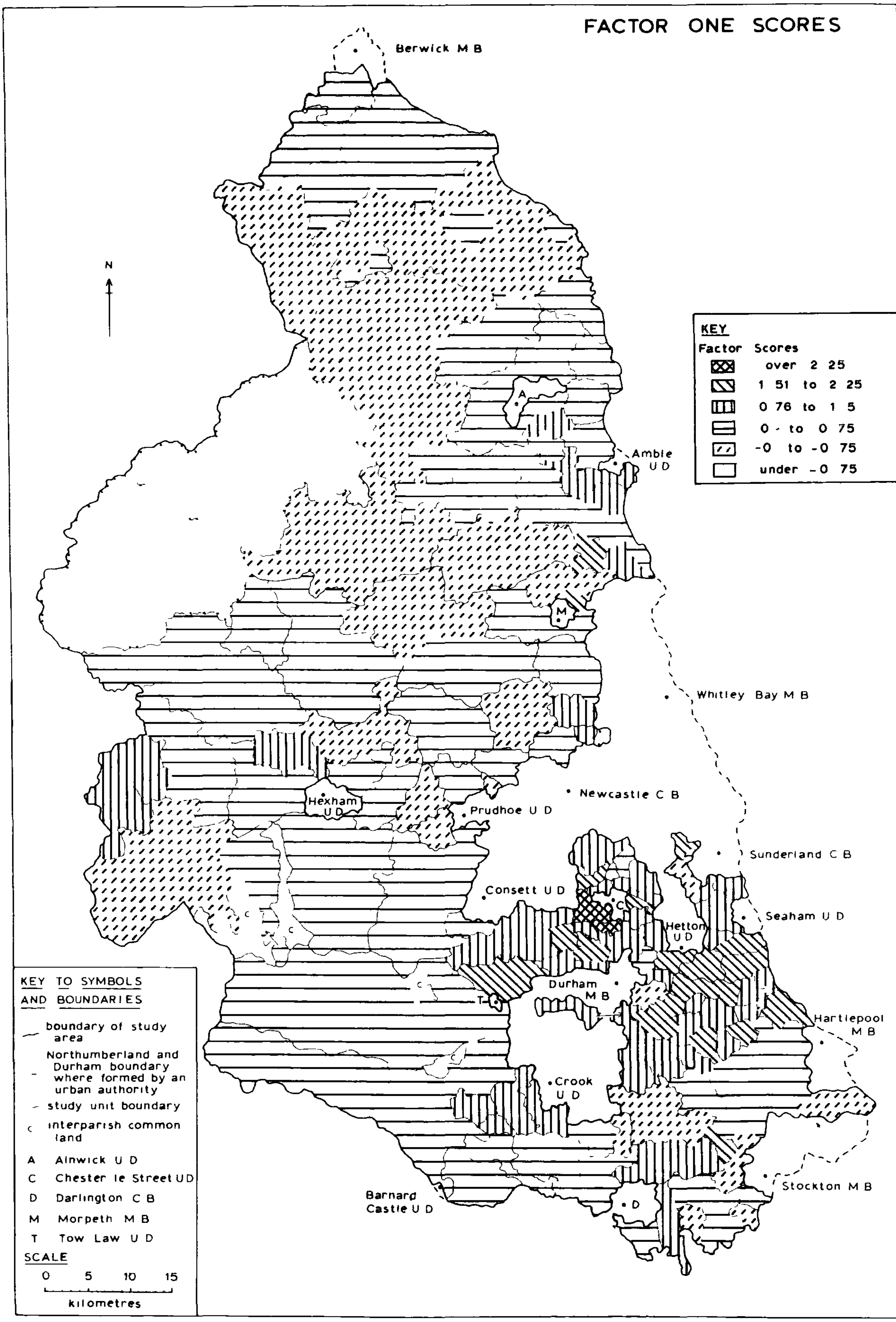

FACTOR ONE SCORES
Berwick M B
N
KEY
Factor Scores
over 2 25
1 51 to 2 25
0 76 to 1 5
0 - to 0 75
-0 to -0 75
under -0 75
Amble U D
A
M
Whitley Bay M B
Newcastle C B
Hexham U D
Prudhoe U D
Sunderland C B
Consett U D
C
Seaham U D
Hetton U D
Durham M B
T
Hartlepool M B
Crook U D
Stockton M B
Barnard Castle U D
D
KEY TO SYMBOLS AND BOUNDARIES
boundary of study area
Northumberland and Durham boundary where formed by an urban authority
study unit boundary
interparish common land
A Alnwick U D
C Chester le Street U D
D Darlington C B
M Morpeth M B
T Tow Law U D
SCALE
0 5 10 15
kilometres

Figure 5.

particular combination of variables has little relevance. Hence, Woolsington does not score highly in terms of Factor 1, and has no reason so to do with, for example, no mining employment and no significant facets in common with this factor. On the other hand, this is not to equate it with the similarly low scoring agricultural areas of Northumberland and Durham and one may look to its score on other factors to ascertain its predominant characteristics.

It will be appreciated that the class intervals used for Figure 3.2, and subsequently, are entirely arbitrary though convenient and Hautmäki (1969) has suggested an alternative method of ascertaining the association of areas with factors through the medium of factor scores. He suggests that if the score exceeds the average (here by definition zero) by a desired number of standard deviation units, the factor in question may be considered typical for that area. On Figure 3.2., therefore, one may consider all parish units in the 0.76 to 1.50 class as having significant affinities to a majority of the variables shown in Table 3.3., whilst those in the higher classes may truly be regarded as type parishes. The units which scored most highly on Factor 1 are given in Table 3.4. In general, therefore, the most typical parishes appear to be

Table 3.4.

Units Scoring most Highly on Factor 1

Number in Table 3.1.	Parish(es)	Score
25	Plawsworth	2.35
23	Edmondsley, Waldridge	2.28
1	Hylton	2.17
31	Shadforth	2.04
8	Cold Hesledon, Hawthorn	1.99
20	Urpeth	1.96
115	Pegswood	1.91
80	Langley	1.85
12	Pittington	1.83
44	Trimdon	1.81

those with considerable mining employment, though some such as the Witton Gilbert unit with few thus employed have sufficient in common with many of the other variables comprising Factor 1, for example Local Authority housing and youthful age structure, to ensure a moderately high score (1.74). It is, nevertheless, noticeable that known extremely densely populated mining parishes such as East Murton only score at a lower level (1.30) and are largely absent in the above table. Indeed, density would appear to be strangely absent from the variables forming Factor 1 and one must look elsewhere for its inclusion.

Factor 2

This factor explained 21.52 percent of the total variance and is, therefore, another basic dimension in rural North-East England, though rather less important than Factor 1. Fewer variables loaded highly on this factor and there was a remarkable lack of scores between 0.55 and 0.80 suggesting that the varimax rotation had had some substantial success in facilitating the interpretation of Factor 2. Loadings of above 0.7 are given in Table 3.5.

Table 3.5

Variables Loading 0.7 or over on Factor 2

Number in Table 3.2.	Variable	Factor 2 Loading
11	Distance from 24,000 person centre	0.8752
37	Agricultural employment, 1966	0.8680
10	Distance from 7,000 person centre	0.8393
12	Distance from 70,000 person centre	0.8374
35	Primary employment, 1963	0.8281
53	Average size of agricultural holding 1967	0.8122
52	Percentage rough grazing and common, 1967	0.8018
13	Distance from population potential centre 1967	0.7163

The nature of the factor and the grouping of variables is clear, obviously relating to agricultural employment and the remoter rural areas at some distance from any sizeable population cluster. The tendency towards large agricultural holdings and rough grazing, including common, is also clear and fits well into the regional context as is apparent from the factor score distribution (Figure 3.3).

Without exception, all Durham away from the extreme west, scores lowly or only moderately. Even where agricultural employment is of some importance as in unit 52 which includes some obviously agricultural parishes, the distance indices work the opposite way to ensure that the score just falls below the 0.76 to 1.5 class, leaving much of the agricultural variables to be soaked up by other non-distance oriented factors or left unexplained. Throughout west Durham and the entirety of Northumberland away from the south-east and coast as far north as Alnwick, factor scores are extremely high reaching over 2.25 in the remote, hill sheep farming uplands of the Scottish border.

Whilst the low scores of south-east Northumberland are obviously caused by proximity to Tyneside, larger populations and the relative unimportance of agriculture, two other points appear sufficiently interesting as to merit attention. The first is the slight yet obvious showing of rural nodes such as Wooler and Rothbury, though Haltwhistle, albeit with its remoteness and over 56 percent of its agricultural land recorded as being in rough grazing, narrowly fails to distinguish itself from the surrounding areas. Secondly, the spur of low value going northwards, up the Northumberland coast reflects the influence of coalmining north of Morpeth, relative proximity to the larger population centres and the existence of some more heavily populated parishes such as Lesbury and Alnmouth where agricultural employment, whilst important, does not hold the predominant position as elsewhere in the county.

Factor 2 type-parish units as shown by the factor scores are given in Table 3.6. The highest scoring units form an unbroken belt along the north-west boundary of the county in an area of maximum remove from any significant urban influence. As the local centres of Berwick, Alnwick and Morpeth are approached, scores

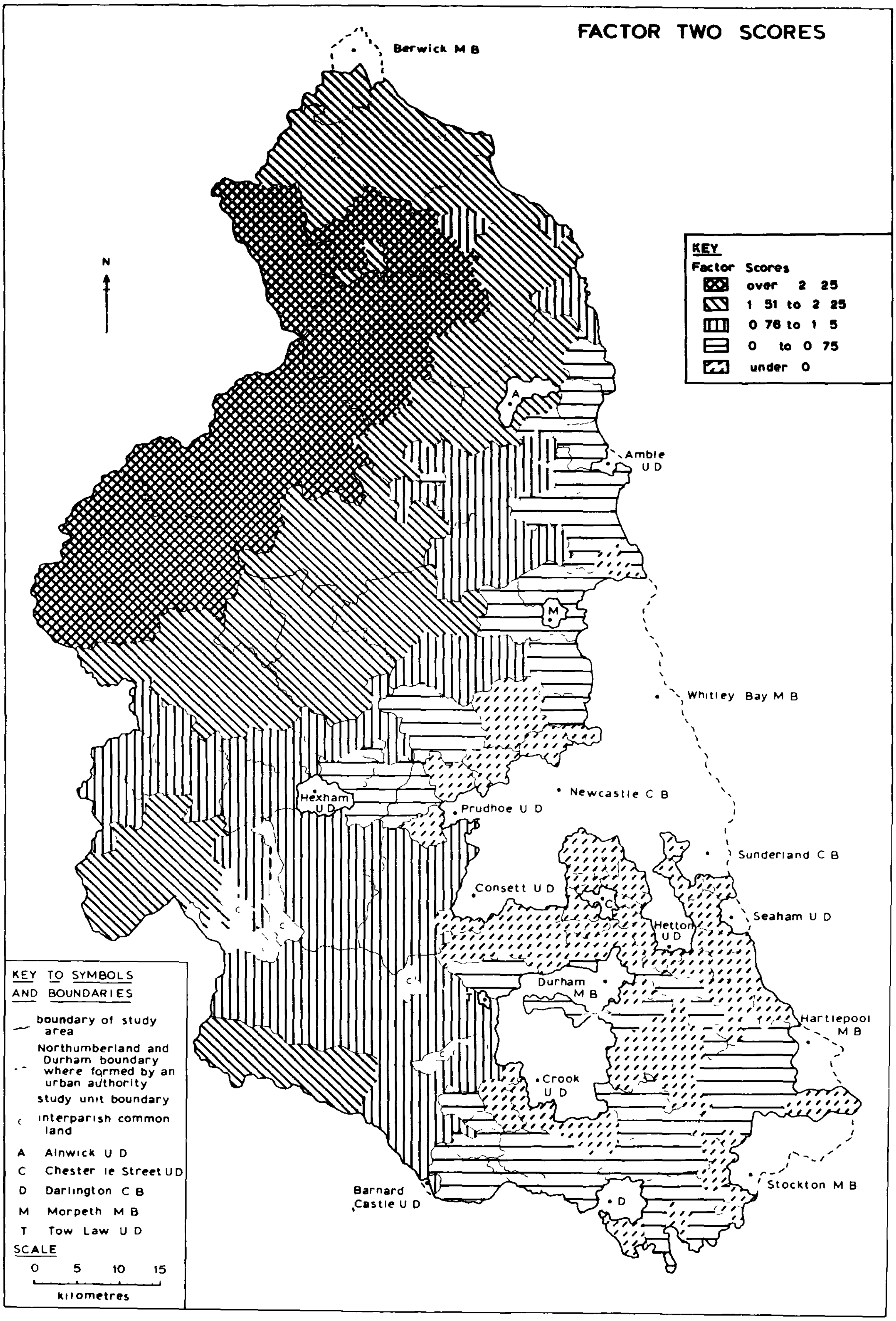

FACTOR TWO SCORES
Berwick M B
KEY
Factor Scores
over 2 25
1 51 to 2 25
0 76 to 1 5
0 to 0 75
under 0
N
Amble U D
Whitley Bay M B
Newcastle C B
Hexham U D
Prudhoe U D
Sunderland C B
Consett U D
Seaham U D
Hetton U D
Durham M B
Hartlepool M B
Crook U D
Barnard Castle U D
Stockton M B
KEY TO SYMBOLS AND BOUNDARIES
boundary of study area
Northumberland and Durham boundary where formed by an urban authority
study unit boundary
interparish common land
A Alnwick U D
C Chester le Street U D
D Darlington C B
M Morpeth M B
T Tow Law U D
SCALE
0 5 10 15
kilometres

Figure 3.3

Table 3.6

Units Scoring most Highly on Factor 2

Number in Table 3.1	Parish(es)	Score
142	Branxton, Carham, Kilham, Kirknewton	3.24
127	Alwinton, Biddlestone, Harbottle, Rochester	3.18
140	Akeld, Chatton, Doddington, Ewart	2.98
110	Kielder, Falstone, Tarset	2.92
128	Alnham, Ingram, Roddam, Ilderton, Earle, Lilburn, Bewick, Chillingham	2.88
143	Ford, Milfield	2.18
144	Bowsden, Lowick, Holy Island, Kyloe	2.16
112	Elsdon, Hepple, Hollinghill, Otterburn	2.09
138	Bamburgh, Easington, Middleton	2.03
86	Coanwood, Plenmeller with Whitfield, Slaggyford, West Allen	2.00

gradually fall below 2.25 even in Norham and Islandshires R.D. Here, the approach to the solitary small market settlement of Berwick-upon- Tweed (1967 population 11,650) and the occurrence of considerably less rough grazing than in most of the units mentioned in Table 3.6 account for the lower scores which reach 1.75 in the northernmost parishes.

Factor 3

This factor accounts for only slightly less variance (19.77 percent) than Factor 2 and so comments made with regard to the importance of the latter may equally well be made here. On the other hand, there are more variables which have an intermediate loading on Factor 3 thus making interpretation somewhat more difficult. Nevertheless, three variables stand out with particularly high scores, and if one includes all variables loading over 0.6 on this factor, its nature becomes entirely clear. Education, occupation and life styles combine here to produce a factor relating to high social status. It is encouraging to note in this factor the occurrence of variables from both

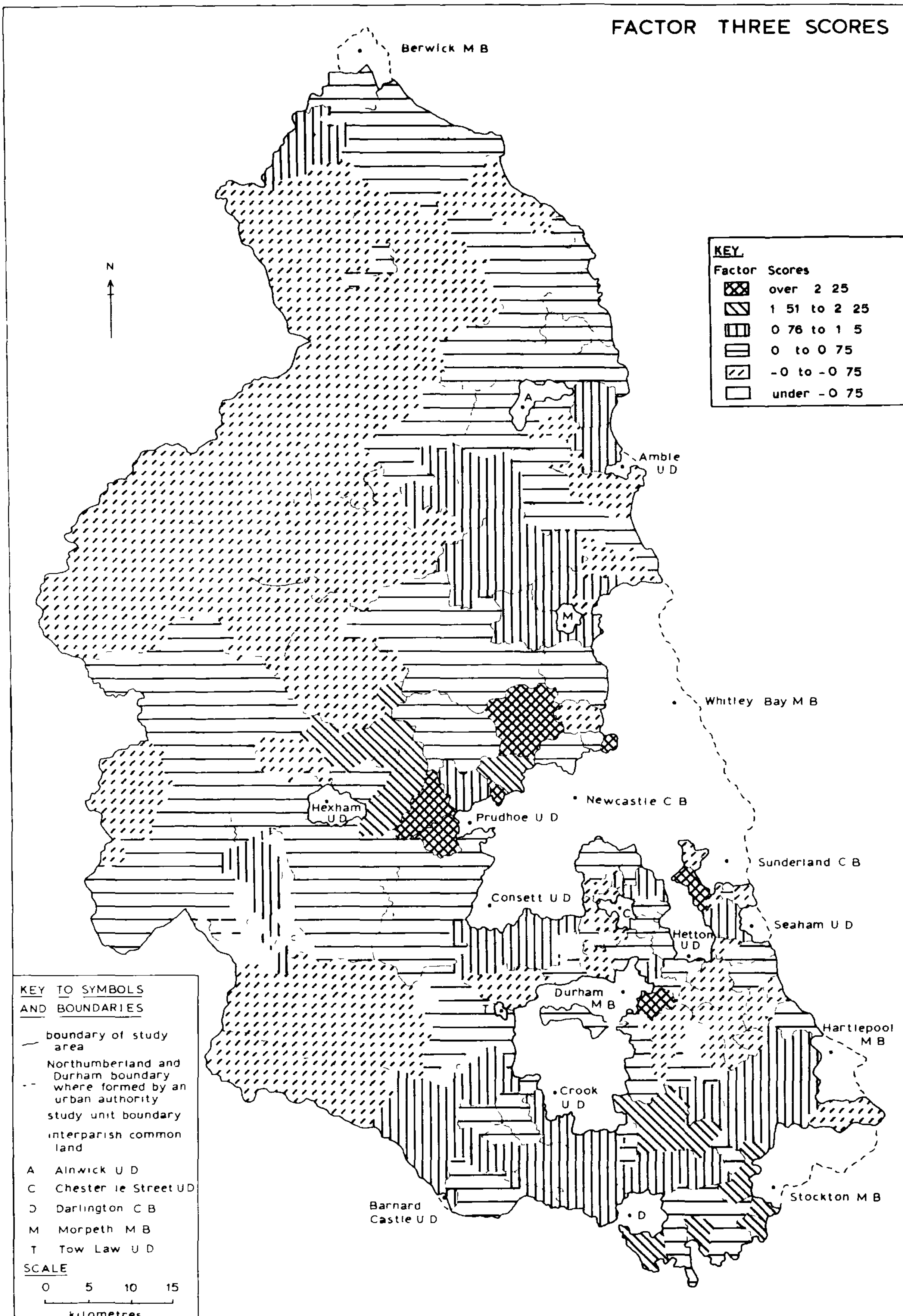
Table 3.7

Variables Loading 0.6 or over on Factor 3

Number in Table 3.2	Variable	Factor 3 Loading
70	Males in top Social Class, 1966	0.8583
72	Males in professional S.E.Gs, 1966	0.8137
69	Terminal Education Age above minimum, 1961	0.7448
60	Owner-occupier households, 1966	0.7200
30	Percentage of 1966 population born outside Great Britain	0.6423
9	Inmovement 1961-6 from outside Local Authority Area as percentage of unit population, 1966	0.6234
68	Persons with household access to two cars, 1966	0.6232

the 1961 and 1966 Sample Census data, suggesting some reasonable correspondence in the material. The relative propensity to long-distance migration of such populations is also shown, whilst the inclusion of the variable relating to a birthplace outside Great Britain reflects the generally high social status of such immigrants into nominally rural areas.

The spatial distribution of this grouping of variables is shown on Figure 3.4. One of the most obvious features is the fact that those parish units in central Durham which scored highly on Factor 1 are particularly unfortunate insofar as their scores on Factor 3 are concerned. To the south, however, there is a broad belt of high values stretching across the Tees lowland from Eggleston in Barnard Castle R.D. to the extreme east of Stockton R.D. These units rate highly on one or more of the variables in Table 3.7 though the combination varies. Thus, in unit 62 (Piercebridge, Archdeacon Newton, High Coniscliffe, Low Coniscliffe, Coatham Mundeville and Walworth) owner-occupation and the high percentage of persons enumerated in the 1966 Census who were in the professional and managerial socio-economic groups, were the main determinants of the 1.47 score. Alternatively in unit 63 (Whessoe, Barmpton, Bishopton, Brafferton, Little Stainton, Great Stainton, Redmarshall, East and West Newbiggin) it is a quite high proportion of persons



FACTOR THREE SCORES
Berwick M B
KEY
Factor Scores
over 2 25
1 51 to 2 25
0 76 to 1 5
0 to 0 75
-0 to -0 75
under -0 75
N
A
Amble U D
M
Whitley Bay M B
Newcastle C B
Hexham U D
Prudhoe U D
Sunderland C B
Consett U D
C
Seaham U D
Hetton U D
Durham M B
Hartlepool M B
Crook U D
Stockton M B
Barnard Castle U D
D
T
KEY TO SYMBOLS AND BOUNDARIES
boundary of study area
Northumberland and Durham boundary where formed by an urban authority
study unit boundary
interparish common land
A Alnwick U D
C Chester le Street U D
D Darlington C B
M Morpeth M B
T Tow Law U D
SCALE
0 5 10 15
kilometres

Figure 3.4

living in households with two cars combining with owner-occupancy which gives the score of 1.38.

Areas of extremely high scores in both counties are restricted to isolated occurrences (Table 3.8). One feature of their distribution is, however, apparent - their proximity to major urban areas, Sunderland, Darlington, Durham City and, most obviously, the Tyneside conurbation, all possess these nearby areas of high social status. The score achieved by North Gosforth is particularly instructive in this respect. Similarly, the development of the Tyne corridor as a commuter hinterland for Newcastle appears well brought out by this social status factor.

Table 3.8

Units Scoring most Highly on Factor 3

Number in Table 3.1.	Parish(es)	Score
104	North Gosforth	4.08
96	Broomley and Stocksfield	3.11
98	Wylam	3.05
39	Whitwell House, Shincliffe, Sherburn House	2.97
101	Ponteland	2.94
95	Broomhaugh and Riding, Bywell	2.55
3	Herrington, Offerton	2.50
99	Heddon-on-the-Wall	2.23
61	Hurworth, Blackwell	2.23
55	Elton, Norton	2.10

The other major point brought out by Factor 3 is the belt of low values stretching around the west of both counties, though it is somewhat attenuated in south-west Northumberland where, for example, Allendale C.P. scores particularly highly (1.29) mainly in consequence of high values for the variables representing terminal education age and owner-occupancy. The areas of extensive moorland stand out well with the lowest score here of-0.73 occurring amidst that broad tract of low scores along the Scottish border in unit 142 (Branxton, Carham, Kilham, and Kirknewton). East Northumberland shows intermediate scores as might be expected from its only moderate showing on the previous two factors. Coalfield units, however, which scored highly on Factor 1 exhibit the lower values (-0.58 of Ellington and Lynemouth) whilst some of the more socially favoured units north-west of Morpeth and east of Alnwick show slightly higher values. Thus, the high proportion of persons with an above minimum terminal education age and the high percentage of persons having household access to two cars leads to the score of 1.44 in unit 114 (Meldon, Mitford and Hepscott).

Factor 4

In approaching the remaining factors, it would seem appropriate at this point to note that in factor interpretations, no single one can be fully interpreted either as regards its nature or areal distribution, without regard to the others. Especially as one progresses to the lower order factors, the variance explained may well incorporate parts of variables, the main variation in which has already been soaked up by an earlier more important factor. In some cases, this residual effect, as happens with Factors 8, 9 and 10, here, leads to factors which, whilst statistically significant have only a little, or even no, significance in terms of a meaningful combination of variables relating to the system under study. Likewise, whilst varimax maintains independent factors in the sense that they are statistically independent (Costello 1971), it has been pointed out elsewhere that such factors may be orthogonal but yet conceptually related (Johnston 1970, Norris 1971). Therefore, the factors ..."need not represent independent lines of variation in the environment of the system studied but rather two correlated gradients" (Norris 1971 p 217). For a full understanding of the patterns extracted from this analysis it is important to bear in mind this conceptual interdependence within the mathematical independence.

The three principal dimensions within the data input have now been discussed and Factor 4 is of considerably less importance accounting for 5.56 percent of the variance. Nevertheless it still represents a minor but significant dimension and its nature is entirely clear from the factor loadings with all but three being below 0.24. The three, however, load highly - inmovement to work at 0.93, the job ratio variable at 0.80 and total movement to work at 0.73.

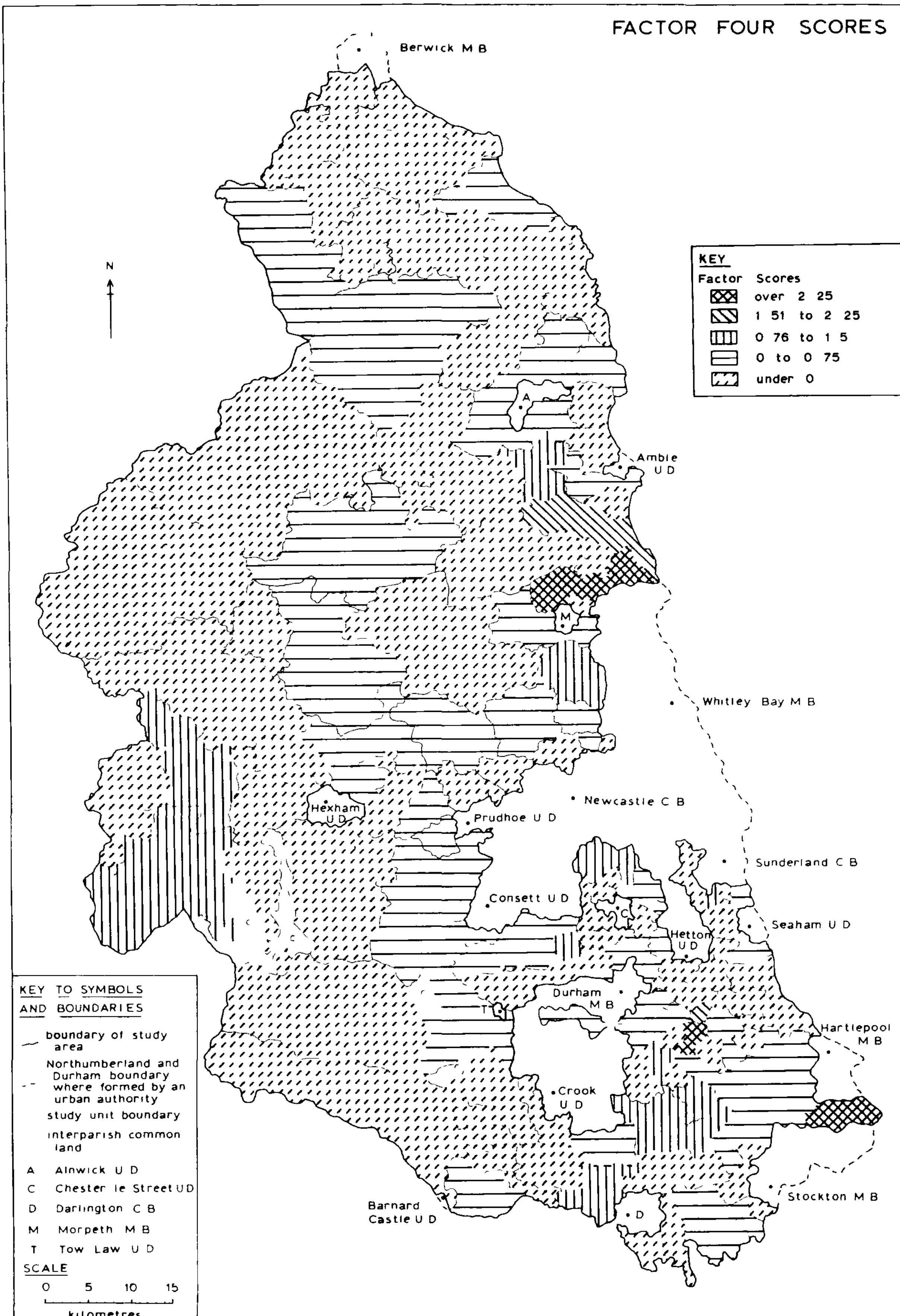
It is, therefore, clear that here measured is the extent to which any parish unit acts as an employment centre in the rural areas drawing in workers from elsewhere. Predictably most parish units score about or below the average being either self-sufficient in net labour terms or 'exporting' employees elsewhere. The significant scores on this factor may be seen from Table 3.9 and Figure 3.5. The astounding score achieved by Greatham and Seaton is mainly attributable to the great influx of workers into

Table 3.9

Units Scoring most Highly on Factor 4

Number in Table 3.1	Parish(es)	Score
53	Greatham, Seaton	8.91
42	Kelloe	3.96
116	Hebron, Longhirst	3.48
117	Ellington, Lynemouth	2.81
37	Thornley	1.82
120	Thirston, Widdrington, Cresswell, West Chevington	1.81
86	Plenmeller with Whitfield, Coanwood, West Allen, Slaggyford	1.44
50	Stillington, Elstob, Preston-le-Skerne, Foxton and Shotton, Woodham, Windlestone, Mordon, Bradbury and the Isle	1.38
51	Sedgefield	1.36
106	Stannington	1.33

the latter which with a very small population (98 in 1961) is largely an industrial appendage of the Hartlepools, and indeed was thus treated in the 1967 boundary reorganization. The Seaton location of the South Durham Iron and Steel Works is obviously of paramount importance here. In Northumberland, despite the inclusion of Stannington, with its hospital complex, in the above table, coalmining is the predominant influence, for example, to the north of Morpeth in units 116, 117 and 120 (open-cast at Widdrington), and even in parts of the high score area of Haltwhistle R.D. In County Durham the situation is rather more varied with


FACTOR FOUR SCORES
KEY
Factor Scores
over 2 25
1 51 to 2 25
0 76 to 1 5
0 to 0 75
under 0
Berwick M B
N
A
Amble U D
M
Whitley Bay M B
Newcastle C B
Hexham U D
Prudhoe U D
Sunderland C B
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KEY TO SYMBOLS AND BOUNDARIES
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SCALE
0 5 10 15
kilometres

Figure 5.5

mining at Kelloe and Thornley but other industrial and service employment important at Sedgefield (a regional hospital centre), Seaton and Stillington. Other known employment centres such as Lamesley with part of the Team Valley Trading Estate also score quite highly (1.28).

Outside the few favoured centres, low, even negative scores are ubiquitous whether in the remoter agricultural areas of Northumberland or the commuter belt around North Tyneside. The latter area shows particularly low scores especially in those parishes which have already been shown to have scored highly on Factor 3. This factor, therefore, is of far less importance overall in the variable associations developed from the data input, but it has great significance in local circumstances.

Factor 5.

This factor accounts for 2.11 percent of the total variance. Its interpretation is again still extremely clear with one variable, the percentage of the 1961 working population employed in defence, loading extremely highly at 0.94, though only one other (percentage of 1966 population born outside Great Britain) has even a moderate loading (0.46). Nevertheless, the connection between the two variables is clear and would seem once more to provide a meaningful minor dimension in variable combination but one which, as previously, has great local significance. Whilst other loadings are particularly low and it is consequently difficult to read much significance into any association with this factor (a loading of 0.2 for example, represents a mere 4 percent of the variance possessed by a particular variable), it is perhaps not entirely fanciful to see in the subsequent highest loadings - 0.20 for inmovement 1961-6 from external Local Authority Areas, 0.16 for the corresponding total mobility percentage including local movements, and 0.15 for the Crude Birth Rate 1964-5 - further meaningful variable links with this factor.

As one might expect, the factor is of extremely localised importance in a spatial context, and only 11 units score above 0.75 (Table 3.10). The main ones include well-known defence establishments of the 1960s such as R.A.F. Middleton, R.A.F. Acklington (East Chevington), R.A.F. Ouston (Stamfordham), R.A.F. Boulmer

Table 3.10

Units Scoring Most Highly on Factor 5.

Number in Table 3.1	Parish(es)	Score
59	Middleton St. George	7.14
134	Longhoughton	5.72
69	Cleatlam, Streatlam and Stainton, Westwick, Whorlton, Winston	3.40
112	Hepple, Hollinghill, Elsdon, Otterburn	3.34
100	Matfen, Stamfordham	3.26
121	East Chevington	2.72
57	Egglescliffe	1.68
127	Alwinton, Biddlestone, Harbottle, Rochester	1.50
60	Great Burdon, Morton Palms, Neasham, Low Dinsdale, Sockburn	1.07
74	Eggleston, South Bedburn, Hamsterley, Woodland, Langleydale and Shotton Marwood.	0.91
40	Hett, Brancepeth, Sunderland Bridge.	0.83

(Longhoughton), Otterburn Camp, the Royal Navy Spare Parts Centre at Egglescliffe, and Streatlam and Barford Camps in Barnard Castle R.D.

Factor 6

Explaining 4.14[1] percent of the total variance this factor has sufficiently high and moderate loadings to permit its ready interpretation. Those variables with a loading of 0.4 or over were : density 1967 as a percentage of 1951 (0.73), maximum electoral population as a percentage of the minimum 1958-67 (0.55), percentage of the 1966 population having entered a unit parish from outside

[1] As the order of factors in the preliminary matrix is maintained after rotation, the situation whereby here Factor 6 explains almost twice as much variance as Factor 5 is valid and often met in the Varimax Factor Matrix.

the Local Authority Area of Residence 1961-6 (0.44), the percentage of the 1961 population having changed residence 1960-1 (0.44), and density 1967 as a percentage of that in 1961 (0.42). The loadings of certain other variables also appear relevant insofar as most of those at between 0.2 and 0.4 appear to be logically associated with those mentioned above, for example Crude Birth Rate (0.27), percentage of 1966 workforce employed in production (0.30), percentage of households with exclusive use of three basic amenities (0.22), and the percentage of households renting from the Local Authority (0.24).

It would seem that this particular factor is combining variables, or what is left of them after Factors 1 to 5 have already extracted much of their variance in explanation (indeed, only the 1951 - 67 density change and 1958 - 67 population stability indices score more highly on Factor 6 than they do on any of the previous factors), which represent rapid population increase between 1951 and 1967 with some hint of an association with new Local Authority housing development, a young population and a fairly high birth rate.

This interpretation is strengthened by the factor scores with all units, which scored above 1.0, being shown in Table 3.11. Included in the five highest scores which stand out well above the remainder are two Durham New Towns (Peterlee and Great Aycliffe), a parish experiencing rapid housing development in response to the outward pressures from Tyneside (Woolsington), two similar parishes with respect to Teesside (Elton and Norton) and a parish which has recently experienced rapid housing development and consequent inmovement in Chester-le-Street R.D. (Ouston).

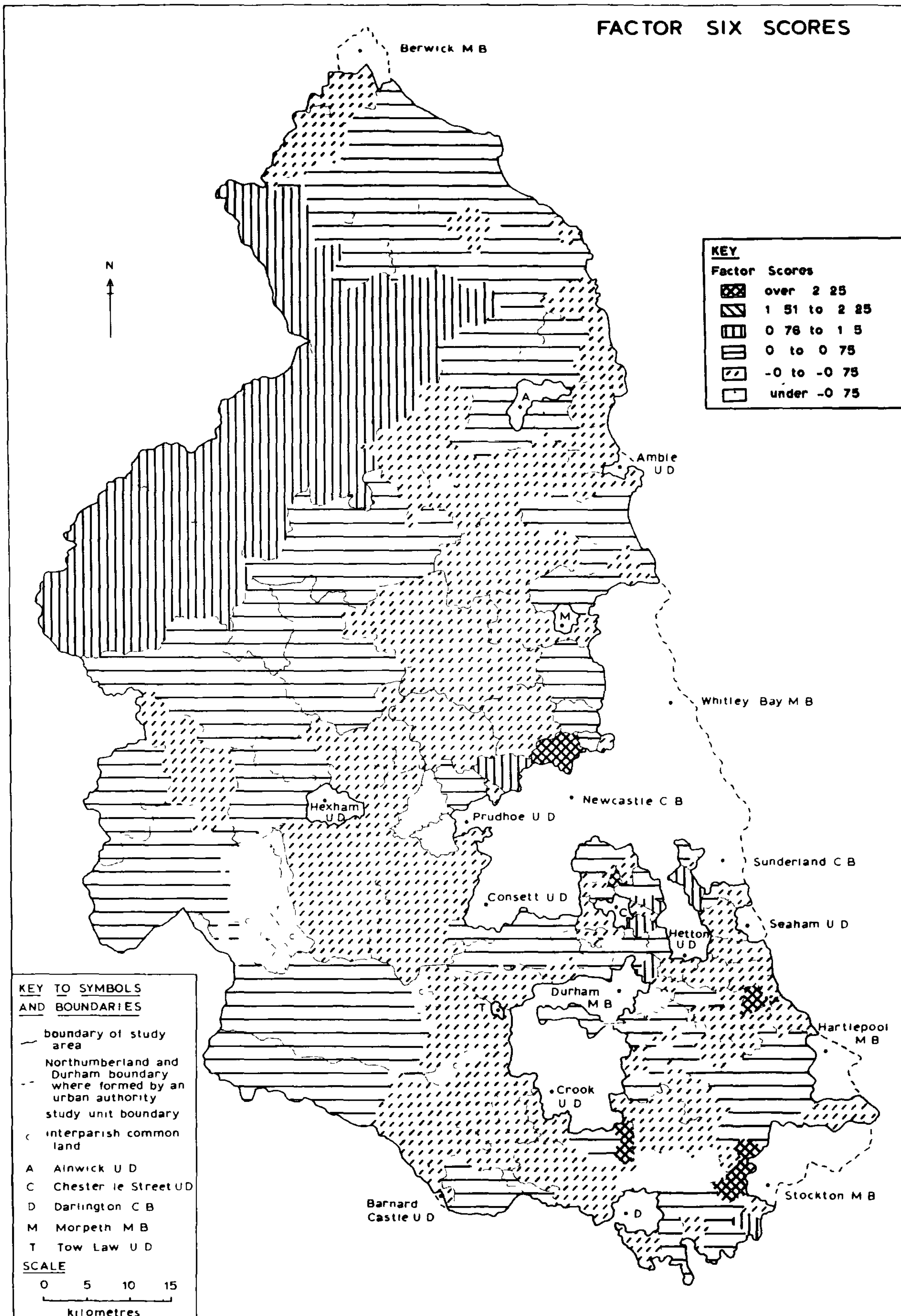
The remainder of the units shown in Table 3.11 are very similar to the above in many respects having experienced housing development and population inmovement over the period in question, either to a lesser degree or alternatively scoring less highly in consequence of relatively more variance having been explained in previous factors. The exceptions are obviously in units 110 and 128 where rather different processes combined to give the

Table 3.11

Units Scoring most Highly on Factor 6

Number in Table 3.1	Parish(es)	Score
102	Woolsington	6.81
55	Elton, Norton	5.46
64	Great Aycliffe	5.08
21	Ouston	2.98
33	Peterlee	2.46
16	Bournmoor, Lambton	1.33
57	Egglescliffe	1.25
3	Herrington, Offerton	1.19
14	Great Lumley	1.12
110	Kielder, Falstone, Tarset	1.12
99	Heddon-on-the-Wall	1.07
128	Alnham, Bewick, Chillingham, Earle, Ilderton, Ingram, Lilburn, Roddam	1.03

moderate scores. In the former case the inmovement (as well as compensating outmovement) of young forestry workers is not insignificant - whilst both units experienced high 1964-5 Crude Birth Rates. Moreover, the one seemingly perplexing area of moderately high scores on Figure 3.6 - a belt along the Anglo-Scottish border - may in many ways be related to the residual nature of these higher order factors. This is especially the case insofar as nearly all the highest loading variables have considerably larger parts of their variance explained elsewhere. Certainly part of the reason for these moderate values lies in the explanation already adduced for units 110 and 128 whilst it may be noted that whereas none of the four parish units concerned showed a gain in population between 1951 and 1967 except the very small one of unit 127 (Alwinton, Biddlestone, Harbottle and Rochester), most had high population instability and all had higher than average birth-rates. Furthermore, such variables as distance from the centre of population potential (0.13) and average size of agricultural holdings (0.20) may have some relevance in their residual loadings.


FACTOR SIX SCORES
Berwick M B
KEY
Factor Scores
over 2 25
1 51 to 2 25
0 76 to 1 5
0 to 0 75
-0 to -0 75
under -0 75
N
A
Amble U D
M
Whitley Bay M B
Newcastle C B
Hexham U D
Prudhoe U D
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D
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Barnard Castle U D
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SCALE
0 5 10 15
kilometres

Figure 3.6

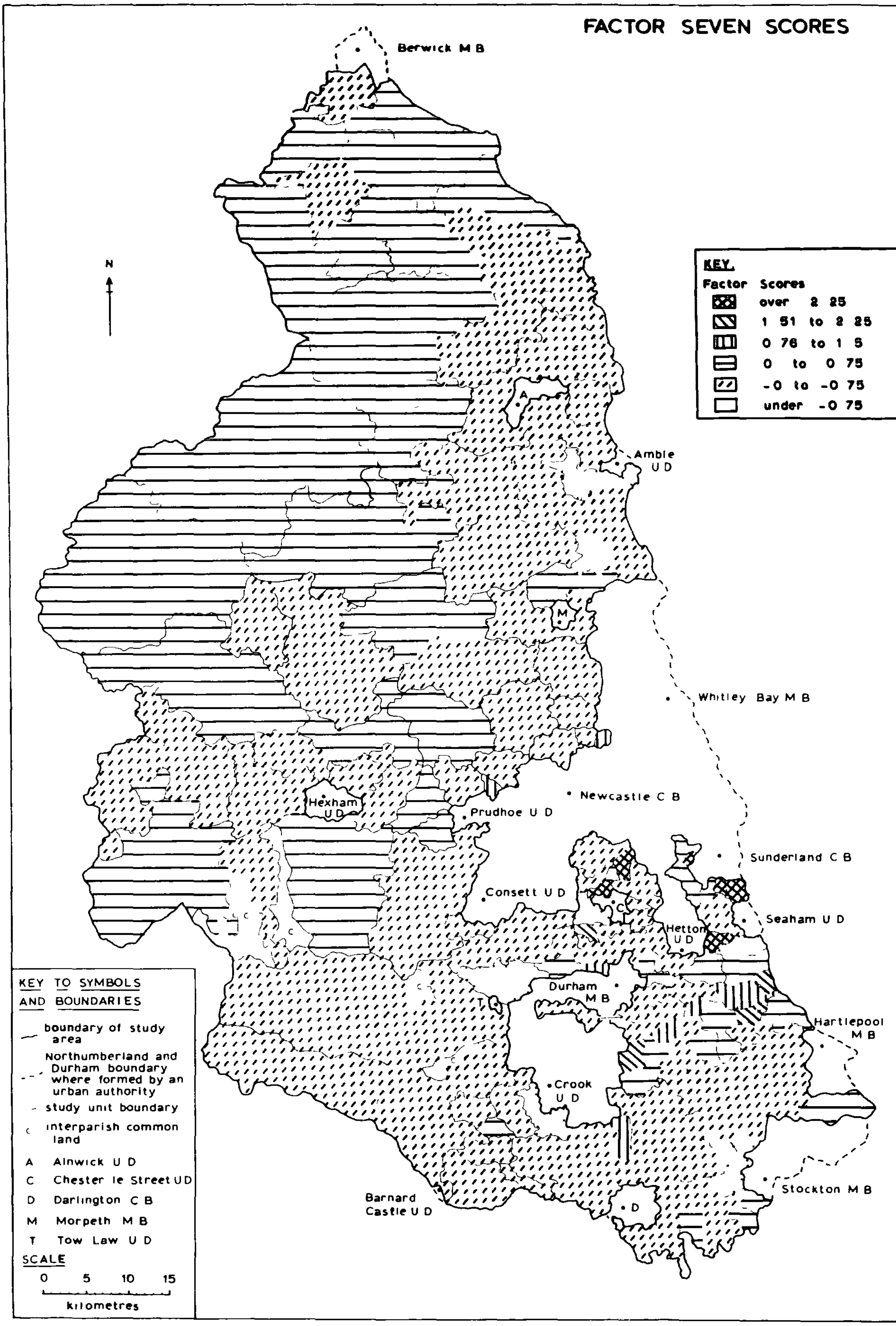
At the other extreme, one may note with interest those units which fall into the lowest class shown on Figure 3.6. The reason for these low values underlines the fact that once the major dimensions of variability have been extracted, other considerably less important ones can only be interpreted fully if regard is given to the precursors. Indeed if Figures 3.4 and 3.6 are compared, it will be found that all parish units scoring below -0.75 on the latter, scored above 0.75 on the former which significantly had population inmovement as an important constituent. Consequently, such parishes as Broomley and Stocksfield with most, if not all, of the variability related to the associated variables already accounted for by Factor 3, here score particularly lowly.

Factor 7

Accounting for 3.13 percent of the variance this factor, nevertheless, explains the lower scores of heavily populated mining units as compared to some of the less densely peopled ones on Factor 1. For, whereas Factor 1 extracted 28.62 percent of the variance attributable to density in 1951 and 25.97 percent of that to density in 1961, the respective totals here were 66.81 percent and 67.67 percent. No other significant loadings occurred and descent is necessary to one of 0.2804 (compared to 0.8174 and 0.8226 respectively) relating to households renting from the Local Authority and 0.2718 on population potential 1951 for the next highest values.

Consequently, Factor 7 is almost entirely a density factor though once again some of the lower loadings which excluding those mentioned above are (over 0.2) regular agricultural workers per hectare, short distance inmovement 1961-6, and employment in production appear to be reasonably if statistically loosely associated with this factor. Indeed it would most certainly appear that Factor 7 is complementary to Factor 1.

The spatial distribution of Factor 7 is shown on Figure 3.7 and in Table 3.12. If not before, certainly the density nature of this factor is now apparent with high density units


FACTOR SEVEN SCORES
KEY.
Factor Scores
over 2 25
1 51 to 2 25
0 76 to 1 5
0 to 0 75
-0 to -0 75
under -0 75
N
Berwick M B
Amble U D
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SCALE
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kilometres

Figure 5.7

Table 3.12

Units Scoring most Highly on Factor 7

Number in Table 3.1.	Parish(es)	Score
2	Ford	5.62
5	Tunstall	4.62
6	Ryhope	4.27
18	Birtley	3.96
9	East Hurton	2.71
22	Pelton	2.66
24	Sacriston	2.13
35	Horden, Castle Eden	1.98
47	Ferryhill	1.91
64	Great Aycliffe	1.24
104	North Gosforth	1.24
32	Shotton	1.22
37	Thornley	1.21
41	Coxhoe	1.01

whether possessing mining employment or not, scoring highly. In 1967, of the parishes shown in Table 3.12 Ford predictably had the highest density of 28.97 persons per hectare and Coxhoe the lowest of 8.44. All units which had a 1951 density of more than 10 persons per hectare are represented in the Table together with Great Aycliffe and North Gosforth which were in the same situation by 1961. The preponderance of County Durham units in Table 3.12 is not entirely surprising and the density dichotomy between the two counties shows up well on Figure 3.7. Such parishes as Great Aycliffe show up clearly to contrast with their score on the mining oriented Factor 1. In contrast one may consider the scores of units which scored highly on Factor 1. Seven of the units mentioned in Table 3.4 have scores here of under -0.6 whilst the lowest score of -1.19 relates to Cold Hesledon and Hawthorn (unit 8). Such units presumably having had their density variances largely accounted for in the first factor, now score extremely lowly. The purely agricultural and extremely lightly peopled units are left to the two classes either side of an average score.

Factors 8, 9 and 10

The percentage explanation achieved by these three factors together was 2.472, the highest individual figure of 0.857 (Factor 8) representing only 0.65 of the input variance of a single variable. These factors, therefore, are truly residual in nature and no variable loads even at a 0.5 level on any of them. Correspondingly all variables score significantly more highly on a factor other than these last three. Thus, Factor 8 has a top loading of 0.4877 on the variable representing rough grazing and common land which still loads at 0.8018 on Factor 2. In terms of the explanatory percentage of this variable, therefore, Factor 2 is very nearly three times more important than Factor 8.

Bearing these points in mind one may nevertheless briefly consider the fairly explicable nature of these subsidiary factors.

Factor 8

As stated above, the highest loading on this factor is that for rough grazing and common land, after which one must descend to a negative loading of -0.2696 on Standard Net Output per holding. This factor, therefore, appears largely to represent poor quality agricultural areas in which output per holding, not merely per hectare, is low. This would seem to be confirmed by other of the higher loadings: -0.1570 for regular agricultural workers per hectare and 0.2134 for distance from a centre of 7,000 or more persons, but the largely statistical and residual gathering in of small portions of unexplained variance is also apparent in such loadings as the negative ones on the other distance variables, reaching -0.1648 on distance from a 24,000 person centre, and those of 0.1139 on employment in production, -0.1352 on the percentage of two or more family households, and 0.1909 on the percentage of owner-occupying households.

Insofar as the scores are concerned, the rough grazing element of this factor is dominant. Consequently the Durham dales units (75, 76 and 77), those formed by some of the Haltwhistle R.D. parishes (86, 87 and 88), and those along and near the hilly western borders of Northumberland (109, 110, 111, 112 and 127) are amongst the very high scores, whilst despite the nature of the distance loadings noted above, the main belt of low scores extends over the northernmost part of the study area in Norham and Islandshires R.D. In view of this it would seem realistic to suggest that this factor is very largely determined by rough grazing and even obscured by the unhelpful noise created through the unmeaningful additions of the residual parts of other variables. Indeed, a simple consideration of the distribution of the single dominant variable would seem to offer far more than this rather insignificant though explicable factor.

Factor 9

Again one must conclude as to the overwhelming effect of the residual nature of this factor. The highest loadings (all around 0.2 and none reaches 0.33) include all four distance variables (positive), the variables relating to percentage agricultural and primary employment (negative), and those concerning two family households, six or more person households, and two or more car households (all negative). High scores are accordingly registered by such contrasting units as Norham, Duddo and Cornhill (1.15) and Fishburn (1.29). In the former the score is despite the negative association of part of this factor with agriculture and, therefore, presumably on account of the distance indices, especially those to the larger population centres. In the latter, dissimilar influences are still able to combine into a high score. Where the two main elements do combine, however, as in Wooler, Rothbury, Belford and North Sunderland for example, the scores reach above 2.0 and even 3.0. Nevertheless, this is small consolation for the remaining tangle and one may also note the high negative scores achieved by such agricultural and quite remote units as 128 (Alnham, Ingram, Roddam, Ilderton, Earle, Lilburn, Bewick and Chillingham) at -1.47 as well as non-agricultural units close to major centres of population such as unit 25 (Plawsworth) with a score of -2.09

Factor 10

This final factor appears as a residual unemployment one after the major variance related to the two relevant indices has been extracted by Factor 1. The unemployment variable for 1961 loads at 0.4811 and that for 1966 at 0.3484. Once more the percentage of two or more family households has a relatively high negative loading at -0.28 whilst the only other variable to reach 0.1 is 1966 mining employment (-0.1072).

Unemployment is thus the dominant influence and consequently all seven units with a score of 2.0 or more on this factor had heavy unemployment reaching 10 percent in at least one of the two years. It is still doubtful, however, whether the factor reveals anywhere near as much as would the consideration of unemployment alone. Such a parish as Thornley with about 6 percent unemployment in 1961 and 1966[1] has an entirely insignificant score (0.1326) on this unemployment factor, obviously having yielded up the relevant variance to other factors. Similarly, the combination of variables, one of the fundamentals of factor analysis and the major object of concern in this section, is not entirely clear with such low loadings and with much 'noise' only serving to obscure the basic unemployment features.

Conclusions from R-Mode Analysis

The R-mode analysis has most certainly been worthwhile and will prove invaluable in considering the topics dealt with in subsequent sections. From the investigation, three fundamental dimensions of variation have appeared with regard to the input data for rural areas of North-East England. The first and by far the most important, combination of variables was a housing/social environment/mining factor. The following two factors represented agriculture/remoteness and high social status variables respectively. In addition, a number of minor dimensions to the problem were recognised, particularly journey to work (Factor 4), defence employment (Factor 5), population increase (Factor 6) and high density (Factor 7).

[1] This is substantially in excess of the unweighted means of 3.50 (1961) and 3.16 (1966) percent.

3.9 The Q-Mode Analysis

Having considered the main dimensions of the data matrix from the point of view of the variables, thereafter discussing as a secondary feature the areal distribution of these dimensions, it was decided to focus attention upon the similarities and differences between areas and ultimately attempt a classification based upon this. Consequently, after standardization (see Section 3.6 (d)) the data were subject to a Q-mode analysis.

Ten factors, the maximum possible, were again extracted but this time accounting for 97.11 percent of the variance. However, it was immediately apparent that three factors which were in total responsible for 94.34 percent of the variance after varimax rotation, were overwhelmingly important, the remaining seven being entirely insignificant by comparison. Consequently, analysis will here concentrate upon these first three factors. It is a noteworthy feature that communalities, this time by area rather than variable, were extremely high only falling below 0.95 in nine cases of which only one (unit 53, consisting of Greatham and Seaton parishes) fell much below at 0.8921.

Factor 1

This accounted for fully 40.07 percent of the total variance. With Q-mode analysis, the composition of factors must be discerned from the factor score matrix and so Table 3.13 gives those scores which contain more than one standard deviation above the average of a variable in Factor 1. Additionally several variables scored -1.0 or less showing considerably below average inclusion in Factor 1. These were: the percentage of persons having household access to two cars (-1.34); parish primary employment 1963 (-1.21); percentage employed in agriculture 1966 (-1.09), and the percentage of males in the professional and managerial socio-economic groups 1966 (-1.05)

The nature of this factor is, therefore, clear. It represents a similar but rather more comprehensive factor than did the first factor extracted from the R-mode analysis. A mere four variables are found in Table 3.3 referring to the latter but not in Table 3.13. These are, the two variables relating to unemployment and the two fertility indices, though three of these only narrowly

Table 3.13

Composition of Factor 1 : Scores on Variables

Number in Table 3.2	Variable	Score
38	Employment in mining, 1966	2.30
61	Households renting from Local Authority, 1966	2.13
14	Population Potential, 1951	1.89
66	Persons living at a density of 1 or more per room, 1966	1.80
8	Inmovement 1961-6 from within Local Authority	1.72
57	Persons per room, 1961	1.68
45	Travel to work outside parish of residence 1966	1.66
73	Males in skilled manual S.E.Gs	1.65
59	Percentage of population in private households	1.53
56	Persons per household, 1961	1.46
27	Ratio of deaths under 65 to those at older ages	1.44
44	Percentage of workers aged 15 to 44, 1966	1.40
50	Standard Net Output per Hectare, 1967	1.31
39	Employment in production, 1966	1.23
15	Population potential change 1951-67	1.22
32	Percentage of households with one family, 1966	1.22
33	Percentage of households with 2 or more families, 1966	1.21
1	Density 1951	1.19
28	Percentage of population married 1966	1.19
16	Percentage of population aged under 15, 1966	1.19
17	Percentage of population aged 15-44, 1966	1.12
2	Density 1961	1.10
64	Percentage of households with 6 or more persons, 1966	1.06
58	Percentage of persons living at over 1.5 per room, 1961	1.02

miss inclusion above with unemployment 1961 scoring 0.98 and for 1966, 0.79, whilst the ordinary fertility ratio for 1966 scores 0.91 and the modified form 0.99. On the other hand, the Q-mode Factor 1 includes density as an important component, this perhaps being far more logical in the case of area comparison than the splitting off which occurred in the R-mode study.

Areas which load highly on Factor 1, therefore, tend to have the following aspects especially in common. Occupationally, mining is likely to be important though manufacturing together with a high percentage of males in the skilled and supervisory manual socio-economic groups, may employ a substantial number of the workforce. Again, many persons are likely to journey to work outside the parish of residence. In the housing sector a high proportion of households renting from the Local Authority, together with some overcrowding, is expected whilst most of the population lives in private households with one and two or more family households rather than no family households being usual. Likewise, much of the population is likely to be in the younger age groups and, in the over 16 sector, married. At the same time, these areas appear to be quite densely populated and near population agglomerations with intra-Local Authority area residential movement and a high proportion of deaths at younger ages being two further typical features.

Having interpreted the factor successfully, the primary concern must now rest with its spatial pattern. This is shown on Figure 3.8 which gives the distribution of various factor loading classes. The class intervals represent a 10 percent spread of the variance within an area being explained by the factor. Therefore, the class 0.71 to 0.77[1] represents a 50 to 60 percent explanation of a unit variance.

Although Figures 3.2 and 3.8 are basically similar in the patterns which they portray, with some of the differences moreover being attributable to the strict non-comparability of the two data set class intervals, the Q-mode Factor 1 appears, nevertheless, to

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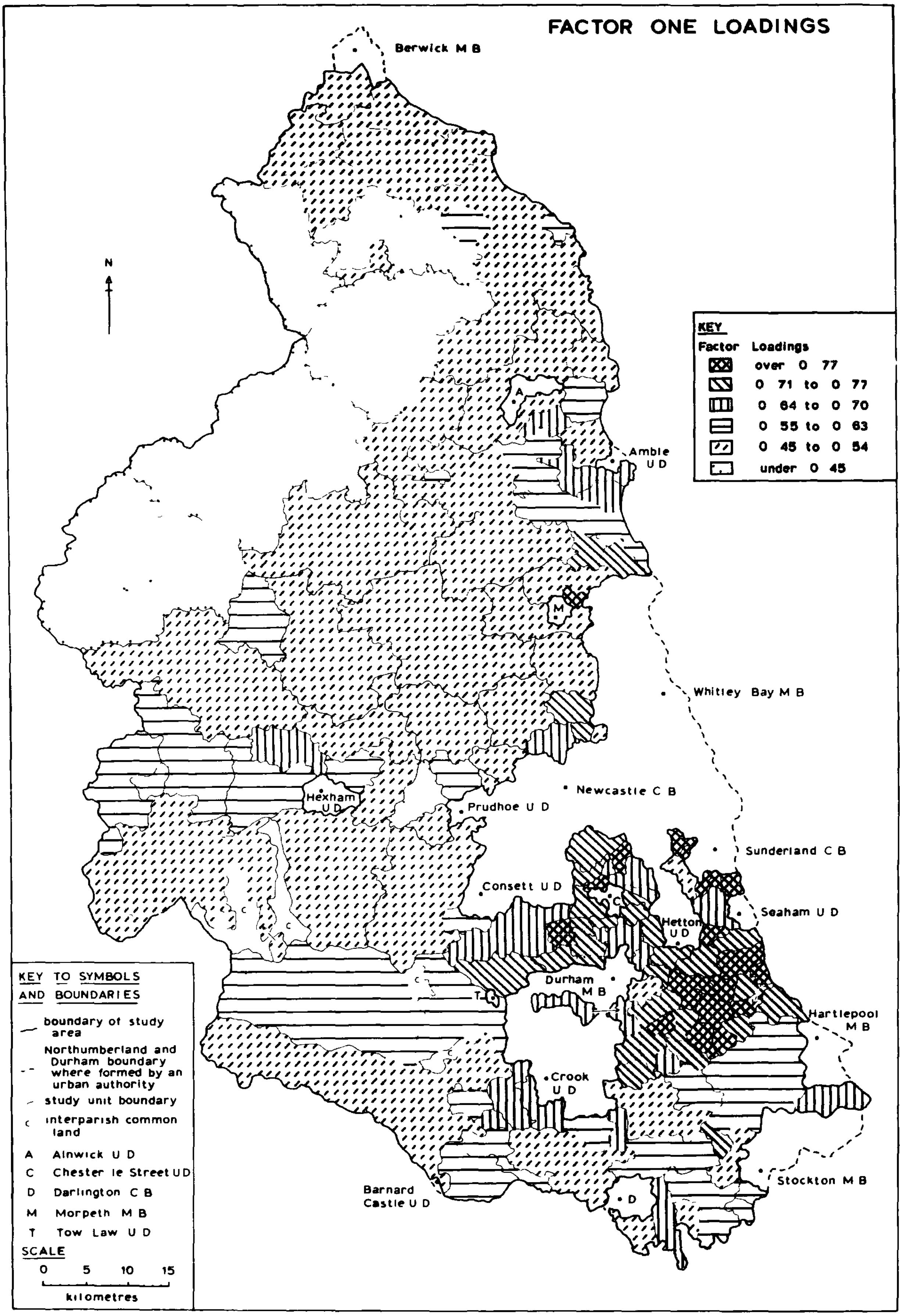
1 These limits arerounded to 2 significant figures on the various maps.


FACTOR ONE LOADINGS
Berwick M B
KEY
Factor Loadings
over 0 77
0 71 to 0 77
0 64 to 0 70
0 55 to 0 63
0 45 to 0 54
under 0 45
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0 5 10 15
kilometres

Figure 3.8

accentuate the range of values with slight detailed changes from the R-mode Factor 1 score distribution. The highest values are again concentrated in north and east Durham with here the densely peopled mining parishes loading most highly on account of the incorporation of density into the Q-mode Factor 1, whereas it was largely absent in the corresponding R-mode factor. This is aptly shown in Table 3.14 in which it can be seen that there are only Hylton, Trimdon and Langley in common with Table 3.4. Indeed

Table 3.14

Maximum Loadings on Factor 1

Number in Table 3.1	Parish(es)	Factor Loading
6	Ryhope	0.8249
1	Hylton	0.8228
32	Shotton	0.8135
37	Thornley	0.8128
5	Tunstall	0.8122
9	East Murton	0.8054
4	Silksworth	0.8039
22	Pelton	0.8029
44	Trimdon	0.7954
80	Langley	0.7922

in the vast and continuous tract of high value in north and east Durham only two units fall below a loading of 0.63 and these, Herrington and Offerton and Shincliffe, Sherburn House and Whitwell House, are probably the two that might be expected from the R-mode results.

In south and west Durham, values are considerably lower. The most extensive of the few islands of high value is in the east of Barnard Castle R.D. covering the mining parishes of Cockfield, Etherley and Evenwood and Barony, the highest loading here reaching 0.6909. Elsewhere similar loadings are achieved by: Great Aycliffe (0.6873) with high density, manufacturing and Local Authority housing values especially above average; unit 60 (Great Burdon, Morton Palms, Neasham, Low Dinsdale and Sockburn(0.6687)) with a youthful population, high outmovement to manufacturing work in Darlington, and a high proportion of one family households many with six or more persons in council accommodation; Carlton and Whitton (0.7126) which have particularly high values for the percentage of economically active and retired males in the supervisory and skilled manual grades, and for manufacturing employment; and finally, Greatham and Seaton (0.6457) with substantial manufacturing employment as well as some in mining.

Northumberland has three main areas of moderate to high value, though it is quite obvious that Factor 1 is very much a Durham-oriented one. The first area is of slightly above average values stretching from Tyneside up the south Tyne Valley though with an isolated area of higher value at Newbrough-Warden where it seems reasonable to cite local extractive employment in 1966 as a major factor. Secondly, there are those units immediately to the north of Newcastle where the typical combination of variables associated with mining are causal in two cases (Hazlerigg, and Dinnington and Brunswick) and density and Local Authority housing development a major influence in the other (Woolsington). The latter case provides an interesting contrast with the position on the R-mode Factor 1 and certainly in terms of areal similarity and differentiation, the picture presented here seems more realistic. Thirdly, in a very similar vein to the R-mode Factor 1, there are areas of high value between and to the east of Morpeth and Alnwick with Pegswood even reaching the highest loading class. One interesting point of contrast apparent from the varimax factor matrix is the lower ranking of the unit (120) containing Widdrington, as compared to the corresponding R-mode factor scores. Despite the employment significance of open-cast activities the inclusion in the present Factor 1 of density, for example, has weighed against a higher loading in this case.

Away from these areas, loadings decrease, and in the remote hilly areas of the border fall to below 0.45. The comparison of these areas with the Durham dales shows the more varied nature and larger agglomerations of population found in the latter being reflected in higher loadings.

<u>Factor 2</u>

Factor 2 on the Q-mode analysis proved to be not very much less important than Factor 1 insofar as it accounted for a further 34.84 percent of the variance. Similarly, many variables scored highly on this factor though once again its nature is clear from the factor score matrix, the main values of which are abstracted in Table 3.15. Additionally, one may note that two variables scored extremely lowly, representing 1951 population potential (-1.23) and outmovement to work (-1.09).

It appears that this second factor extracted by the Q-mode technique is very similar to that extracted by the R-mode although the former again appears to be more comprehensive, incorporating several elements of other factors which were separately distinguished in the R-mode analysis. Distance and agricultural employment are once again the main components of this factor but some of the other variable associations are equally interesting and relevant. Other agricultural indices appear, for example the ratio of theoretical to actual Standard Man Day labour requirements, Standard Net Output per holding and average holding size. The association of the first mentioned (see Section 6.4) may well be resultant upon the relative absence of very small holdings, insufficient for the full-time employment of the owner in the remoter agricultural areas as compared to the coalfield for instance, rather than, though not necessarily in the absence of, any undertones of efficiency. The last two mentioned both refer to the larger sizes of holdings in the remoter areas in contrast to the more densely populated zones where net output per hectare rather than per holding assumes importance. The inclusion in this factor of the percentage of total agricultural employees working full-time on a regular basis is a reflection of the consistently high figures found in these areas rather than the more erratic, sometimes very low ones reached elsewhere.

Perhaps somewhat paradoxical at first might appear the inclusion of the variables relating to car ownership especially bearing in mind the low scores of the agricultural areas on Factor 3, that of high social status, in the R-mode analysis. However, locationally remote population, especially when associated with agriculture, may quite

Table 3.15

Composition of Factor 2 : Scores on Variables

Number in Table 3.2.	Variable	Score
37	Agricultural employment, 1966	2.36
12	Distance to nearest settlement of 70,000 or more persons	2.34
35	Primary employment percentage, 1963	2.34
11	Distance to nearest settlement of 24,000 or more persons	2.12
10	Distance to nearest settlement of 7,000 or more persons	2.01
13	Distance to regional population potential peak, 1967	1.88
52	Percentage of agricultural land in rough grazing, etc. 1967	1.87
49	Ratio of theoretical to actual S.M.D needs, 1967	1.81
54	Percentage of ~~1967~~ agricultural workers, regular whole-time	~~1.44~~
53	Average size of holding, 1967	1.41
51	Standard Net Output per holding, 1967	1.40
68	Percentage of persons with household access to 2 cars, 1966	1.39
67	Percentage of persons with household access to 1 car, 1966	1.33
26	Average age at death, 1967-8	1.29
62	Households with exclusive use of 3 basic amenities, 1966	1.20
19	Percentage of population aged 60 and over, 1966	1.19
59	Percentage of persons in private households, 1961	1.14
63	Households with two or less persons, 1966	1.10
65	Persons living at density of below 0.5 per room, 1966	1.08
31	Percentage of households with no family, 1966	1:08
25	Crude Death Rate, 1967-8	1.07
15	Population potential change, 1951-67	1.06
20	Dependency Ratio, 1966	1.01

reasonably be high-ranking here without there being any social status corollary. Indeed, this may reflect necessary quantity rather than quality of private transport. More straightforward, and highlighting one aspect of the rural problem are a number of demographic and linked variables included within Factor 2. Two death indices stand out strongly but if, at first, that representing a high average age at death would appear favourable, the balance is redressed by the inclusion of the Crude Death Rate variable. A reconciliation of these two is thereafter found in the fact that areas loading highly on this factor appear to typically have a high proportion of their population aged 60 and over (hence also the inclusion of the Dependency Ratio index in Table 3.15) living in households of two or less people and no family. Associated with this is the relatively low density per room. The inimicality of these typically remoter agricultural areas to normal types of institutional population (hotels, hospitals, etc) is shown by the association, as with Factor 1, of the variable representing the percentage of the population living in private households.

Turning to the areal distribution of Factor 2 loadings (Figure 3.9), the pattern displayed is as expected in the light of the above discussion of this factor. Again, north Northumberland and the Scottish borders show the highest values though the greater extent of the belt of maximum value here as compared to Figure 3.3 may be seen from a comparison of Tables 3.7 and 3.16 to be mainly a function of the non-comparability of the class intervals used to portray the Q-mode loadings and R-mode scores. The great similarity between Tables 3.7 and 3.16 suggest that, despite the more comprehensive nature of the Q-mode factor, the spatial pattern it displays is very similar indeed to that shown by the R-mode Factor 2.

North of this belt of maximum value there are four units of slightly lower loadings, again reflecting the approach to Berwick with, accordingly, the lowest loading of 0.7391 being found in the most northerly, whilst the three enclosed areas of lower value at Wooler (0.7168), Belford (0.6966) and North Sunderland (0.6834) are readily explicable in terms of their larger settlements, higher densities and slightly less agricultural

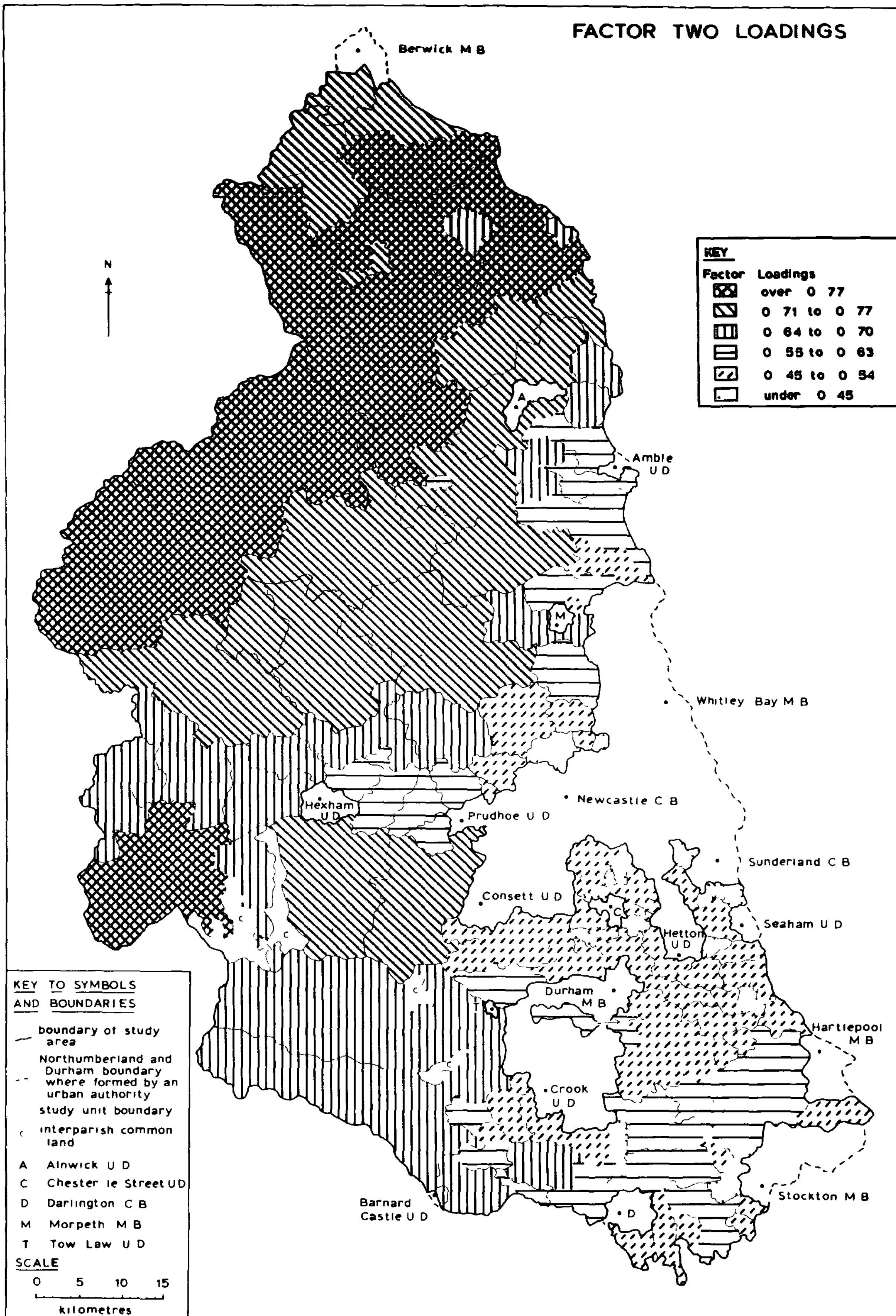
FACTOR TWO LOADINGS
Berwick M B
KEY
Factor Loadings
over 0 77
0 71 to 0 77
0 64 to 0 70
0 55 to 0 63
0 45 to 0 54
under 0 45
N
A
Amble U D
M
Whitley Bay M B
Newcastle C B
Hexham U D
Prudhoe U D
Sunderland C B
Consett U D
Seaham U D
Hetton U D
Durham M B
Hartlepool M B
Crook U D
Stockton M B
Barnard Castle U D
D
T
KEY TO SYMBOLS AND BOUNDARIES
boundary of study area
Northumberland and Durham boundary where formed by an urban authority
study unit boundary
interparish common land
A Alnwick U D
C Chester le Street U D
D Darlington C B
M Morpeth M B
T Tow Law U D
SCALE
0 5 10 15
kilometres

Figure 3.9

Table 3.16

Maximum Loadings on Factor 2

Number in Table 3.1.	Parish(es)	Factor Loading
142	Branxton, Carham, Kilham, Kirknewton	0.8463
127	Alwinton, Biddlestone, Harbottle, Rochester	0.8416
140	Chatton, Akeld, Ewart, Doddington	0.8349
110	Kielder, Falstone, Tarset	0.8296
128	Bewick, Alnham, Ingram, Roddam, Ilderton, Earle, Lilburn, Chillingham	0.8247
144	Bowsden, Lowick, Kyloe, Holy Isle	0.7918
126	Whittingham, Callaly, Netherton, Snitter, Thropton	0.7894
138	Middleton, Easington, Bamburgh	0.7837
136	Adderstone, Ellingham, Beadnell	0.7800
86	West Allen, Slaggyford, Coanwood, Plenmeller	0.7777

emphasis. These loadings, however, are still high, and in the case of Wooler significantly so, and it is not until Rothbury is reached on the edge of this belt that a noticeable fall in loading value is achieved at 0.6241[1].

To the south and east of this belt of maximum value there exists a broad tract in which loadings vary between 0. 71 and 0.77 showing the close interrelationship between the agricultural and locational indices. It is not until this area has been traversed that two axes of lower value are met, running at right angles to each other. The first runs northwards along the urban rim of south-east Northumberland from Woolsington and then up the coast halting finally to the south-east of Alnwick. This tract is the same one

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1 It should be constantly remembered that these figures should be squared in terms of explanatory percentages. Thus, 0.6834 represents an explanation of about 47 percent of the variance compared to the 39 percent of a loading of 0.6241.

as was noted above to have stood out on Factor 1 as being one of the areas in Northumberland of slightly higher value. The same reasons as were adduced to account for the slightly higher loadings there, equally result in the slightly lower ones here.

The other axis of lower Northumberland values goes from Tyneside along the Tyne valley though it begins to peter out noticeably to the west of Hexham before the dominance and poor nature of agriculture and remoteness from urban influence combine sufficiently strongly to give the very high loading of unit 86 in the extreme west of Haltwhistle R.D. In the Tyne valley area of lower loadings, the commuter nature of much of the zone leading often to a minor role for agriculture, as well as proximity to large population centres and frequently atypical demographic characteristics insofar as Factor 2 is concerned, are obviously the main sources of explanation. Similarly, though values are rather higher, the influence of the mining noted in the discussion of Factor 1 is still sufficient to stop some parishes in Haltwhistle R.D. from reaching loadings of a sufficient magnitude to be included in the two highest classes.

In County Durham, the distribution of loadings is considerably different. The entire north and east of the county are covered by areas of low loadings, this in nearly every case being the reciprocal effect of conditions which caused high explanations by Factor 1. In the few cases such as Herrington and Offerton, where the Factor 1 values were low also, the inapplicability of Factor 2 leads one to await the major part of the variance explanation in another factor. On the other hand, as one progresses into south Durham more moderate values are encountered though as was noted previously in considering the R-mode Factor 2, the restricted nature of agriculture in Durham and the nearness of all except the extreme west, to substantial agglomerations of population, mean that the highest loadings such as the 0.6376 of unit 67 in the south-east of Barnard Castle R.D, and the east of Darlington R.D., are still considerably below the level reached by areas in agricultural Northumberland. Even within this south Durham belt, very low values are occasionally encountered and the 0.4449 of the fringe parishes of Elton and Norton, or the 0.4271 of Great Aycliffe with its New Town are obvious examples. Indeed, it is not until the west of Barnard Castle R.D. and Weardale R.D. are encountered that loadings reach even moderately high levels. The Durham peak is reached in unit 75 (Middleton-in-Teesdale, Forest and Frith and Newbiggin C.Ps) at 0.7063, though again a comparison with upland agricultural areas in Northumberland reflects very unfavourably on the former.

Factor 3

Whilst Factor 2 was only slightly less important than Factor 1 in terms of percentage variance explained, Factor 3 shows a marked drop to 19.43 percent, though as such it is very much on a par with the R-mode Factor 3 which had an explanatory percentage of 19.77. A comparison of the main aspects of the two factors may be made from Tables 3.8 and 3.17.

Whilst it is perfectly obvious that both Factor 3s describe essentially the same dimension - that of high social status - there do appear some ordering differences in the importance of various variables, with those relating to a birthplace outside Great Britain and household access to two or more cars being noticeably less important in the Q-mode. Nevertheless, it is the similarity of the two factors rather than their differences that should be stressed with all variables mentioned in Table 3.17 loading at least 0.44 on the corresponding R-mode factor and most well over 0.5

Although the factor primarily describes aspects of social status, the variables it contains deserve further comment in relation to their associations. Those described in relation to the R-mode Factor 3 hold equally true here with the addition of some other similar indices such as the percentage of persons having household access to one car. Additionally, however, one sees the commuter nature of these units emphasised by the strong showing of the outward journey to work variable whilst their proximity to major employment centres is apparent on the high score of 1951 population potential. At the same time the occupational composition of these areas is shown to tend particularly towards the tertiary sector, though the production

Table 3.17

Composition of Factor 3 : Scores on Variables

Number in Table 3.2	Variable	Score
60	Percentage of owner-occupying households, 1966	2.25
72	Males in professional and managerial S.E.Gs 1966	2.16
70	Males in Social Class 1, 1966	2.08
9	Inmovement 1961-6 from outside Local Authority Area	2.07
69	Persons with Terminal Education Age above 15, 1961	1.98
71	Males in Social Classes 1, 2 and 3, 1966	1.88
45	Persons travelling outside parish of residence to work, 1966	1.68
40	Employment in services, 1966	1.62
30	Percentage of 1966 population born outside Great Britain	1.51
68	Persons with household access to two cars, 1966	1.48
67	Persons with household access to one car 1966	1.47
73	Males in professional, managerial and skilled manual S.E.Gs 1966	1.43
65	Percentage of persons living at density of under 0.5 per room, 1966	1.41
50	Standard Net Output per hectare, 1967	1.41
62	Households with exclusive use of 3 basic amenities, 1966	1.21
7	Total inmovement into parish 1961-6	1.17
14	Population Potential, 1951	1.12
6	Persons having changed residence 1960-1	1.02

employment variable does achieve a score which is only slightly below 1.0. With regard to household characteristics, the ubiquity of basic household facilities is shown, whilst in contrast to most areas of population growth, possibly in combination with house size, there is the inclusion of the percentage of persons living at densities of 0.5 persons per room and below.

One comment on the agricultural sector does appear (Standard Net Output per hectare) emphasising the necessarily intensive agricultural use of land in these parish units.

The high negative scores on this factor are very much as might be expected with variables representing rough grazing, two distance indices, densities of one person per room and over and mining all scoring below -1.0. Additionally and more noteworthy, is the score of -1.04 achieved by the intra-Local Authority Area movement variable. This shows the lack of short distance migration with respect to such areas partly as the reverse of the association between much short distance residential movement and substandard housing clearance.

Spatially, the distribution of factor loadings (Figure 3.10) compares well with the pattern shown by the corresponding Figure 3.4 though some difficulty of comparison is once more apparent in the necessarily differing scales of measurement. Again, however, the large extent of extremely low values throughout the whole of Northumberland away from parts of the south-east shows clearly, and the lowest loading of all (0.2543) is attained in the border unit which contains the parishes of Branxton, Carham, Kilham and Kirknewton. Some few areas of higher loadings do show up amidst this sea especially, as before, Warkworth and Lesbury and Alnmouth to the east of Alnwick U.D. together with a spur going north-west from Morpeth M.B.

As expected, the main area of significantly high values in Northumberland (see Table 3.18) is in the south of Castle Ward R.D. and along the Tyne valley to Hexham, the latter perhaps showing up a little more clearly here as compared to Figure 3.4. As found in the R-mode analysis, North Gosforth again appears out on its own as the epitome of the North-East's equivalent of a semi-rural stockbroker belt.

In County Durham the predominantly agricultural west and the mining areas of the north and east appear devoid of any even moderate values. Towards the south of the county, loadings do occur which are on a par with the moderate values found north-east of Hexham U.D. in Northumberland. The same areas which stood out

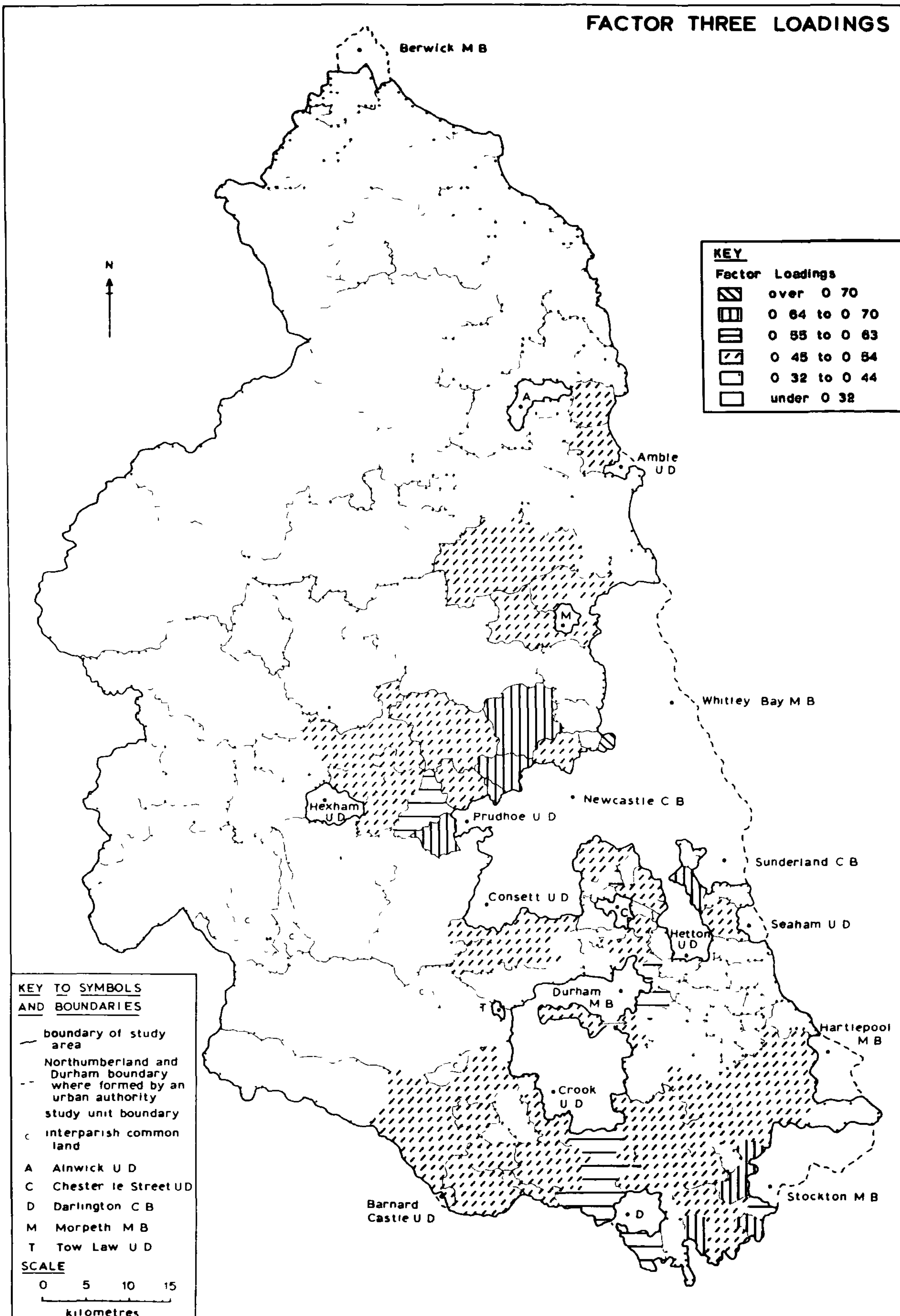
FACTOR THREE LOADINGS
Berwick M B
KEY
Factor Loadings
over 0 70
0 64 to 0 70
0 55 to 0 63
0 45 to 0 54
0 32 to 0 44
under 0 32
N
A
Amble U D
M
Whitley Bay M B
Newcastle C B
Hexham U D
Prudhoe U D
Sunderland C B
Consett U D
C
Seaham U D
Hetton U D
Durham M B
T
Hartlepool M B
Crook U D
Stockton M B
Barnard Castle U D
D
KEY TO SYMBOLS AND BOUNDARIES
boundary of study area
Northumberland and Durham boundary where formed by an urban authority
study unit boundary
interparish common land
A Alnwick U D
C Chester le Street U D
D Darlington C B
M Morpeth M B
T Tow Law U D
SCALE
0 5 10 15
kilometres

Figure 3.10

on Figure 3.4. do so here also, though, as will be apparent if Tables 3.8 and 3.18 are compared, with some interchange in the

Table 3.18

Maximum Loadings on Factor 3

Number in Table 3.1	Parish(es)	Factor Loading
104	North Gosforth	0.7477
55	Elton, Norton	0.6899
101	Ponteland	0.6884
3	Herrington, Offerton	0.6758
98	Wylam	0.6596
99	Heddon-on-the-Wall	0.6596
96	Broomley and Stocksfield	0.6593
57	Egglescliffe	0.6457
59	Middleton-St.George	0.6449
39	Whitwell House, Shincliffe, Sherburn House	0.6232

order. Thus, Egglescliffe, Middleton St. George, Herrington and Offerton, and Elton and Norton appear to have improved their position on the Q-mode social status factor as compared to the relative decline of the Whitwell House, Shincliffe and Sherburn House unit, though it must again be stressed that in the last mentioned case, the different scales of measurement contribute to what is certainly a visual overstatement of the decline between Figures 3.4. and 3.10.

Elsewhere in Durham, areas of moderate value stand out, rather better on Figure 3.10 probably relating here to the inclusion of employment variables especially the journey to work index, and the relatively greater importance of owner-occupancy in the Q-mode solution. Hence, the appearance of Ouston and Belmont, for example, amongst the quite highly loading areas, whilst some other parishes and units having experienced recent housing development are not very far behind. Framwellgate Moor and Kimblesworth (0.4998) and Lanchester and Greencroft

(0.5104) being typical.

Factors 4 to 10.

In the first three factors one has the explanation of 94.34 percent of the total variance and though the Q-mode analysis extracts a further seven factors, their combined explanatory power is a mere 2.77 percent. The most important constituent of the latter accounts for only 0.698 percent of the variability and is, therefore, less significant than the least important factor in the R-mode analysis. As some lower order factors in the latter solution were difficult to interpret, it is not surprising that this is often the case here with the residual nature of the variable amalgamations obvious. Hence, very brief comment only will be made on the most significant aspects of these factors and one must, in any case, continually bear in mind their low explanatory powers.

Factor 4

The most important of these residual factors, the nature of the variable associations is not entirely clear with high negative scores on primary and agricultural employment, yet a strong (1.98) positive one on rough grazing and common land. Among the other variables which score over 1.0 a number do, however, appear to be logically related. Thus, Crude Death Rate (1.68), the percentage of persons aged 60 and over (1.75), the percentage of households of one or two persons with at least one of these of pensionable age (1.69), the percentage of persons living at a density of under 0.5 persons per room (1.48) and the percentage of households with two or fewer persons (1.05) appear to form the nucleus of this factor. This is, however, obscured by other highly scoring variables whose relation with the former group would seem at best unproven and at worst of a purely residual statistical nature, such as the percentage of agricultural land under rough grazing and common, 1961 unemployment, employment in production and the percentage of economically active and retired males in the top three social classes.

Looking at the distribution of loadings, therefore, one may expect to find the highest values representing units with the characteristics shown in the main variable grouping but with an admixture from other sources also. As might be expected from the low explanatory percentage of this factor, loadings are extremely low with the maximum a mere 0.2775. Nevertheless, some pattern does appear from a consideration of loadings in excess of 0.1.

Most of the highest Durham values are found in the two most westerly Rural Districts of Barnard Castle and Weardale. Here, Etherley, Cockfield, Evenwood and Barony, Lynesack and Softley, the Middleton-in-Teesdale unit, Stanhope and Wolsingham all load at over 0.1 forming well in excess of half the Durham examples. The two highest loadings, those of the Middleton and Stanhope units (0.2421 and 0.2207 respectively) show especially the results of unfavourable death rates and age structures. Other variables outside this group do, however, have an influence. Rough grazing and common land, and the high proportion of males in the skilled and supervisory manual socio-economic groups are presumably the main determinants of the Cockfield loading of 0.2070 though the Crude Death Rate is also above average. Similarly, rough grazing and employment in production certainly contribute to the Stanhope loading, the skilled manual socio-economic index to the Healeyfield loading (0.1451) and such variables as unfavourable age structure, a high death rate and substantial 1961 unemployment to the Sedgefield loading of 0.1314.

The Northumberland pattern of scores is rather more interesting. If one excludes the lowest of 0.1239 (Acomb and Sandhoe) attributing it mainly to uncharacteristically high 1961 unemployment and a high 1966 proportion of males in the socio-economic groups relevant to this factor, then the remaining loadings over 0.1 fall into two groups. The first represents a number of the remoter mainly agricultural parishes (despite the 'negative' association of this factor with agricultural employment) in Haltwhistle R.D. in units 87 and 89 where such variables as persons aged 60 and over, males in the skilled manual socio-economic groups, Crude Death Rate, owner-occupancy, and small-sized households often with a person of pensionable age, have noticeably higher than average values. The majority group, however, is more significant and consists of Haltwhistle (0.2512), Allendale (0.1963), Bellingham (0.1274), Rothbury (0.2775), North Sunderland (0.1790), Belford (0.1894) and Wooler (0.1984). The significance of this group of units rests upon two points. First, the association of this factor with an unfavourable age structure, the death rate, and small households often consisting solely of old persons, should be remembered. Second, as these parishes form some of the few significant nuclei of population in much of north and west Northumberland, one aspect of the so-called rural problem may be appreciated. For, in 1969, it was suggested that in the rural areas of Northumberland certain villages should be considered for consolidation in the fight against rural depopulation (Ross 1969). Beneath the primary level which included such settlements as Norham, Lowick, Corbridge, Felton and Stamfordham, the subcentres were named as Wooler, Belford, Seahouses (North Sunderland C.P.), Rothbury, Allendale, Bellingham and Otterburn.

In all these subcentre parishes except Otterburn with its army camp, the Crude Death Rate for 1967 and 1968 was above the unweighted average for Northumberland and Durham and, furthermore, exceeded the Crude Birth Rate variable in all cases. The extreme was reached in Belford where the two rates were 11.31 and 19.77 respectively, without including the population of the sizeable Belle View Old Persons' Home in the calculations. Indeed, though distance from a centre of 7,000 or more persons, the proportion of males in the skilled manual socio-economic groups and owner-occupancy are fairly consistently above average for the units mentioned above, the main body of variables related to this factor which have such values in every case, often well above average, relate to persons aged 60 and over, Crude Death Rate, one or two person households with at least one occupant of pensionable age and persons living at a density of below 0.5 to a room.

<u>Factor 5</u>

After the 0.693 percent explanation of Factor 4 a further drop occurs with none of the remaining factors reaching above the 0.421 of Factor 6. Factor 5 relates to a value of only 0.37 percent. Its nature is mainly that of inmovement to work, though unlike the R-mode Factor 4, it is now somewhat obscured by the inclusion of other variables which have no obvious relationship to this constituent. Thus, whilst percentage inmovement scored 1.77, the job ratio index 1.68, and the total percentage journey to work movement 1.68, the percentage of the population married has a score of 1.10, the percentage aged 44 to 59 one of 2.10, males in the professional and skilled manual socio-economic groups one of 1.77 and the Standard Man Day ratio variable one of 1.33. Although one may try to rationalise the factor in terms of such areas of inmovement to work quite possibly having a high proportion of married persons and population aged 44 to 59 with many employed in skilled manual work, such a connection would be tenuous and in the light of the low explanatory percentage of this factor, and the overwhelming extraction of variance by the preceding factors, entirely unjustifiable. One may merely note that most of the highest loadings do relate to employment nodes, 0.2708 for Kelloe, 0.2610 for Seaton and Greatham and 0.1248 for Lamesley for example. On the other hand, such units as Thornley with a job ratio of 254.5 load as lowly as 0.0173 whilst some parish units such as Denwick, Edlingham and Rennington with a marked job deficiency, load quite highly (0.1193) on account of the other main constituents of the factor especially the Standard Man Day ratio.

<u>Factor 6</u>:-

The majority of variables attached to this factor relate to overcrowding and associated indices. The two variables representing a high density per room, score 1.60 (1961) and 2.52 (1966), whilst the percentage of six or more person households reaches 2.90 and two or more family households the maximum 3.55. If the 1961 unemployment variable (1.07) outmovement to work (1.10) and the skilled manual socio-economic groups index (1.77) would seem to be reasonably associated, considerably less clear is the association of persons with household access to two or more cars (1.15), and owner occupancy (1.44). Moreover, the association with 1963 primary employment (1.23) is rather questionable insofar as some of the highest loadings refer to largely non-agricultural parishes. Cold Hesledon and Hawthorn (0.2694), Urpeth (0.1517), Plawsworth (0.1615) and Carlton and Whitton (0.2170) load highly despite the fact that none of them had even 4 percent primary employment in 1963. In such cases the overwhelmingly dominant elements are obviously related to the high household density variables and one may note that the percentage of two or more family households exceeded 4 (the unweighted average for all units is 1.51) in all cases mentioned above, together with above average values in the other related indices.

Factor 7

Largely associated with rough grazing (3.06), the two primary and agricultural employment variables score at 2.15 (1963) and 1.81 (1966). The only other two scores at over 1.0 relate to the modified fertility ratio (1.16) and, rather less reasonably, population potential 1951 (1.69). In terms of factor loadings, associations of over 0.1 were shown by units 83 (Edmondbyers, Muggleswick, Healey, Hedley, Shotley Low Quarter), 84 (Hunstanworth, Slaley, Blanchland, Hexhamshire, Hexhamshire Low Quarter), 86 (Coanwood, Plenmeller, Slaggyford, West Allen), 109 (Greystead, Simonburn, Wark), and 110 (Kielder, Falstone, Tarset) though none reached above 0. 1471 (unit 110). Additionally, negative loadings were shown by a number of parish units mainly in north Northumberland where Horncliffe, Ord and Shoreswood at -0.2035 possessed the largest negative total.

Factor 8

In some ways, Factor 8 replicates the main aspect of Factor 4 containing Crude Death Rate (1.61), persons aged 60 and over (1.57), households with one or two persons of a pensionable age (1.86), persons living at a density of below 0.5 per room (1.50) and two or less person households (1.77). Unlike Factor 4, however, one has included in scores of over 1.0, Standard Net Output per hectare (1.27), percentage of persons aged 44 to 59 (1.10), mining employment (2.24), households containing no family unit (2.37) and males in the professional and managerial socio-economic groups (1.04).

Following from the composition of this residual factor it is not surprising that a variety of parish units have loadings of above 0.1. They include such units as Easington, Pittington and Little Lumley where, despite the link with high socio-economic status, the indices relating to mining, the age-structure and the death rate are sufficient to cause loadings of 0.1091, 0.1179 and 0.1345 respectively. Alternatively, the Shincliffe, Sherburn House and Whitwell House unit with a relatively low death rate and little mining employment loads at 0. 1209 mainly on account of its unfavourable age structure and high percentage of economically active and retired males of high socio-economic status[1]. Allendale (0.1329) and Rothbury (0.1347) have moderate loadings for similar reasons as were advanced in explanation of Factor 4. Finally, one may note the loadings achieved by Bywell and Broomhaugh and Riding (0.1575) and Broomley and Stocksfield (0.1191). In both of these, the age structure tends to be slightly older than average and the proportion of small households with no family and living at low person per room densities somewhat higher. Likewise, the socio-economic structure is more favourable than average though mining is insignificant and, in the former, the Crude Death Rate low. Correspondingly low loadings are achieved by such units as Elton and Norton (-0.1277) and Great Aycliffe (-0.2253) where none of the constituent factor variables have any significance.

It may be appreciated, therefore, that many different types of unit are able to load relatively highly on such a residual factor owing to the nature of the variable associations. Although in this sense, such a factor is a perfectly valid dimension of difference amongst parishes of an otherwise heterogeneous nature, the relevance is severely limited by the minor importance and the lack of any meaning in other than a statistically residual sense of such variable combinations.

Factor 9

An unsatisfactory and quite large assortment of variables contribute significantly to this factor from mining employment (1.85) to low density in 1951 and 1961 (-2.57, -2.75) and from persons living at over 1.5 per room in 1961 (1.25) to a low percentage of six or more person households (-2.12). A mere five units load more highly than 0.1 and none above the 0.1406 of Cresswell, Thirston West Chevington and Widdrington. This particular factor has the lowest explanatory percentage of all (0.275), though Factor 10 is little higher, and further consideration would seem unnecessary.

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[1] Note the effect of Sherburn Hospital (Old Persons' Home) which is included in the Census age structure table.

Factor 10

Of the seven variables with a positive score above 1.0, two stand out considerably above the remainder - unemployment 1966 at 1.97 and, especially, unemployment 1961 at 4.52. In view of this, despite the low explanatory power of this factor, the areas with loadings of above 0.1 are almost entirely explicable in terms of 1961 unemployment. Hence, such units as Stannington, Sedgefield and Plawsworth where the 1961 Sample Census gave unemployment as being above 10 percent of the workforce have loadings which vary from 0.2168 in the first case to 0.1488 in the last. The lowest 1961 percentage unemployment of the eight units with such loadings was that of 6.98 percent for Pittington though here the corresponding figure for 1966 was 13.33 percent.

Conclusion to the Q-mode Analysis

The Q-mode analysis, like the R-mode, established three main dimensions of variability in the rural areas of North-East England. Further factors were relatively insignificant though some interpretation was possible from the major groupings of variables. However, well over 90 percent of the total variance was explained by the first three factors which achieved a most meaningful combination of variables. The Q-mode analysis in terms of the dimensionality of the problem and the resultant distributions was most successful.

3.10 A Comparison of R-Mode and Q-Mode Results

Though differences between the two solutions do occur these should not be allowed to detract from the predominant similarities expressed. Without any doubt, most of the variance of the 74 input variables is adequately synthesised by three factors:

i) A mining (some manufacturing) dimension incorporating especially associated density and housing features.

ii) An agricultural dimension incorporating remoteness.

iii) A favoured social and economic status dimension.

The first two in the Q-mode analysis have quite similar magnitudes of importance whilst the last is rather less so; in the R-mode study the second factor is relatively less important and is more nearly on a par with the third.

Having emphasised the similarities[1], one may proceed to question the significance of the differences found. Firstly, it may be noted that the Q-mode explained a slightly higher percentage of the variance (97.11) as compared to the R-mode (94.31) also combining a far higher proportion into the first three factors (94.34 compared to 76.91 percent). Moreover, the comparisons made during the analysis of both sets of results (Sections 3.8 and 3.9) suggest that the combination of variables achieved in the main part of the Q-mode analysis makes it, of the two, the rather more comprehensive and meaningful form. Nevertheless, one must bear in mind the different starting points for the two forms of analysis. Thus, the R-mode in focusing attention on the variables, produced three main combinations and seven of a lower order. These latter were considerably more meaningful than the largely residual factors

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[1] The extent of this may be discerned from a rank correlation of the ranking of unit loadings (Q-mode) and scores (R-mode) for the three main factors. On Factor 1 there was a correlation of 0.88, on Factor 2 of 0.91 and on Factor 3 of 0.88. It is interesting to note that the greatest similarity on this basis exists between the second factors despite the fact that unlike the close agreement of Factor 3 variances for example, the R-mode Factor 2 had an explanatory percentage of 21.52 whilst that relating to the Q-mode was 34.84. This shows that despite the inclusion of a wider set of variables in the latter, the spatial distribution remained very much the same.

produced by the Q-mode technique. In such terms, the separation of density (Factor 7) from the first factor was meaningful and relevant. On the other hand, where variation over space of a maximum explanatory dimension was the prime concern it was more logical here for such variable combinations themselves to be combined into a factor which was at the same time more general and, especially from a classification point of view, more comprehensive and significant. In this sense the Q-mode analysis achieved a better combination of variables overall. These results would seem to amplify and agree with the findings of Miesch (1969) as to the comparative merits of the two techniques.

3.11 A Classification of Parish Units in North-East England

Having now assessed the main dimensions of difference in numerous characteristics relating to the rural areas of North-East England, and the spatial distribution of these, a synthesis of the material presented in the earlier sections of this chapter seems relevant. With regard to this, one of the most satisfactory methods would seem to be some form of classification of the parish units, founded upon the basic underlying patterns of variation which have been extracted by the factor analysis. Indeed, classification must logically form the next step, especially after the use of a Q-mode technique.

Many methods of classification might be utilised. Robson (1969) mainly utilises a cross-classification of scores on his first two components from R-mode analysis with further modifications based upon extreme values of Components 3 and 4. Moser and Scott (1961) similarly made the scores of areas on the first two components the basis of their classification of British towns whilst Morgan (1971) in delimiting areas of differing rainfall regime in west Malaysia, defined his main regions with reference to Component 1 and subdivided by use of Component 2. Grimshaw, Shepherd and Willmott (1970) used a complex form of cluster analysis based upon similarity coefficients in a study of population mobility and social structure in Biddulph, Staffordshire. Yet another technique applicable to problems of geographical classification has been demonstrated by Pocock and Wishart (1969) when they described the use of dense space analysis for regionalization.

All these methods are attempts to increase the objectivity of classifications in geography though the subjective nature of any such regionalization has been noted ... "there are few objective guides to which an investigator can refer in order to assist this choice of a method of classification. Unless the individuals form definite groups there are likely to be minor alterations in the classification according to the method chosen. Much geographical data clearly does not form such discrete groups and regions characteristically consist of a number of well-defined core areas surrounded by transitional zones .... Classification is a subjective process" (Johnston 1968, pp 587-8). Consequently, an attempt to achieve a generalization of the factor solutions in terms of classification must be seen in this light.

The method of classification adopted here is a simple form of cluster analysis based upon the concept of proximity between points distributed in multidimensional space being a measure of the overall similarity between the areas concerned (Cole and King 1969, King 1969, Mather and Doornkamp 1970). Such a method was first described by Berry (1961) and has been successfully used by Horton, McConnell and Tirtha (1970) in looking at spatial patterns of socio-economic structure in India and, with an inbuilt contiguity constraint by Goddard (1970) in defining functional regions in Central London by an analysis of taxi flows.

A computer programme in PL/1 by the present author achieved the classification by the following steps:

1) For each of the 147 units, co-ordinates were fed in representing the position of the unit with respect to each of the three main Q-mode factors by the factor loading values. This effectively classifies the areas on 94 percent of the total variance of the 74 input variables. It was felt unnecessary as well as irrelevant to include the extremely low loadings of the remaining seven nebulous factors. No attempt was made to use the factor scores of the R-mode analysis in a similar classification for three reasons. Firstly, the greater meaning and comprehensiveness of the Q-mode analysis in areal terms suggests that any tentative classification should be based upon it. Secondly, the great degree of similarity between unit rankings on the comparative factors of the R and Q-mode analyses would appear to argue the sufficiency of a single classification as a generalization of the regional distribution. Finally, the factor scores being standardized for every factor (Klovan 1968) are of the same order of magnitude for Factor 10 as for Factor 1, and

in consequence, the co-ordinate of an area in R-mode derived classification is not weighted according to the explanatory percentage of the corresponding variable association as is the case with the factor loadings in Q-mode analysis. This last point would seem to argue the relative inefficiency of R-mode derived classifications where such a standardization procedure is found.

ii) Based upon these co-ordinates half of the 147 x 147 distance matrix, excluding the principal diagonal, is calculated to give the Euclidean distance between every pair of units in the three factor space. This is simply found through use of the formula

$$D_{ij} = \sqrt{\sum_{m=1}^{n} (L_{pi} - L_{pj})^2}$$

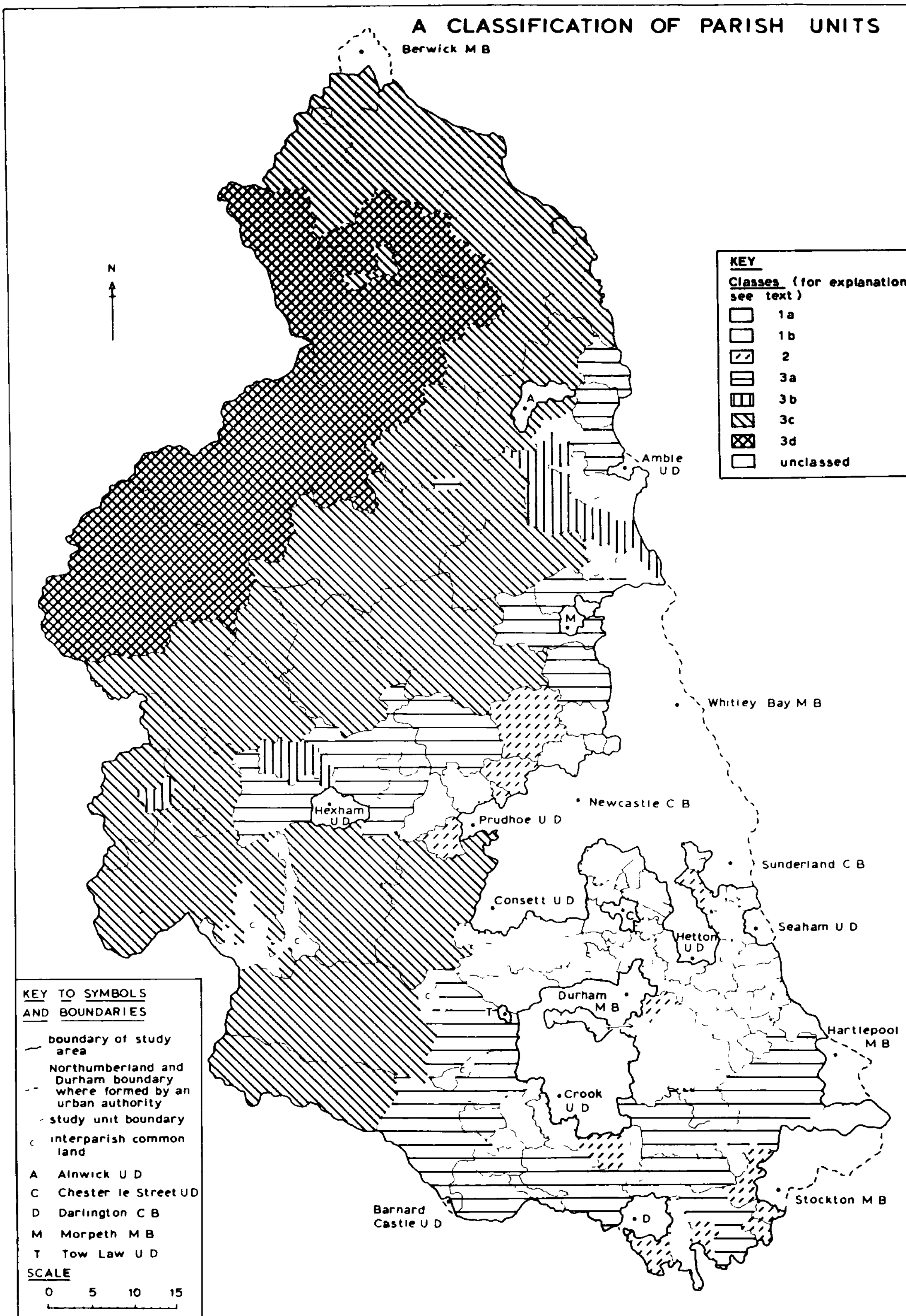
where m = a co-ordinate, n = the number of co-ordinates (here three), L_{pi} = the factor loading on the ith unit, and L_{pj} = the factor loading on the jth unit.

iii) The two parish units separated by the shortest distance are thencollapsed into one new point mid-way between the two old ones and the co-ordinates revised accordingly. This point replaces the pre-existing two which are now eliminated. The matrix, with one less row and column is then recompiled, the process then being repeated until finally only one point remains. When two points of unequal weighting were joined, for example a point representing an amalgamation of several original points and one representing a single individual, the co-ordinates of the new group-point were assessed in direct relation to the weight of the joined points.

As such, therefore, this process represents a type of grouping algorithm through hierarchical classification by reciprocal pair analysis with no inbuilt contiguity constraint, this having no relevance in the present situation. The process may be stopped at any point when it is felt that a sufficient degree of abstraction has been reached. Various techniques have been devised to accomplish this by statistical means but here it was felt that a convenient and justifiable break point (see King 1969) occurred when seven classes, plus two units, which still remained unclassified, remained. These appeared to have a meaningful interpretation whilst subsequent collapsing of points began to involve noticeably larger inter-group distances.

Figure 3.11 shows the results of this classification. Of the two unclassed units, that containing the parishes of Broomhaugh and Riding and Bywell is a unique area in having affinities both with the agricultural dimension (especially Bywell) and also with the areas of higher social status. This results from residence in the unit of labour employing farmers who would fall into the managerial socio-economic groupings and commuters of a similarly high social class ranking. Ultimately the latter characteristic proved stronger and the unit was drawn into the high social status group but with a particularly large distance separating the unit and the group centroid. Secondly, the parish of North Gosforth is not linked with the high social status category until the step ~~following that at which the grouping procedure was interrupted to~~ give the present classification. Though in some senses, North Gosforth certainly falls into this group, it is of such an extreme type that again the distance from the group centroid is large and causes a massive 28.5 percent increase in linkage distance over the previous step. It would consequently appear more logical in both cases to leave the units with these comments but unclassed.

The first class which is recognised is subdivided into two. Class 1a represents those areas which tended to load particularly highly on Factor 1 and are very much type areas of this factor. In almost every case mining has a premier place in the employment sector and many of the associated facets of Factor 1 are likewise evident. As a result this type of unit extends over much of east Durham in an unbroken tract representing the main mining area in the county. A more attenuated zone runs from Lanchester R.D. even including the unit of Cornsay, Hedleyhope and Satley where perhaps surprisingly, mining still employed nearly 25 percent of the workforce in 1966, to Birtley in Chester-le-Street R.D. where the main links



A CLASSIFICATION OF PARISH UNITS
Berwick M B
KEY
Classes (for explanation see text)
1a
1b
2
3a
3b
3c
3d
unclassed
N
A
Amble U D
M
Whitley Bay M B
Hexham U D
Prudhoe U D
Newcastle C B
Sunderland C B
Consett U D
C
Seaham U D
Hetton U D
Durham M B
T
Hartlepool M B
Crook U D
Barnard Castle U D
D
Stockton M B
KEY TO SYMBOLS AND BOUNDARIES
boundary of study area
Northumberland and Durham boundary where formed by an urban authority
study unit boundary
interparish common land
A Alnwick U D
C Chester le Street U D
D Darlington C B
M Morpeth M B
T Tow Law U D
SCALE
0 5 10 15
kilometres

Figure 3.11

with Factor 1, whilst undeniable, are predominantly with variables other than mining. Elsewhere, isolated occurrences are restricted to Greatham and Seaton, and Carlton and Whitton which have industrial rather than agricultural populations with a significant number being enumerated as employed in mining despite the south Durham location and to Cockfield in Barnard Castle R.D. This unit narrowly falls into class 1a rather than 1b despite its lower mining employment than some of the surrounding parishes, largely on account of its otherwise greater affinity with Factor 1 having led to a loading slightly above those of the nearby parishes which are included in class 1b. In Northumberland few units fall into this class and those which do are without exception the ones with major mining employment from Hazlerigg just north of Newcastle to Shilbottle just south of Alnwick.

Class 1b describes parish units which have one or more of the following features in common: mining employment, a large population or a non-agricultural population. Where mining is important it tends to be less so than in the 1a areas or, alternatively as in Evenwood and Barony and Etherley in the east of Barnard Castle R.D., within rather larger units at some remove from the major population nodes and with smaller populations. Likewise, such parishes as Woolsington which have rapidly increased in population since 1951 are included here as a result of such associations as a high percentage of Local Authority housing, a large population and much outmovement to work. The unit containing Lanchester and Greencroft might be cited as a similar example from Durham in which Great Aycliffe also significantly falls into this group.

Class 2 is the most simple of all three major divisions having a mere twelve members if North Gosforth be regarded as so extreme as to alone form a separate type. These are those parishes for which the high social status factor was the only relevant one. The distribution, peripheral to the major urban areas, was adequately commented upon in the discussion of Factor 3 in Section 3.9 and need not be reiterated here.

Finally, class 3 composed mainly though by no means entirely of low density and agricultural parishes, has been subdivided through the linkage algorithm into four subsets. Class 3a includes large parishes where agriculture may occupy most of the land surface as in Sedgefield, Wolsingham and Longhoughton but where a substantial proportion of an often large population is otherwise employed. Elsewhere units which exhibit one or both of two features are included. First, many units where agriculture is of major significance in employment terms but which are in close proximity to the heavily populated zones of Durham and Tyneside, especially some of the largely agricultural south Durham parishes, fall into class 3a. Second, as one goes further away from this peripheral belt, those units in Hexham R.D. which have incorporated commuter functions, though otherwise remaining largely agricultural in aspect, are also related to this class subdivision.

Class 3b forms a small group of four units, which were subsequently incorporated into class 3a. All four units, Haltwhistle, Newbrough and Warden, Newton-on-the-Moor and Felton, and Widdrington, West Chevington, Thirston and Cresswell, whilst being predominantly allied to this third class do have some affinity with Factor 1 and, therefore, the units of the first class, insofar as all possessed some mining employment in 1966 with Haltwhistle at 10.9 percent the least affected. Hence loadings on this Q-mode factor were moderately high varying from the 0.6178 of the Widdrington unit to the 0.6531 of Newbrough and Warden. Factor 2 loadings were nevertheless slightly higher in all cases. It is mainly due to this significant mining employment that incorporation into class 3a, between which and class 3c, these units lie, was so long delayed with the distance of the link ultimately being quite considerable.

The third and fourth subdivisions of this class, relate to the more obviously agricultural areas further away from the major population centres forming in class 3c a broad unbroken tract from the south-west of Barnard Castle R.D., through Haltwhistle R.D. then going north-eastwards through a broad band of central Northumberland and reaching the coast for the first time just north of Alnwick and covering the extreme northern tip of the county. The most extreme agricultural class, both by virtue of the absence of significant population centres such as Stanhope, Belford or Bellingham and the remote location, runs along the Anglo-Scottish border from Falstone in the south to Carham in the north.

If one excludes the atypical Tyne valley commuter belt and Haltwhistle (see above) both classes 3c and 3d exhibit a single example of an inlier of lower value. In the former case Rothbury is in class 3a, and its location would seem to be the main determinant of this despite the parish's relatively high density. In the tract of 3d values, Wooler despite its quite large population merely falls into class 3c, hence still remaining in a strongly rural category. Again, location would seem to be a prime influence though one must not be unmindful of the fact that Wooler is not only a small service and market centre but also the residence for many agricultural workers in the immediate surrounds.

This classification, therefore, appears to be most realistic in terms of the studied characteristics. Whilst no more than a moderate correspondence with the parish classification undertaken in Section 2.6 is to be expected in view of the non-comparability of indices used (for there the essential concern was to clarify the concept of rurality and its four major connotations whilst here the object has been to study these areas and populations in terms of many variables some of which have an obvious connection with rurality, e.g. agricultural employment and others which do not.e.g. owner-occupancy) it isworthwhile comparing the two classifications. Some simplification of the present groupings may be obtained by regarding class 1a as being densely populated/urban/industrial/mining in nature; class 1b as non or minimally agricultural and largely non-rural; class 2 as urban fringe/residential/commuter hinterland; classes 3a and 3b as having an important agricultural concern but within the range of urban and/or mining influence; class 3c as remoter rural/agricultural, and class 3d as isolated/rural/agricultural.

Any comparison between the earlier Index of Rurality and the present classification is hampered further by the parish amalgamations necessary in the latter. However, despite this and the wide variety of indices used in the present section, a comparison of Figure 3.11 in terms of the above rationalisation and Figures 2.11 and 2.12 shows many similarities, with class 1a largely forming the urbanised nucleus of the Rural Districts, passing into the fringe areas in classes 1b and 2 and thence the rural areas of class 3. Discrepancies obviously do occur and may largely be related to the differing emphasis of the processes leading to the two classifications. Thus, Kelloe here is clearly linked with the coalfield core areas both in terms of its location and population characteristics, especially the process whereby mining employment in the factor model has been inextricably linked with urban related characteristics and not left as being of an indeterminate nature. Therefore, significant mining employment helps to place this parish in class 1a despite the restricted population density and moderate primary land use which in Part 1 placed it in the rururban category. In the Cornsay, Satley and Hedleyhope unit, mining again is the prime cause of a 1a rating despite the fact that the lowest index of rurality value was a rururban one for Cornsay.

Similarly, the dominance of the mining variable in Factor 1 and, therefore, class 1a, places the parish of Shilbottle to the south of Alnwick U.D., albeit in a late stage of the classification procedure, into the 1a category whilst a consideration solely of the four defined prime features of rurality linked it very marginally (index value of 3.01) with the rural areas, as indeed, from a land use and situational viewpoint (note also the only moderate density), it would appear to be. On the other hand it is comforting to note that every parish in class 3c units had an Index of Rurality in excess of 3.5 whilst, despite the necessary parish aggregations, only seven of those classed in 3a, 3b and 3c (under 4 percent) were placed in the rururban category. Some of these such as North Sunderland and Rothbury are classed here primarily with regard to the importance of location in Factor 2, whilst others such as Alnmouth result directly from the parish aggregations. Perhaps most interesting of all, however, is the comparison of parishes here classed in category 2 with the Index of Rurality. It will be found that excluding North Gosforth thirteen of the seventeen parishes thus classed were earlier determined to be of a rururban nature.

The two classifications, therefore, provide an interesting comparison with a large measure of agreement, despite the difference in emphasis of the procedures adopted. Even so, the emphasis must be on complementarity. Both procedures are valid in their own right, the first in terms of the concept of rurality and the second in terms of overall economic, demographical, socio-economic and social similarities and differences with some of these being related to the former abstraction. The large measure of agreement is, therefore, encouraging and each of the two categorizations may be regarded (Section 3.1) as a complementary investigation from a different approach angle into the similarities or differences of a homogeneous group in the other.

3.12. Conclusions of Chapter 3

Having previously investigated the concept of rurality and applied certain fundamental tests in this regard to the Urban and Rural Districts of Northumberland and Durham, the present chapter commenced with the purpose of studying the already noted heterogeneous populations living in the twenty pre-April 1967 Rural Districts in order to assess any basic underlying similarities and differences in their demographic economic, socio-economic and social characteristics. To do this, a multivariate technique of analysis was selected (factor analysis) and from this, three fundamental dimensions were extracted to summarise the basic similarities and differences between the parish units. Additionally, other significant combinations of variables and their spatial distribution were noted. Perhaps not surprisingly, the two main axes discovered related to mining, industrial and usually heavily peopled areas, and the remoter agricultural areas, whilst the third axis extracted a dimension relating to areas of high social status.

The spatial distribution of these dimensions as well as the nature and distribution of the variable associations developed in the R-mode analysis have great geographical significance in exemplifying the homogeneity and heterogeneity within North-East England Rural Districts. Hence the detailed consideration in the present chapter. Two further basic elements are, however, of the utmost significance at this point.

First, it is apparent that the classification of parish units following the Q-mode results is important in terms of the analysis: "A Geographical Study of Post-War Rural Populations in North-East England" and, as such, may be regarded not merely as the end product of a factor analysis but as an aid in further study of the geographical characteristics of these populations and resultant spatial patterns. The nature of such characteristics as the intensity of agriculture or the distribution of service employment will be looked at individually in the following chapters with regard to the present classification. Moreover, it has been encouraging to note that the results of a conceptual approach to differentiating between more and less rural populations (Part 1) and a synthetic approach to a differentiation based on many measured characteristics some of which have been noted to be non-significant in the above terms, give a wide measure of agreement. Thus, rurality as a concept, and areas and populations thereby categorised have a validity insofar as a much greater range of characteristics are concerned. The extent of this in terms of individual characteristics will be explored in the following chapters.

Second, one may at least begin to appreciate the forces at work in creating the basic dimensions of difference in the region's rural populations and it would seem reasonable at this stage to form a preliminary model, both functional and descriptive in nature, to describe these (Figure 3.12). This is relatively simple to comprehend, being a triangle of forces based upon the factor analyses. The apex of the triangle may be regarded as representing the remoter agricultural areas of extensive land use. The two inverted base angles represent the extremes of industrial-mining development and commuter residential areas in the Rural Districts. Linking into this model, which must be regarded as an open system, though outside the actual triangle of forces, are the main regional centres of employment and population. These separate the two extremes of the base though they are intimately connected with both, in employment and two kinds of contrasting overspill pressure. Three gradient types connect the corners and represent the different forms of factor combinations. Thus, for example, as has been shown to occur in the Tyne valley, high social status areas seek to divorce themselves from the regional population centres and industrialised rural parishes. This they are able to do on account of the extensive car ownership and ability and willingness to commute relatively large distances. At the same time, some proximity to the basic urban facilities is required and hence the push into the agricultural hinterland of the larger urban areas is restricted. Such dual-character parishes as Broomhaugh and Riding are one example of the interplay of forces along the social status gradient.

Similarly, at the other side of the triangle one meets such mainly primary land use parishes as Etherley where the mining industry has had, and still has, a considerable influence.

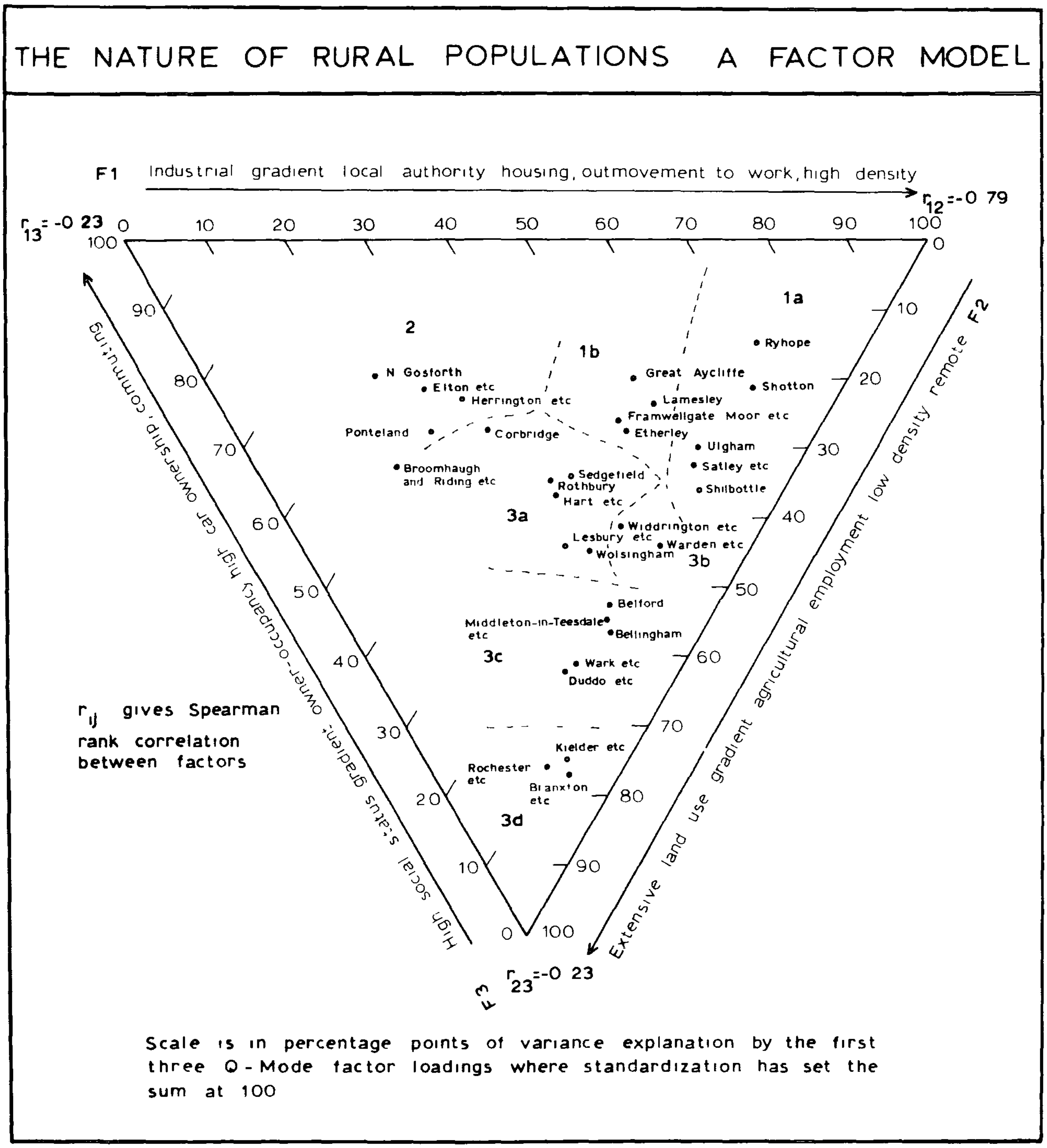

THE NATURE OF RURAL POPULATIONS A FACTOR MODEL
F1 Industrial gradient local authority housing, outmovement to work, high density
r12 = -0 79
r13 = -0 23
r23 = -0 23
F2 Extensive land use gradient agricultural employment low density remote
F3 High social status gradient owner-occupancy high car ownership, commuting
1a
1b
2
3a
3b
3c
3d
Ryhope
Great Aycliffe
Shotton
Lamesley
Framwellgate Moor etc
Etherley
Ulgham
Satley etc
Shilbottle
N Gosforth
Elton etc
Herrington etc
Ponteland
Corbridge
Broomhaugh and Riding etc
Sedgefield
Rothbury
Hart etc
Widdrington etc
Lesbury etc
Warden etc
Wolsingham
Belford
Middleton-in-Teesdale etc
Bellingham
Wark etc
Duddo etc
Kielder etc
Rochester etc
Branxton etc
r ij gives Spearman rank correlation between factors
Scale is in percentage points of variance explanation by the first three Q-Mode factor loadings where standardization has set the sum at 100

Figure 3.12

Alternatively other parishes such as Ryhope exhibit extreme mining-industrial characteristics. From this inverted base of the triangle one passes through the various categories of parish units recognised in Figure 3.11 before arriving at the areas of extensive agriculture. In the centre of the diagram one has fairly remote rural nodes such as Rothbury where some service industries and a few high social status residents, possibly retired, are found. On the other hand, it is undoubtedly part of the agricultural scene and too remote to add any commuter facilities to itself. Such a parish unit as that including Hart is agricultural but its proximity to major population centres means that intensive land use is necessary and only legal controls may prevent its absorption into a more densely peopled area on one side or the other of the central land use/location gradient.

All this may be seen to be illustrated by Figure 3.12 with the approximate class limits of the various parish unit categories also being shown. The connection between the three gradients may be gauged from the given Spearman correlation coefficients based upon the ranks of each parish unit on the three main Q-mode factors. A very high negative association is shown between Factors 1 and 2 despite the similarities which exist between them, especially location. On the other hand the relationships between these two factors and Factor 3, whilst still negative and significant at the 99 percent level, are far smaller indicating the relative weakness of the connections.

It may be expected that a close consideration of the individual characteristics of parish units will clarify and augment some features of this preliminary model and shed further light on the processes operating. Having discovered the basic dimensions of the rural scene from a geographical point of view, it now remains to consider the spatial distribution and importance of individual characteristics. Thus, whilst mining was the predominant variable in both R-mode and Q-mode Factor 1s, the spatial distribution attributed to this factor is not solely that of mining but of a combination of variables. Hence, a consideration of the distribution of mining employment may be held to be necessary both in terms of its importance in the basic patterns underlying North-East Rural Districts as well as alone without the aggregated influence of other associated characteristics. In this way the factor analysis may be regarded as a starting rather than end point.

Furthermore, certain variables such as Crude Birth Rate do not stand out as a predominant influence in any factor often being quite equally divided between the main ones. Therefore, it may be asked what distribution pattern (which of course may be considered as significant in itself) and close relationships such variables show, especially in the light of the classification already undertaken. Consequently, it is now necessary to turn to the individual characteristics and forces at work and consider them alone, though the basic dimensions of the pattern analysed in the present chapter are a necessary complement to be kept in mind. Indeed, the analysis and classification undertaken so far may be regarded as: " ... a framework within which further research can be conducted" (Robson 1969 p.72). How do the sub-regions and regions recognised, identify themselves with regard to individual variables, both those that are well summarised in the extracted factors and those which are not?

CHAPTER 4

DENSITY, STABILITY AND DISTRIBUTION OF RURAL DISTRICT POPULATIONS

4.1 Introduction

Three significant and related elements will be treated in the present chapter. First, especially in the light of the previous two chapters, density will be further considered. Second, and leading on from this, several aspects of population stability will be examined. Here, emphasis will be placed upon the importance and relevance to the organic rural scene of changes in density including the emotive topic of rural depopulation. In addition the stability of the adult population will be considered, as it is revealed by the electoral rolls over two recent periods, and the extent and nature of migration into a unit will be dealt with as this is shown by the 1961 and 1966 Censuses. Third, the importance of location will be investigated in terms of population potential and distance from sizeable population clusters.

In the analysis which follows, reference will necessarily be made to the linkages between variables and, consequently, to save duplication in the various sections, a full table of relevant rank correlations[1] is given below. Though any break points, especially in view of the effectsof autocorrelation, are necessarily arbitrary and subjective in nature, only correlations in excess of $\pm$ 0.4 are shown. Between 0.4 and 0.6 a correlation will be regarded as moderate, between 0.6 and 0.8 as high and above this level as very high. A list of variables considered for inclusion in the correlation tables in addition to those specified in Table 3.2. will be found in Appendix C.

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[1] The orthodox Spearman Rank Correlation Coefficient has been used as being by far the most efficient way in the circumstances of providing a large correlation Matrix (here 114 by 114). By no means all variables are normally distributed and the ways in which they depart from normality are many and varied. To have attempted to normalise them all would have been virtually impossible and very time-consuming with some distributions extremely skewed or bimodal. Consequently a non-parametric approach has been adopted.

Table 4.1

Spearman Rank Correlation Matrix of Chapter 4 Variables

Variable	1	2	75	3	4	5	6	76	77
1	*	.97	.95						
2	.97	*	.99						
75	.95	.99	*						
3				*	.78				
4				.78	*				
5						*			
6							*	.48	.73
76							.48	*	
77							.73		*
7									
8									-.42
9	-.42			.42					.60
78									
10	-.53	-.69	-.70						
11	-.59	-.61	-.53						
12	-.57	-.61	-.64						
13	-.55	-.57	-.57						
14	.72	.75	.76						
15									
79	.71	.75	.76						
19									
25									
26	-.44	-.50	-.52						
27		.45	.47						
30									
85									
86									
35	-.92	-.97	-.96						
37	-.89	-.93	-.93						
87	-.88	-.91	-.91						
38	.64	.60	.56						
88	.66	.62	.59						

Table 4.1 cont

Variable	7	8	9	78	10	11	12	13	14	15	79
1			-.42		-.63	-.59	-.57	-.55	.72		.71
2					-.69	-.61	-.61	-.57	.75		.75
75					-.70	-.63	-.64	-.57	.76		.76
3			.42								
4											
5											
6											
76											
77		-.42	.60								
7	*		.62								
8		*	-.57								
9	.62	-.57	*								
78				*							
10					*	.71	.69	.67	-.80		-.80
11					.71	*	.84	.72	-.87		-.87
12					.69	.84	*	.58	-.84		-.85
13					.67	.72	.58	*	-.87	-.42	-.86
14					-.80	-.87	-.84	-.87	*		1.00
15								-.42		*	
79					-.80	-.87	-.85	-.86	1.00		*
19				.52			.41				-.41
25			-.42								
26					.45	.45	.55		-.51		-.52
27					-.44	-.43	-.51		.50		.51
30			.40								
85					.45	.49	.48	.45	-.50		-.50
86						-.41			.42		.43
35					.63	.57	.53	.57	-.71		-.71
37					.68	.64	.62	.58	-.76		-.76
87					.59	.61	.58	.56	-.72		-.71
38		.55	-.55		-.40			-.44	.52		.51
88		.53	-.54		-.47			-.51	.56		.55

Table 4.1. cont.

Variable	1	2	75	3	4	5	6	76	77
39	.59	.64	.66						
89	.46	.52	.55	.48	.40				
40									.41
44	.47	.51	.54						
91	.48	.52	.52						
45	.58	.59	.61						
47	.40	.42	.42						
93	-.69	-.71	-.70						
49	-.67	-.70	-.71						
95	.60	.60	.61						
50	.55	.58	.59						
51		-.42	-.42						
97		-.41							
98	.60	.62	.64						
100	.54	.57	.59						
52	-.46	-.50	-.52						
53	-.68	-.70	-.70						
101	.45	.46	.46						
102									
55	.52	.54	.57						
56									
57	.58	.59	.56						
106	.52	.53	.53						
61	.63	.66	.64						
107	.63	.66	.64						
62				.49	.47				
65	-.40	-.42	-.41						
67	-.56	-.52	-.48						
68	-.68	-.67	-.65						
109	-.70	-.67	-.63						
69	-.52	-.48	-.45						
70									
71				.46	.41				
72	-.51	-.47	-.43						.45

Table 4.1. cont.

Variable	7	8	9	78	10	11	12	13	14	15	79
39					-.55	-.60	-.70	-.43	.64		.65
89						-.54	-.65		.51		.52
40			.43								
44						-.43	-.41		.49		.50
91									.43		.44
45					-.64	-.74	-.67	-.57	.72		.73
47					-.53	-.60	-.55	-.46	.57		.57
93					.45	.49	.49	.40	-.54		-.53
49					.44	.52	.55	.42	-.56		-.56
95					-.63	-.64	-.72		.65		.65
50					-.61	-.60	-.67		.60		.61
51											
97											
98					-.67	-.64	-.75		.65		.65
100					-.63	-.59	-.67		.58		.58
52					.55	.57	.65		-.53		-.53
53					.51	.54	.63		-.55		-.55
101											
102							.42				
55					-.60	-.54	-.56		.56		.56
56						-.40	-.44		.46		.46
57		.40			-.48	-.42		-.47	.55		.55
106					-.42	-.48	-.48	-.48	.58		.58
61		.46	-.47						.47		.47
107		.44	-.48						.47		.46
62			.41								
65									-.44		-.44
67			.56						-.43		-.42
68		-.50						.40	-.50		-.50
109		-.45	.59		.43				-.53		-.52
69		-.54	.54								
70			.48								
71											
72		-.49	.58								

Table 4.1 cont.

Variable	1	2	75	3	4	5	6	76	77
110	-.56	-.63	-.60						
73									
112	-.59	-.57	-.53						0.44
113	.63	.66	.67						
114				-.46	-.41				

Variable	7	8	9	78	10	11	12	13	14	15	79
110		-.48							-.42		-.41
73			-.42								
112		-.57	.57								
113					-.46	-.54	-.50		.52		.53
114											

4.2. Density

The main lineaments of the modern pattern of density with regard to the Rural Districts of North-East England have already been discussed (see Section 2.2) with a basic division existing between south-east Northumberland and central and east Durham on one hand and north Northumberland and the entire west of the two counties on the other. Here, therefore, one may rather stress the nature of the pattern of intercorrelations shown by this attribute. It has already been seen that, insofar as areal similarity is concerned (Section 3.9) density may be positively integrated into the picture as part of the major dimension which includes mining, production, proximity to population agglomerations, overcrowding and Local Authority housing. Consequently, it is in this direction that one may here look for the most significant correlations.

The highest coefficients shown by the three density variables included in Table 4.1. are those between themselves, showing that the overall pattern of density distribution in the twenty pre-April 1967 Rural Districts has remained much the same since 1951. The lowest of the intercorrelations (0.95) quite reasonably exists between the extremes of the period for which figures were available or calculated, showing the probable existence of minor changes in density, though locally these may be quite considerable.

Nearness to sizeable population agglomerations is also well displayed by the high negative correlations which are evident with regard to distance from such centres of various sizes. It is interesting to note that though the correlations are not of greatly differing magnitudes varying from -0.55 for that between density in 1951 and distance from the 1967 centre of population potential to -0.70 between density in 1967 and distance from a settlement of 7,000 or more persons, all increase between 1951 and 1967 reflecting a polarisation of the settlement density pattern. Similarly, density shows the expected high correlations with population potential for both 1951 and 1967 but with a noticeable increase between the two dates almost certainly reflecting the progressive suburbanisation of previously low density parishes surrounding the major urban areas.

In the remainder of the quite large number of moderate or high correlations, associations which one might expect consequent upon preceding analysis emerge strengthening the view that the Q-mode solution was the more satisfactory of the two factor analyses undertaken. Thus, negative correlations of above 0.8, even 0.9 are exhibited with the three agricultural and primary employment measures whilst lower order coefficients show the connection of density with a young average age at death, mining, production, a quite youthful workforce, outmovement to work, intensive land use, small agricultural holdings, Local Authority housing, high person per room densities, a lack of car ownership and poor showing on the measures of high social status. It is noticeable that those units with high person per room densities in owner-occupied properties tend to correlate with areas of higher overall population densities also.

Two conclusions, therefore, emerge from this analysis. First there are many features which correlate at moderate or high levels with density, emphasising the wide-ranging significance of this feature and its inclusion in the Q-mode Factor 1. Second, whilst many of the variables included in Table 3.13 are included in Table 4.1. as having correlations of $\pm$ 0.4 or over with density, this is not true of all, for example short-distance residential mobility 1961-6 and the proportion of the adult population married in 1966. Moreover, the moderate rather than high nature of many of the correlations is an indicator that whilst of undeniably great importance in considering the nature of North-East England Rural District populations through a wide geographical spectrum, the position of density is not foremost in a multivariate synthesis, hence its relatively poor showing in Table 3.13.

4.3. Stability of Population

i) Density Change

The modern pattern of population distribution in the nominally rural areas is the result of a long and complex evolution, one which, though seemingly stable at the regional level in the short term is always dynamic and in a state of flux locally. Three main processes have operated, and in some cases are still operating, to cause the present density distribution. It is, therefore, relevant to briefly discuss the import of these before considering more recent changes in their light.

One of the most spectacular of these processes in its effects was the rise of coalmining in the Northumberland and Durham coalfields. Indeed, from 1801, when much the greater part of the entire region possessed a predominantly agricultural population and a dominant settlement pattern of small villages (Smailes 1938, Dewdney 1970) one may trace the opening-up of the now largely abandoned western part of the coalfield. From the mid-nineteenth century through to the late nineteenth and the twentieth centuries emphasis gradually changed to the concealed eastern portion as a remarkable result of which "villages have become towns without changing their functional structure" (Conzen 1949 p.79).

During the same period of approaching two centuries, a corresponding and nearly continuous process of population decline has occurred in the more obviously rural areas of the region. Indeed, it has been said of the rural-farm areas in the North-East that ".. the problem of depopulation has been an ever-present spectre since the 1840s" (House 1959 p.6). The phenomenon of rural depopulation has a secure place in the literature and has been exhaustively analysed in its causes, nature, extent and results by Saville (1957). It would appear irrelevant, therefore, to comment upon it any more than is required for a further understanding of the recent position and developments.

Depopulation often severe, there has certainly been in the rural areas of the North-East. Its causes, in common with other affected areas in Britain have been generally related to declining employment opportunities in the countryside, whether industrial or agricultural, and the growth of industrialism and modern technology (Ravenstein 1885, Longstaff 1893, Willatts and Newson 1953, Saville 1957 and 1966, Lee 1966, Osborne 1964) though other authors stress developments in and the prevailing condition of agriculture (Welton 1900, Roxby 1912, Ironside 1964). The onset of this far reaching trend varied in different parts of the country. Saville (1957) and Smith (1951) consider, however, that the overall pace of rural outmigration to the cities began to quicken even prior to 1800, whilst at some point between 1821 and 1851 a considerable proportion of the villages and rural parishes in England and Wales passed into actual population decline. Indeed the former notes that from 1841-51 when Wiltshire and Montgomery were thus affected entire counties began to experience intercensal losses of population whilst, in Scotland, it has been pointed out (Osborne 1964) that eight counties even lost population between 1831 and 1841. Likewise Lawton (1967) holds that rural numbers declined absolutely as well as relatively after 1861, though many rural parishes had reached a maximum ten years previously, with nearly all suffering extremely heavy migrational losses. Nevertheless this is to generalise the position greatly, and Longstaff (1893) noted that "... whilst Cambridgeshire increased by only 3,345 in forty years, the town of Cambridge alone increased double as much as this in twenty years, so that there must have been in reality a considerable rural depopulation in that county" (p.383).

It would appear that North-East England followed this general trend. Though Smailes (1960) notes an exodus of population from the northern valleys since Elizabethan times when that area supplied the Keelmen of Tyneside, House (1959) considers that depopulation in rural areas first became apparent in the 1840s whilst the late nineteenth century saw the greatest population decline with the farm labour force falling in every decade between 1851 and 1901 and by as much as 11, 697 inthe 1871-81 decade in Durham and Northumberland. A further complicatory feature in the North-East, however, was the development prior to 1860 of a joint farming-mining economy in some rural areas especially where lead mining occurred in the western dales. Here, after the peak of the 1860s and 1870s, decline was on a remarkable scale as the mining side of the economy collapsed. Hence, "Between 1851 and 1890 the northern valleys lost by migration, during each ten year period, as much as one-fifth of the population, registered at the previous census year. This scale and persistence of depopulation is paralleled only in the most isolated parts of the Cheviot sheep-farming district". (House 1959 p.32). Indeed, as Smailes (1960) points out, in Allendale, upper south Tynedale, and Derwentdale, the present day population is significantly less than it was in 1800. Finally with regard to this aspect of depopulation, it should be noted that much of the coalfield has become similarly affected, especially in the west in the twentieth century. Daysh and Symonds' (1953) investigation into the problems of West Durham stands as a stark testimony to this, whilst it is noted elsewhere that by 1921, the maximum population level had been reached in most of the mining areas there (Durham County Council Planning Committee 1951)

The third main process operating is very much part of the modern era and as such, will be discussed below in greater detail. However, its presence has been long apparent and the influence of suburbanisation and residential outmovement from the cities to surrounding administratively rural areas was thought worthy of comment many years ago: "The important conclusion that we reach is that however thoroughly we purify the population of urban and mining influences, we still find that the remaining population falls less or increases more in the neighbourhood of industry or residence" (Bowley 1914, p.607).

Turning to the recent distributional history of population growth in the North-East, itself as a whole a noted area of post-war migrational loss (Osborne 1956), one sees developments in the light of the working out of these trends. It is generally agreed that the twentieth century has seen a slowing down of rural depopulation with inter-urban movements replacing those from town to country as the major migrational streams (Cairncross 1953). Thus, 1921 to 1931 saw population losses greater than 5 percent only in upland Wales, northern England, Suffolk and parts of Wiltshire (Willatts and Newson 1953).

The post-war period has seen a similar pattern with the most marked losses continuing from the rural highland areas (Tanner

1961), though as Osborne (1961) has demonstrated, population decline by this time was also greatly affecting many mining districts in the North-East, with, for instance, Easington R.D. only sustained in its total by the remarkable growth of Peterlee New Town. Moreover, although losses from the remoter Rural Districts may have declined in absolute terms since the turn of the century, the present position still gives much cause for concern - "Studies of rural areas of the North-East since 1945 have brought to light a gradually deteriorating situation, presently dramatic in only a few localities, but with trends threatening an uncertain less prosperous future" (House 1965 p.149).

The post-war situation in the Rural Districts of North-East England may be summarised as follows (See Table 4.2). Between 1951 and 1971 (taking Sunderland R.D. between 1951 and 1967) six of the Durham Rural Districts saw their populations increase: Darlington by 179 percent, Stockton by 66 percent, Durham by 19 percent, Chester-le-Street by 14 percent, Easington by 4 percent and Sunderland by 27 percent over the shorter period. Two new towns and residential development elsewhere as at Belmont in Durham R.D. or Ouston in Chester-le-Street R.D. were the causes. Three of the four declining areas were the west Durham Rural Districts of Lanchester (-7.9 percent), Barnard Castle (-15.1 percent) and Weardale (-13.9 percent). The first was obviously attributable to decay in the old mining settlements such as Esh or Langley and despite residential developments at Lanchester and Healeyfield: the second was partly resultant upon the same cause but with noticeable declines also in the more obviously rural parts, whilst the third was caused by straightforward rural depopulation. The final declining Durham area, that of Sedgefield R.D. lost a mere 4.3 percent of its population 1951-71 and this is once more largely the result of the decline in coalmining in such parishes as Chilton and Cornforth offsetting the increases elsewhere consequent upon new estate development as at Sedgefield itself.

In Northumberland, however, the picture is considerably different. Only two Rural Districts, saw their population increase 1951-71, and these are entirely predictable. Castle Ward R.D.

Table 4.2

Rural District Population Change 1951-71

Rural District	Population 1951	Population 1961	1951-1961 Change	Population 1971	1961-1971 Change	1951-1971 Change
NORTHUMBERLAND						
Alnwick	12,055	12,148	+0.77	11,094	-8.68	-7.97
Belford	5,140	5,004	-2.65	4,602	-8.03	-10.47
Bellingham	5,347	5,287	-1.12	4,604	-12.92	-13.90
Castle Ward	14,916	24,500	+64.25	36,414	+48.63	+144.13
Glendale	7,575	7,031	-7.18	6,073	-13.63	-19.83
Haltwhistle	7,492	6,879	-8.18	6,531	- 5.06	-12.83
Hexham	20.869	20.248	-2.98	21,189	+ 4.65	+ 1.53
Morpeth	17,927	17.033	-4.99	16,818	- 1.26	- 6.19
Norham and Islandshires	4,418	3,867	-12.47	3,450	-10.78	-21.91
Rothbury	5,631	5,498	- 2.36	4,971	- 9.59	- 9.59
DURHAM						
Barnard Castle	18,718	17,027	-9.03	15,892	- 6.67	-15.10
Chester-le-Street	40,992	41.169	+0.43	46,853	+13.81	+14.30
Darlington	11,411	23.531	+106.21	31,822	+35.23	+178.87
Durham	33,632	35,043	+4.20	40.006	+14.16	+18.95
Easington	82,170	85,186	+3.67	85,410	+ 0.26	+ 3.94
Lanchester	15,365	14,612	-4.90	14,147	- 3.18	- 7.93
Sedgefield	36,583	36,893	+0.85	35,017	- 4.28	- 4.28
Stockton	7,978	9,270	+16.19	13,267	+43.12	+66.29
Sunderland	25,293	28,368	+12.50	30,349[1]	+ 6.90[1]	+19.70[1]
Weardale	9,284	8,457	-8.91	7,991	- 5.51	-13.93

Source O P C S 1971

[1] For Sunderland R.D. these columns refer to 1967 estimates

experienced great residential overspill development from the Tyneside conurbation particularly at Woolsington and Ponteland and showed a 144 percent growth in the 20 years. Similarly Hexham R.D., despite a small loss in population between 1951 and 1961, increased in the following decade to show a 1.5 percent growth overall. Residential outmovement into the Tyne valley commuter belt finally offset the decline in the more rural areas. Elsewhere the pattern is one of general loss from 6.1 percent in Morpeth R.D. and 8 percent in Alnwick R.D.to 19.8 percent in Glendale R.D. and 21.9 percent in Norham and Islandshires R.D. Hence, those areas picked out by House (1952, 1959 and 1965) as being the most severly affected by depopulation in the past are still suffering the most acutely at present.

It is informative and relevant to compare the level of population reached in the Northumberland Rural Districts in 1971 and that which had been planned for them some years previously (Northumberland County Council Planning Committee 1952). The course of events would seem to have taken Castle Ward R.D. over 70 percent above its planned level for 1971 and Hexham R.D. slightly over 5 percent above. In every other case a shortfall occurred particularly in Morpeth, Bellingham, Norham and Islandshires and Glendale R.Ds.

There is nevertheless some considerable diversity within this general scene and, indeed, it has been argued that: " .. the more the analysis is conducted on a regional and on an area level the more diversity will be discovered. If we are to get a real measure of the effects of the rural exodus, we must take the discussion down to a regional, and in the end, to the parish level". (Saville 1957 p.69). Figure 4.1. depicts the change in population in the 147 parish units between 1961 and 1967. The general analysis given above quite obviously holds true with decline, a feature of west Durham and the entire area of Northumberland away from the south-east and Tyne valley east of Hexham. At times the decline has been severe, being over 12.5 percent (2.1 percent per annum) in Branxton, Carham, Kilham and Kirknewton (all of which lost population) this being a worsening of the situation compared to the 1.4 percent mean yearly decline experienced between 1951 and 1961. It can

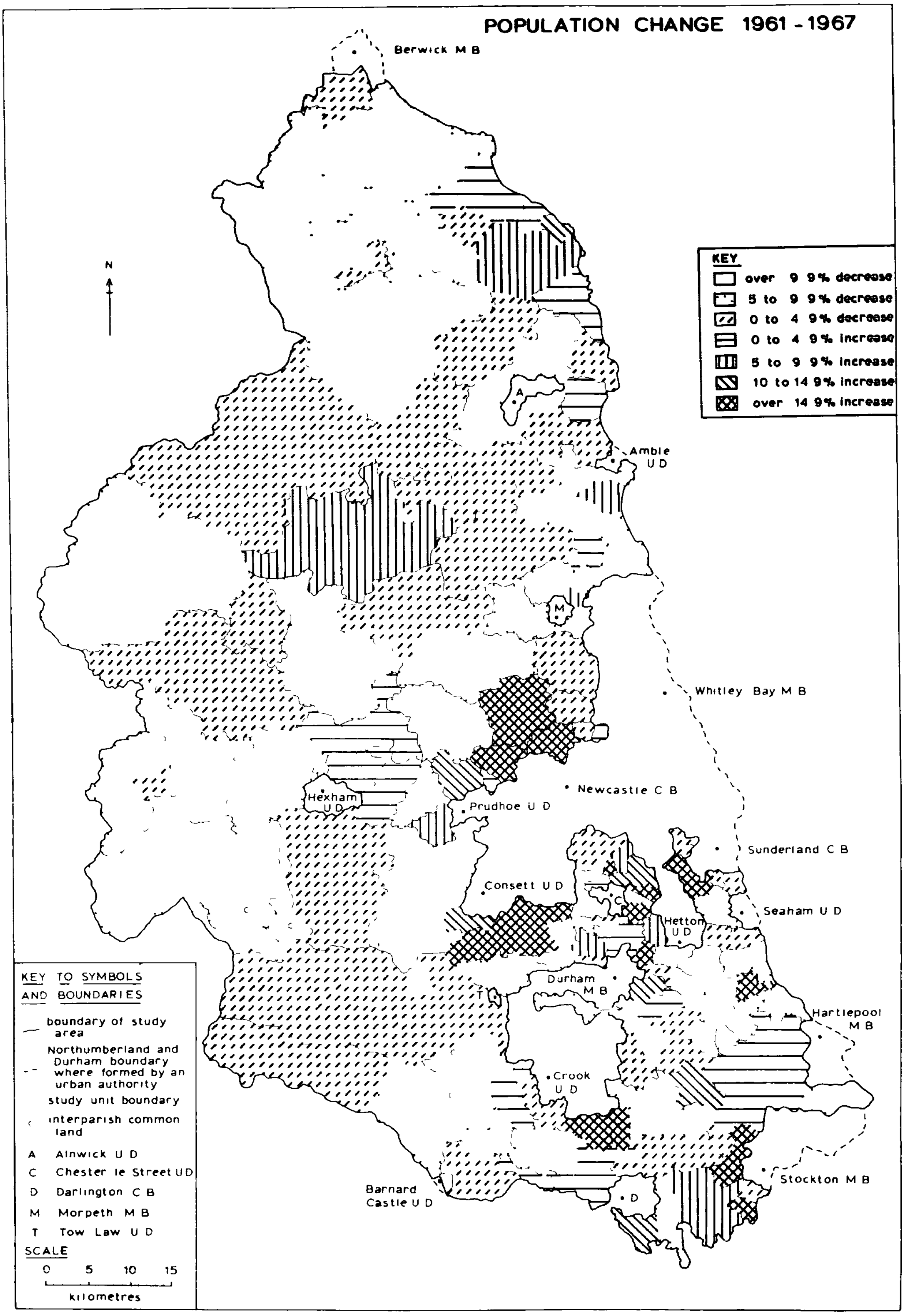
POPULATION CHANGE 1961 - 1967
Berwick M B
Amble U D
Whitley Bay M B
Newcastle C B
Prudhoe U D
Hexham U D
Sunderland C B
Consett U D
Seaham U D
Hetton U D
Durham M B
Hartlepool M B
Crook U D
Stockton M B
Barnard Castle U D
A
M
C
T
D
N
KEY
over 9 9% decrease
5 to 9 9% decrease
0 to 4 9% decrease
0 to 4 9% increase
5 to 9 9% increase
10 to 14 9% increase
over 14 9% increase
KEY TO SYMBOLS AND BOUNDARIES
boundary of study area
Northumberland and Durham boundary where formed by an urban authority
study unit boundary
interparish common land
A Alnwick U D
C Chester le Street U D
D Darlington C B
M Morpeth M B
T Tow Law U D
SCALE
0 5 10 15
kilometres

Figure 4.1

clearly be seen that there are few islands of actual population increase and those which do occur are usually of small magnitude. Thus, Middleton, Easington and Bamburgh increased by 4.2 percent in the six years; Craster, Embleton and Newton-by-the-Sea by 2.7 percent, and Lesbury and Alnmouth by 1.2 percent. Nevertheless in some areas local conditions gave rise to more noticeable increases. In the Adderstone, Easington and Bamburgh unit growth at Bamburgh was the main cause of the 7.7 percent rise, in North Sunderland, a small decline during the previous decade was reversed 1961-67 to a 2.1 percent per annum increase, whilst in Hepple, Hollinghill, Elsdon and Otterburn, a decline of 1.5 percent per annum in the previous decade was reversed solely by growth at Otterburn almost certainly related to fluctuations in defence undertakings.

Nevertheless, the belt of population increase along the Northumberland coast from Alnmouth east of Alnwick to Middleton in the north of Belford R.D., broken only by Longhoughton with its defence establishment at R.A.F. Boulmer is noteworthy, providing an interesting comparison with earlier analysis (see, for example, Figures 2.6 and 2.11) and may well correlate with the development of a holiday trade along this part of the coast.

Here, therefore, one has the updating of the rural depopulation process, which is still obviously extremely active in nearly all of the remoter rural areas whether small parishes of few inhabitants or the larger rural subcentres such as Belford, Rothbury, Wooler, Haltwhistle and Allendale, all of which showed losses between 1961 and 1967 although the first three mentioned had made small gains in the previous decade. It is, of course, impossible to say whether this outmovement will continue from the remoter rural areas, although it is somewhat sobering to consider that in Northumberland, Bellingham, Glendale, Norham and Islandshires and Rothbury R.Ds all have fewer inhabitants today than they did in 1801 - in the second and third cases by nearly half - whilst Belford would soon appear likely to join the group. Indeed, it is now the case that "A very poor village can be viable when it is completely isolated. A relatively rich village may not be viable when a still richer group falls within the frame of reference of the villagers" (Constandse 1960 p.110). The present day frame of reference is constituted by the social and economic standards of urban life (Ashby 1939, Mitchell 1950).

However, it is noticeable that there is little sign of any cessation in the process or even the stabilisation/growth of selected nodal centres as advocated by House (1966) and in most cases, at the Rural District level the 1961-71 period has seen a more accentuated loss than 1951 to 1961. The annual percentage decline in Glendale R.D. rose from 0.72 to 1.36 and that in Bellingham from 0.11 to 1.29. There is, therefore, little reason to consider that the tide of rural depopulation is being stemmed and it has been stated with reference to Northumberland that under present circumstances, rural depopulation will continue (Ross 1967). Moreover, previous optimism seems to have been fundamentally misplaced. Even ignoring pious early hopes expressed by such authors as Bell (1901) and Roxby (1912) such statements as "The equalizing of the rates of growth between 1931 and 1939 and the later development now in favour of the rural section may be the beginning of a reversal of the long-dated earlier trend .." (G.R.O 1951 p.xviii), appear to have been proved incorrect. Similarly, a still more recent opinion to the effect that in the remoter areas where depopulation has been continuous for a considerable period, the final stages are now being reached (N.R.P.C. 1967a), would appear questionable at least in terms of the continuation of population outmovement. Indeed, even the relatively mild hope expressed by House (1965) that as much migration 1951-61 resulted from post-war adjustments in farming and in the service industries, so an equilibrium might well be reached by 1971, appears to have been extinguished and one is left throughout the greater part of the Rural Districts with the feeling that "There is little evidence to suggest that in the absence of government action these depopulating trends will be halted. The pressures of urban society will continue to exert themselves upon the diminishing rural sector and without the provision of work in the countryside the rural population will continue to decrease" (Saville 1957 p 37.).

Population decline, however, is not peculiar to the remoter rural areas and Figure 4.1 points to the fact that if the development of coalmining once caused the population of Easington R.D. to increase from 2,300 in 1801 to 52,800 by 1901 and over 80,000 in the post-war period, in many rural mining areas the wheel of Smailes' (1938) population cycle in mining districts is now in a late phase of its revolution. Even at the time of writing, he saw fit to note that "Except locally, the remainder of the coalfield is at a stage past the peak of a population cycle, and the rate of decrease is held in check only by the difficulty of finding work elsewhere" (Smailes 1938 p.226). It is, therefore, no surprise that in the period 1961-7 when the mining industry was going through a period of rapid contraction, most parishes on the coalfield with substantial mining employment, experienced population loss. In some cases this was every bit as spectacular as the most extreme examples furnished by the rural areas with losses of over 11 percent experienced by Haswell and Pittington and one of over 12 percent by Edmondsley and Waldridge. Pride of place must, however, go to Urpeth in Chester-le-Street R.D. where the average annual population loss 1961-7 was 3.3 percent following the substantial loss already experienced in the previous decade. Exceptions naturally do occur though despite, rather than on account of mining. Thus Great Lumley, Silksworth and East Chevington all grew during the early 1960s, the first two through housing estate development and the last more probably on account of an increase in the then substantial defence establishment of R.A.F. Acklington. Even so, this does little to offset the picture of ubiquitous marked decline which pervades the remainder of the mining areas in Rural Districts, especially Easington.

Whilst the processes of mining decay and orthodox rural depopulation are operating in similar ways, an entirely different though considerably more localised process is to be found elsewhere. Thus one has the conclusion that though " .. there was no migration from rural areas as constituted in 1931 into urban areas as constituted in 1931. There might, however, have been migration from rural areas far from towns into those rural areas on the fringes of towns ... This would constitute a real movement from country to town " (MacDougall 1940 p.35), a conclusion further exemplified by Warriner (1960).

Thus, to the north and south of Tyneside, in parts of central Durham, on Teesside and to a lesser extent, in the Tyne valley, residential movement from the cities is causing rapid population increase. Ponteland has grown from 3,466 in 1951 to 6,030 in 1961 and an estimated 7,707 in 1967. Woolsington has experienced a similar rise from 1,083 to 4,089 and 10,656 at the respective dates, whilst in Durham, Ouston grew from 991 to 1,181 in the first period before then taking off to reach 3,368 in 1967. A discontinuous arc of such parish units surrounds the conurbations of Tyneside, Wearside and Teesside whilst the vicinities of Darlington and Durham exhibit similar features.

Such areas as these, or the new towns of Aycliffe and Peterlee are characterised by particularly rapid population growth whether in response to public or private housing development. One may note average annual growth rates 1961-7 of 15.7 percent for Herrington and Offerton, 30.9 percent for Ouston, 14.8 percent for Egglescliffe, 26.8 percent for Woolsington and, most astonishingly of all, 64.9 percent for Elton and Norton in Stockton R.D. Many of those areas which were demonstrated in Chapter 3 to exemplify enclaves of high social status are included in the most extreme positive category in Figure 4.1 and in those cases where the increase was small as at North Gosforth, or non-existent as at Preston-on-Tees, it will generally be found that 1951 to 1961 saw a major population inmovement. Indeed, over this period, North Gosforth grew from 828 inhabitants to 3,694 and Preston-on-Tees from 1,415 to 1,885.

One area which might have been expected to have shown a far greater increase on Figure 4.1 based upon previous analysis, is that extending down the Tyne valley from Wylam to Hexham. In fact, except for the noticeable growth in the units formed by Broomley and Stocksfield, and Ovington, Ovingham and Horsley, increases appear particularly low or non-existent. However, the Corbridge, Acomb and Sandhoe, Wylam and Broomhaugh and Riding and Bywell units all saw a marked population increase 1967-9. Wylam, for example, having grown from 1,495 in 1961 to an estimated 1,538 in 1967 would appear to have increased in the following two years to 1,671. Correspondingly, the decline in Broomhaugh and Riding and Bywell, largely attributable to the latter parish was reversed 1967-9 when a 15.5 percent increase occurred. Thus, a strengthening of the Tyne valley commuter belt seems to have taken place in the late 1960s emphasising the growth axis which, whilst apparent on Figure 4.1 is not as striking as might have been expected.

If one turns attention to the showing of the two variables included in the factor analysis - population (density) change 1951 - 1967 and 1961 - 1967 - in the correlation matrix of Table 4.1, it is immediately apparent that correlations of a moderate or greater degree are relatively rare. Indeed, the highest is one of 0.78 between the two variables themselves, showing a high though by no means perfect correspondence between population change over the two time spans. Quite naturally such occurrences as population growth in the 1950s followed by a small but persistent decline in the 1960s will weaken the correlation. The more recent period may be considered more relevant in terms of the data used in the preceding analysis.

Of the remaining correlations above 0.4, that of 0.42 with longer distance inmovement 1961-6 is perhaps the most interesting reflecting the greater importance of such moves as compared to intra-Local Authority ones with respect to migrational population increase. At the same time, a moderate positive correlation with the proportion of economically active and retired males in the first three social classes and a negative one with those in social classes 4 and 5 suggests an element of higher social status to be connected with population increase. The provision of modern housing in such areas is also shown by the 0.49 (1951-67) and 0.47 (1961-7) correlations with the provision of basic household facilities, though the level of this association would appear somewhat lower than might be expected. The remaining moderate correlation with employment in production (1961) is not greatly illuminating and, whilst reasonable in terms of such growth areas as Woolsington and Peterlee, one might have expected a similar showing for service employment[1] in other units such as Elton - Norton and Ponteland. This is particularly so when it is considered that though the two variables at present

[1] It should be noted that the Census employment data used are with reference to the industry of employment and not the occupation whilst defence employment, separated out in 1961, in 1966 was included in the wider category of national and local government which has here been included within service industries for the purpose of analysis.

under consideration formed the nucleus of a separate Factor 6 in the R-mode analysis, being incorporated also to a lesser but still noticeable degree in Factors 1 and 3, in the Q-mode analysis, despite an overall weak showing, the social status Factor 3 would appear to be the main source of their incorporation. Nevertheless, the correlation with service employment 1961 is not much lower and, indeed, though none reach the 0.4 level, the relative position of the correlations with production and service employment are reversed with reference to 1966

ii) Stability

A relevant and significant extension of this analysis is a consideration of the year of maximum electoral population for individual parishes in the Rural Districts (Figure 4.2). Even at this micro-level, the above treatment is well vindicated. In Durham, though exceptions do occur such as Kelloe where a small increase of 29 electors was experienced 1958-69, the coalfield stands out as a markedly declining area except for Peterlee. On the other hand, whilst some of the agricultural parishes of south Durham were experiencing decline also, it is noticeable that others, especially the larger or less remote ones such as Hart, Elwick Hall or Gainford were registering their maxima at the period end. The main areas of increase, however, may clearly be related to urban influence and it is notable how all urbanised areas in Durham have an albeit broken surround of growing parishes in the Rural Districts. This is equally true whether one is dealing with settlements of Borough status such as Sunderland, the Hartlepools, Darlington or Stockton (Teesside from 1967) or more amorphous urban areas such as those in central and north Durham. To the west, however, the picture alters rapidly and a population maximum towards the end of the 1960s is experienced no further west than the expanding parishes of Healeyfield and Lanchester. Although Wolsingham is a minor exception, the dales' parishes show again the ever declining nature of their populations.

Northumberland exhibits slightly more variable tendencies but in the main holds true to the example of County Durham. Many of the late maxima are to be found in the relatively densely peopled south-east of the county around Morpeth and Tyneside although once again

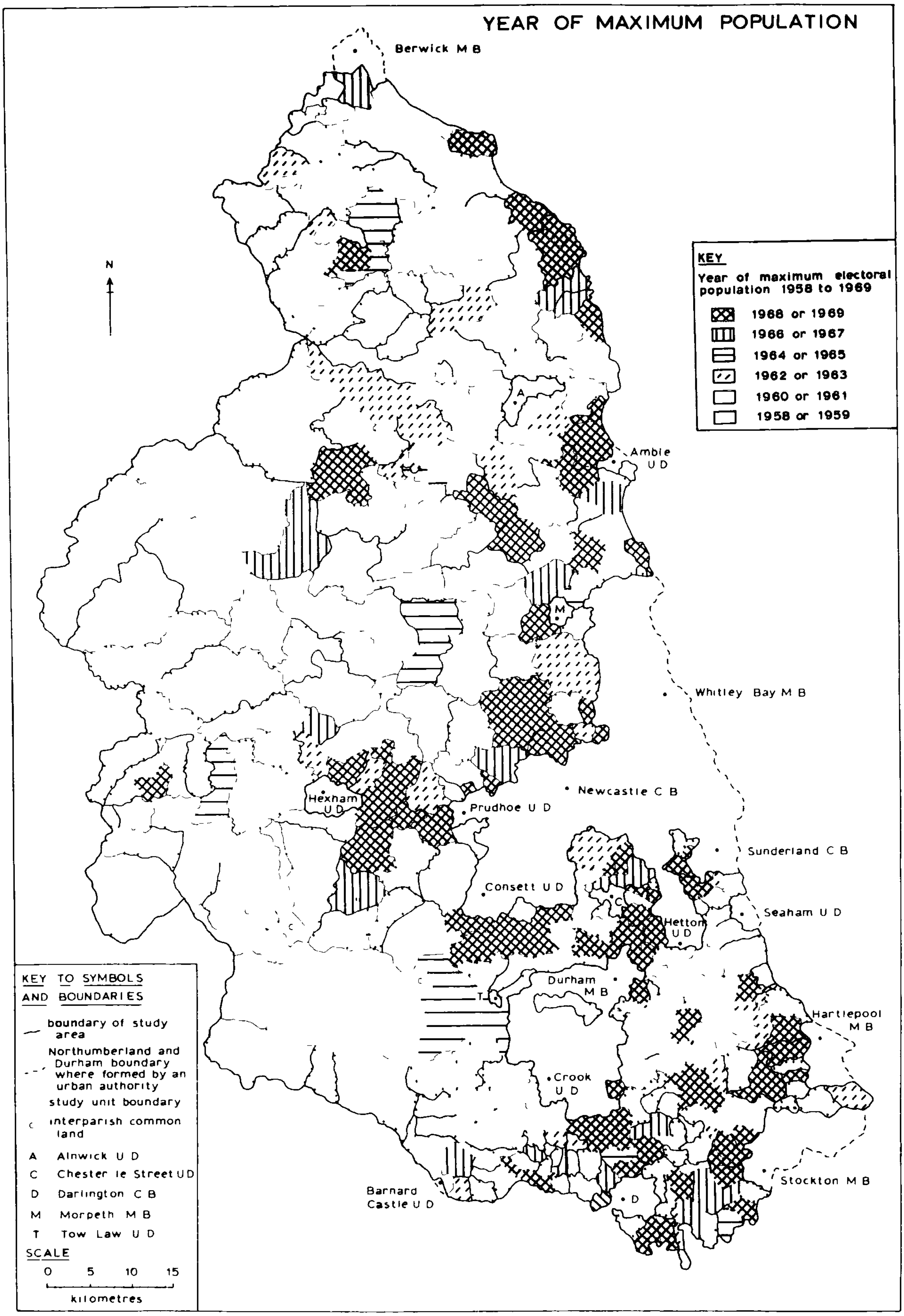
YEAR OF MAXIMUM POPULATION
KEY
Year of maximum electoral population 1958 to 1969
1968 or 1969
1966 or 1967
1964 or 1965
1962 or 1963
1960 or 1961
1958 or 1959
N
Berwick M B
A
Amble U D
M
Whitley Bay M B
Newcastle C B
Hexham U D
Prudhoe U D
Sunderland C B
Consett U D
C
Seaham U D
Hetton U D
Durham M B
T
Hartlepool M B
Crook U D
Barnard Castle U D
D
Stockton M B
KEY TO SYMBOLS AND BOUNDARIES
boundary of study area
Northumberland and Durham boundary where formed by an urban authority
study unit boundary
interparish common land
A Alnwick U D
C Chester le Street U D
D Darlington C B
M Morpeth M B
T Tow Law U D
SCALE
0 5 10 15
kilometres

Figure 4.2

some mining parishes such as Dinnington or remoter parishes such as Matfen show population decline over the period as a whole. The commuter belt to the east of Hexham is particularly well highlighted in Figure 4.2. with seven parishes here (Acomb, Broomhaugh and Riding, Broomley and Stocksfield, Corbridge, Healey, Ovingham and Wylam) registering their maximum population at the period end. To the west of Hexham a less clear picture emerges though Bardon Mill with its mining employment achieved a 1964 maximum and Haltwhistle with its larger population recovered sufficiently by the end of the period to possess two more electors than at the beginning.

In the remainder of the county late maxima are sporadic and local although the coastal belt from Amble northwards stands out as an area of increase, quite probably a direct result of holiday trade developments with, for example, the electoral population of Bamburgh increasing from 437 at the beginning of the period to 497 at the end and that of Beadnell from 400 to 558. Apart from these, few late maxima occur and those that do are generally insignificant. Otterburn with its substantial defence sector is unique whilst Akeld and Harbottle together had a mere 19 more electors in 1969 as compared to 1958. Consequently, the spectre of population decline is emphasised in the vast majority of parishes throughout the main rural areas of Northumberland and again the conclusion is reached that one can not be at all optimistic for the future.

To approach the question of population stability from a different angle, Figure 4.3 has been constructed to show the magnitude of variation in the electoral population, regardless of direction, between the extremes registered over the ten year period 1958-67. Overall, small fluctuations are the rule and the vast majority of units had a maximum of 10 percent or less above the minimum. This is especially so in the declining areas both of the coalfield and remoter rural areas. In some senses this is heartening showing a degree of stability within the decline. However, taken with what has been demonstrated above, it is hardly possible to be optimistic over a steady decline of up to 10 percent in a decade, especially when lower values of under 5 percent are rare exceptions.

POPULATION STABILITY 1958-1967

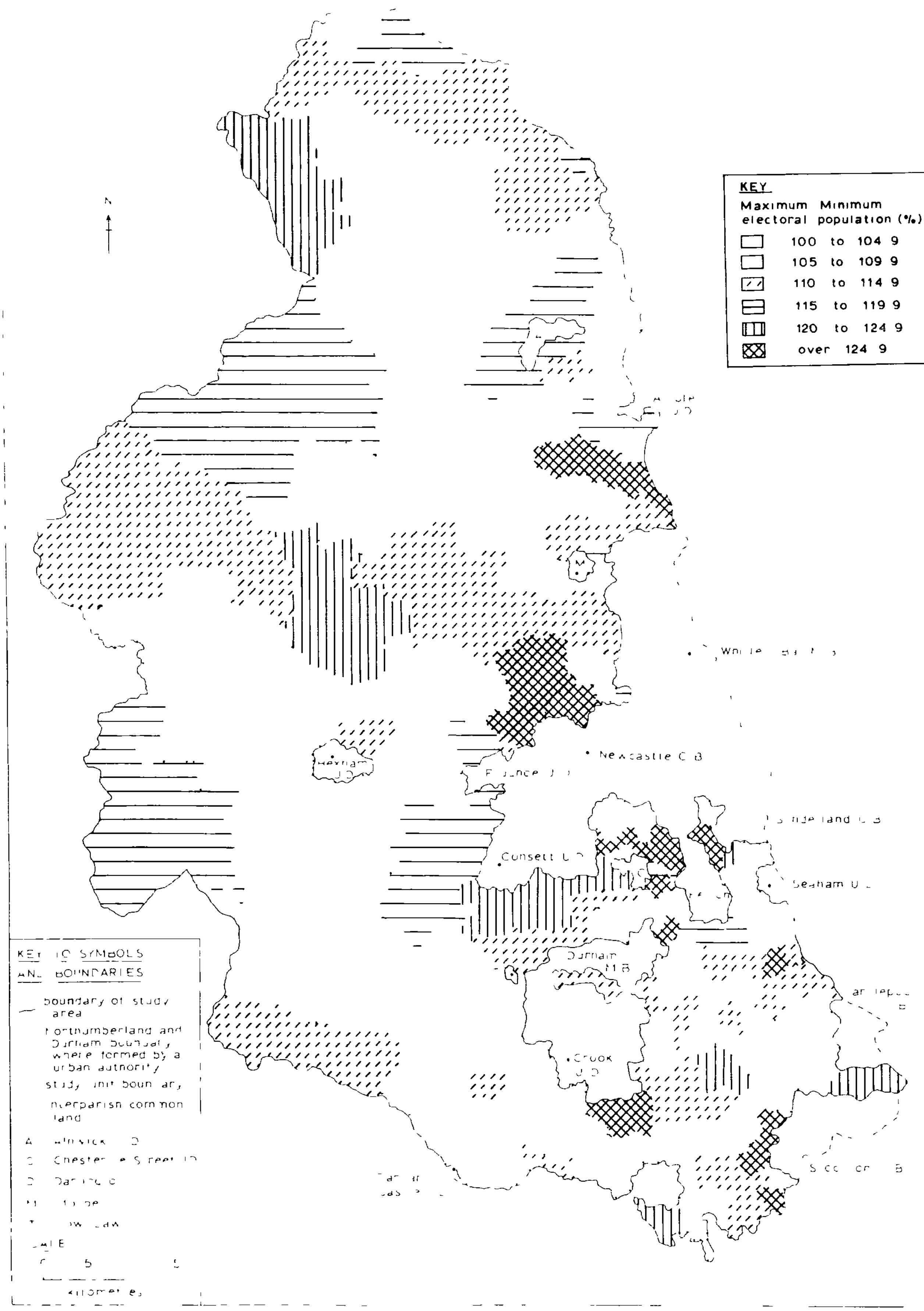

Figure 4.5

Levels of 15 percent instability are also in a minority and the extreme examples are once again predictable, usually being rapidly expanding residential units such as Ponteland (143.5 percent) or Woolsington (747.1 percent) in Northumberland, and Ouston (285.2 percent), Peterlee (194.4 percent) or Elton and Norton (732.4 percent) in Durham. Two exceptions to this general trend do nevertheless appear. The high rating of Urpeth in Chester-le-Street, R.D. is the result of a unique decline which took the electoral population from 1,267 in 1958 to 969 in 1967. In Northumberland, the unit containing Cresswell, Thirston, Widdrington and West Chevington similarly experienced a population decline of sufficient strength to place it in this category.

Less extreme high instability values are in many ways similar. Thus, the growth of residential areas in the Sedgefield, Hurworth-Blackwell and Lanchester units and another marked population decline in the Greatham-Seaton unit all resulted in high instability values. Rather more interesting is the tract of moderate values along much of the western border of Northumberland. In these remote areas, marked declines in population were the causal factors once more, again showing the extent of the problem of stabilising population in such remote areas. Particularly is this so when it is considered that these areas also show (see below) quite high ratio values for population inmovement especially from a distance. This emphasises their instability in a very real sense.

Looking at the nature of the correlations shown by this stability variable, it is somewhat perplexing at first to find that none reach 0.4, the highest being 0.34 with longer-distance inmovement 1961-6. However, if one might, for example, have expected a moderate correlation with the population change variables, it is worth recalling that it has already been demonstrated above that instability would work opposing ways insofar as the density change variables were concerned. Hence it is perhaps not entirely surprising that this variable fails to reveal any close intercorrelation. At the same time, it is relevant to note that, in the R-mode Factor Analysis, over 30 percent of the variability attributable to this index was incorporated into Factor 6 which was largely a population increase factor, with a further 28.5 percent in Factor 1, presumably connected here with population decline especially on the coalfield, and 21.7 percent in Factor 3 where the population increases in some of the areas of high social status were the causal attributes.

iii) Migration

Included in the above analysis of population change and stability are the two constituent components of natural increase (or decrease) and migrational balance. With regard to the former, attention will be paid to vital rates in Chapter 5 whilst exhaustive studies have been carried out of migration from the North-East Rural Districts particularly by House (1953,1965), Edwards (1963), Ironside (1964), House and Knight (1965), N.R.P.C. (1967b) House and Willis (1967) and House, Thomas and Willis (1968). It is not proposed to reiterate such analysis here and one may merely note the most salient conclusions. The main finding was that in most Rural Districts the major characteristic of importance was the heavy loss of males aged under 24 though in the noted problem areas of Norham and Islandshires, Weardale and Haltwhistle, there is a wide spectrum of age group losses. Female trends are noted to be largely a reflection of the male although the tendency towards earlier migration was apparent especially in the coalfield areas thus showing the obvious pre-eminence of employment considerationsin migration (Clarke 1972, Bogue 1969). Secondly, it appears (House 1965) that whilst short distance (within 10 miles) migration, as noted in Chapter 3, is particularly important in the coalfield areas (see also House and Knight 1965), medium distance migration (within the same county) is generally of more importance. Effects are, in any case, the same - "In rural areas the effects of migration may vary from a welcome relief from population pressure to depopulation, dereliction and abandonment. Between these two extremes lie various stages, such as the adverse effect of unbalanced age and sex structures on farming, population growth and social activities, the closure of village schools, the retreat from marginal hill land, the amalgamation of properties ..." (Clarke 1972 p.137).

Here attention will be paid to the nature and extent of in-migration both in terms of movements within the same Local Authority area and movements between Local Authority areas. The importance of in-migration,whilst less considered is of a similar nature to that of out-migration. This significance may be subdivided and Bogue (1969) has given the two principal facets. First: "Differences in birthrates and death rates between communities of the same nation often are rather small in comparison with differences between communities in migration rates. As a result, the principal mechanism for redistributing the population within a nation is internal migration" (p.752). Second: "A population may gain in size by experiencing an influx of migrants and it may diminish in size by an exodus of some of its members to join another population. If this in-migration or out-migration is selective of people with particular demographic social or economic characteristics, it will affect not only the size but also the composition of the population" (Bogue 1969 p.752).

What, therefore, may one glean from an analysis of in-migration and mobility between 1960 and 1961 and between 1961 and 1966? With the material here being based upon the 10 percent samples of 1961 and 1966, the longer period has been taken as likely to reflect more accurately any notable trends during the early part of the 1960s[1].

Figure 4.4. portrays the extent of intra Local Authority area movement (here taken as representing short distance mobility). It is apparent that many of the highest rates of migration in this case, are found on the coalfield. Indeed the mean value of nearly 15 percent of a unit's 1966 population having moved within the same area between 1961 and 1966 is exceeded by nearly every unit on the coalfield in central and east Durham - East Murton at 23.5 percent, Easington at 24.7 percent, Shadforth at 21.2 percent, Shotton at 19.7 percent and Trimdon at 22.8 percent are typical examples. It is further noticeable that Peterlee New Town has a significantly larger percentage internal mobility and inmovement from Easington R.D. (29.0 percent of the 1966 resident population) than does Newton Aycliffe (18.9 percent) from Darlington R.D. The parish of Bishop Middleham in Sedgefield R.D. has the maximum value of 37.1 percent.

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[1] The calculation of sampling errors for individual figures, differences and proportions is covered in the introductions to the various reports of the 1966 Census. Whilst much of the analysis will be directed at the overall patterns presented thereby reducing, if not eliminating any significant chance errors, comments made in Section 3.5. hold equally true here.

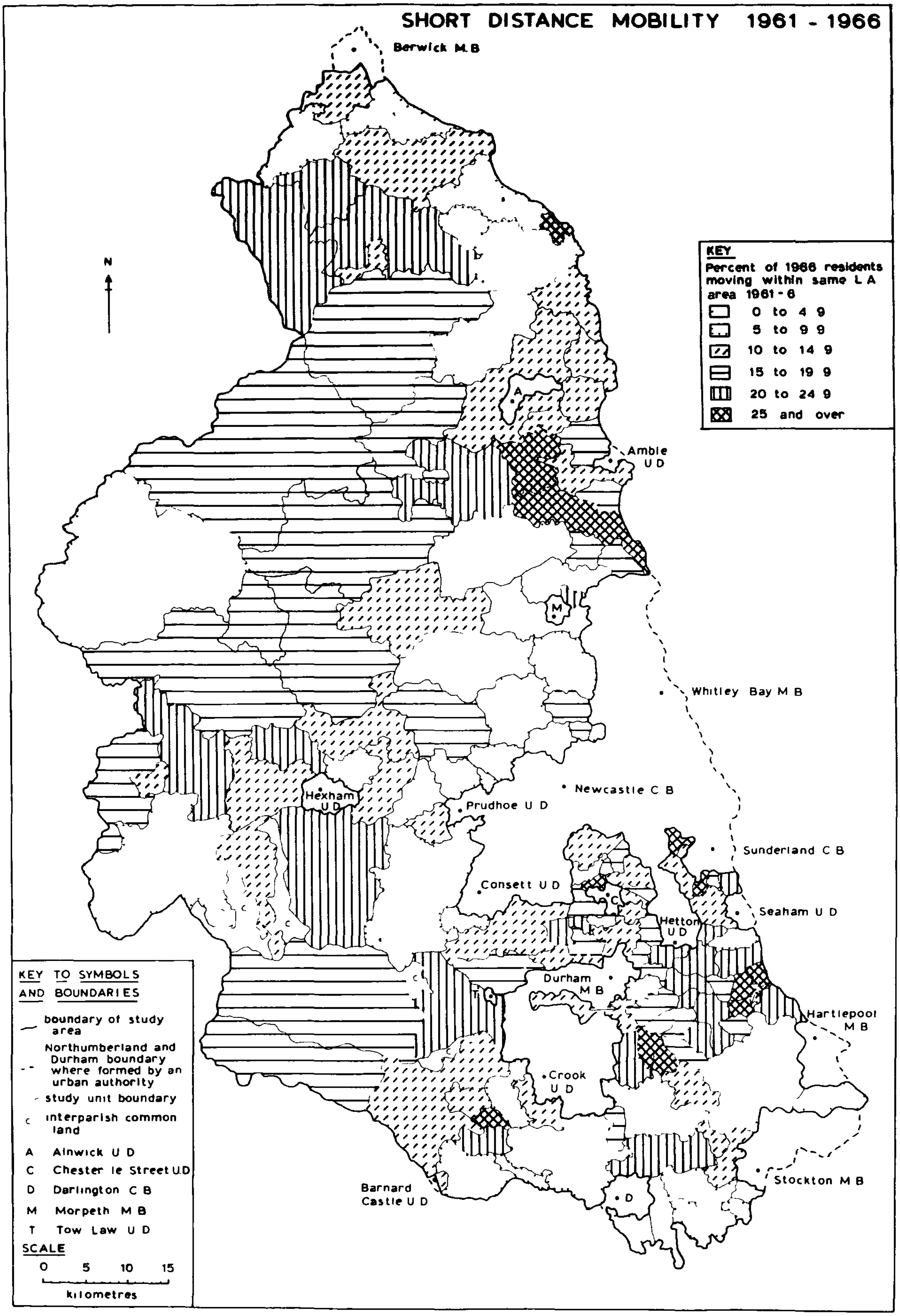

SHORT DISTANCE MOBILITY 1961 - 1966
Berwick M.B
N
KEY
Percent of 1966 residents moving within same L A area 1961 - 6
0 to 4 9
5 to 9 9
10 to 14 9
15 to 19 9
20 to 24 9
25 and over
A
Amble U D
M
Whitley Bay M B
Newcastle C B
Hexham U D
Prudhoe U D
Sunderland C B
Consett U D
C
Seaham U D
Hetton U D
Durham M B
T
Hartlepool M B
Crook U D
Barnard Castle U D
D
Stockton M B
KEY TO SYMBOLS AND BOUNDARIES
boundary of study area
Northumberland and Durham boundary where formed by an urban authority
study unit boundary
c interparish common land
A Alnwick U D
C Chester le Street U D
D Darlington C B
M Morpeth M B
T Tow Law U D
SCALE
0 5 10 15
kilometres

Figure 4.4

Away from the mining dominated areas only four units achieve a figure of 25 percent or over. Cockfield in Barnard Castle R.D. at 26.3 percent (with the Staindrop unit to the south also showing a quite high value), the Cresswell unit north of Morpeth at 26.5 percent and the unit comprised of Newton-on-the Moor and Felton at 25.0 percent all have mining interests, whilst the notable exception is North Sunderland (26.9 percent) where such short distance mobility and inmovement appears to have been a major source of the population growth noted above. Areas exhibiting a lower but still high value of over 20 percent tend to be rather more varied. In Ford and Milfield (23.2 percent) in Glendale R.D. consolidation measures with regard to the rural population centering on Milfield would appear important though two adjacent units exhibit only slightly lower values. Two units north of Hexham U.D. have a moderate proportion of their population involved in mining whilst to the south, the unit comprising the parishes of Hunstanworth, Blanchland, Hexhamshire, Hexhamshire Low Quarter and Slaley had a short distance mobility value of 20.1 percent mainly consequent upon movement into or within Blanchland and Hexhamshire. Slightly to the south-east, Wolsingham probably reflects its position as containing one of the most important settlements of Weardale and some long-term institutional establishments, in its value of 21 percent.

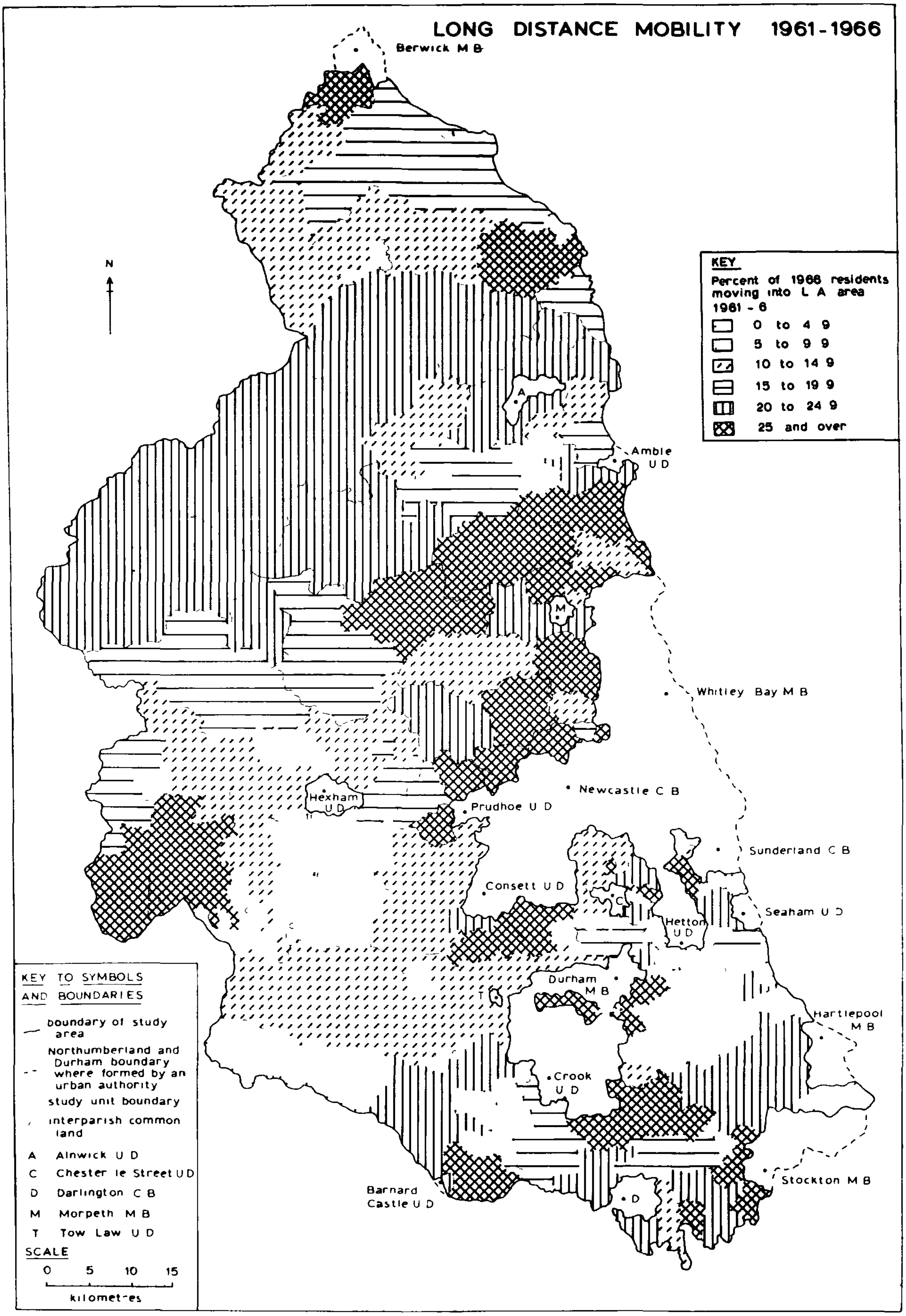
Elsewhere, moderate or low values reign supreme. In the remoter rural areas, it would, however, appear that short distance migration is of greater significance in the moorland areas where values tend to be at or slightly above average (Stanhope 15.3 percent, Alwinton, Biddlestone, Harbottle and Rochester 15.3 percent and even Bellingham 16.0 percent) than in better quality farming areas with values in such units on Tweedside and in north-east and south-east Northumberland generally falling below 10 percent. Most of the south Durham farming areas are similarly low scoring in intra-Local Authority area movement.

Finally, it would appear reasonable to note that many of these areas which were pointed out above as having experienced rapid population increase between 1951 or 1961 and 1967 have particularly low values with reference to short distance residential mobility, showing the predominance of longer migratory movements here, despite the obvious exceptions of the Durham new towns. Few units in Castle

Ward R.D. achieve an average value with Woolsington at 2.9 percent and North Gosforth at 2.6 percent obvious examples. This effect similarly penetrates the commuter belt of the Tyne Valley and one may look to the correlation analysis below for further enlightenment. Likewise, in Durham, the Shincliffe unit saw only 5.1 percent of its 1966 residents moving internally or entering from Durham R.D. in the previous five years whilst at Preston-on-Tees the corresponding figure was 4.4. percent.

With regard to inmovement 1961-6 from outside the Local Authority area in whichthe enumeration district of residence was located, despite the only slightly higher unweighted average of 17 percent, the picture presented (Figure 4.5) is entirely different at the extremes. Inmovement considerably below average is particularly pronounced on the Durham coalfield and the percentages corresponding to those of short-distance mobility above are East Hurton 5.4 percent, Easington 2.6 percent, Shadforth 5.2 percent, Shotton 4.0 percent and Trimdon 4.3 percent. Similarly in Castle Ward R.D. the two mining units of Hazlerigg and Dinnington-Brunswick stood out as islands of high value in Figure 4.4. but here, amidst a sea of maximum values, are notable depressions. Though Peterlee (24.0 percent) and Aycliffe (30.4 percent) have high values as in the case of short-distance mobility, these are obviously explicable in terms of their New Town status, and the only example of a mining unit exhibiting maximum values in both cases is that of the Cresswell unit in south-central Northumberland where 26.5 percent of the 1966 residents were noted to have entered from outside Morpeth R.D. between 1961 and 1966 though the significance of this, if any, remains unclear.

Particularly high percentage values are shown by several units all of which have shown great recent population growth. Thus, Herrington and Offerton at 40.6 percent, Ouston at 41.0 percent, Elton and Norton at 56.0 percent, Egglescliffe at 47.9 percent, Middleton-St.-George at 42.5 percent, Heddon at 40.6 percent and Woolsington at 56.5 percent are the units which had at least two-fifths of their population having entered from outside the 1966 Rural District of residence in the preceding five years. Many other high value units may be similarly explained especially in the Tyne valley, with noticeably above average values shown, for example,



LONG DISTANCE MOBILITY 1961-1966
Berwick M B
KEY
Percent of 1966 residents moving into L A area 1961 - 6
0 to 4 9
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A
Amble U D
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Hexham U D
Prudhoe U D
Sunderland C B
Consett U D
C
Seaham U D
Hetton U D
Durham M B
T
Hartlepool M B
Crook U D
Stockton M B
Barnard Castle U D
D
KEY TO SYMBOLS AND BOUNDARIES
boundary of study area
Northumberland and Durham boundary where formed by an urban authority
study unit boundary
interparish common land
A Alnwick U D
C Chester le Street U D
D Darlington C B
M Morpeth M B
T Tow Law U D
SCALE
0 5 10 15
kilometres

Figure 4.

by Lanchester and Greencroft, Hurworth and Blackwell, the Shincliffe unit, Great Lumley, Sedgefield (though note again here and in the unit to the west, the influence of permanent or long-term institutional residential movement), Ponteland and Broomley and Stocksfield, all of which had below average values for short distance mobility. Elsewhere, other reasons may be adduced in explanation of high values. In much of the forested tract of west Northumberland, long distance inmovement 1961-6 accounted for between one-fifth and one-quarter of the 1966 population which, taken with the only slightly lower short distance residential movement proportion, and population change between 1961 and 1967, shows the great instability of these areas. This would appear to compare well with Ironside's (1964) statement that a substantial turnover of workers occurred in the forestry settlements during the 1950s and that " .. despite substantial immigration of forestry workers since 1945, the local population total has not been completely stabilised. Loss by migration has persisted and, although numbers are small, the high proportion of youths and girls who leave the district makes it a vital one " (Ironside 1964 p 586).

Units containing armed services' population also quite naturally appear likely to experience longer distance in-migration, and this may well be the explanation, at least in part, of the high values in the south of Barnard Castle R.D., at Middleton-St.-George, Stamfordham and Matfen, East Chevington, and Longhoughton. At the same time the residual of high value units is rather more difficult to explain, and may even be chance occurrences especially around the meeting place of Rothbury, Bellingham and Morpeth R.Ds, and in the south of Haltwhistle R.D. where Plenmeller and Coanwood C.Ps were the main reception areas though isolated industrial undertakings such as the Cascelloid Division of Bakelite Xylonite at Plenmeller may not be unimportant. However, it should be noted that long term population loss is by no means incompatible with large scale gross movements. Indeed gross movement has been estimated as being up to twenty times more important than net migration change reveals (Newton and Jeffrey 1951) and one study has even gone so far as to demonstrate that gross population change is not even necessarily related to the net figures produced by the Census (Johnston 1967).

Likewise, there would seem close agreement with the findings here and the conclusions of a general study of migration and residence duration in North-East England (House and Willis 1967). There it was postulated that the vast majority of areas in the North-East which have high short-term residence values occur on the edge of industrial areas where considerable overspill across Local Authority boundaries might be expected. Darlington and Sunderland R.D. are given as Durham examples, whilst similar processes are noted to be at work in causing the high short-term residence duration considered to occur in CastleWard and Hexham R.Ds. At the other extreme ... "More typical of rural areas suffering from depopulation are quite high long-term residence periods and low short-term ones" (House and Willis 1967 p.30).

This is both reflected above and with regard to total movement, be it predominantly short or long distance. Here nearly all units fall within 10 percent of the mean value of slightly under 32 percent. Those with particularly high values again reflect the influence of rapid recent population change, with long distance inmovement predominating. Thus, units with over half their 1966 population having changed their usual place of residence in the previous five years were Herrington and Offerton (51.3 percent), Ouston (62.3 percent), Peterlee (53.0 percent), Elton and Hecton (70.0 percent), Egglescliffe (57.5 percent), Middleton-St. George (51.5 percent), Woolsington (59.4 percent) and the anomalous Cresswell unit (53.9 percent). At the other end of the scale very few units fall below the 20 percent level and only one, that of Greatham and Seaton (3.6 percent) showed a remarkable lack of any inmovement in consequence of its older residential and highly industrial nature.

Turning to the nature of intercorrelations, it has already been seen in Chapter 3 how the short distance migration variable appeared as an important constituent in the first factors of both the R and Q-mode analyses, whilst the longer distance migration variable appeared in the third factors. In the present analysis high short-distance mobility has been shown to be a characteristic particularly of Class 1a units (see Section 3.11) whilst longer distance in-migration is particularly associated with units of a

Class 2 type. Consequently one would expect here to see in more precise detail the strength and nature of these connections. The three variables from the 1961 Census corresponding to those from the 1966 Census though they are only for the single year preceding the former, show few moderate or high correlations. Nevertheless, the index of longer distance mobility 1960-1 does show correlations of over 0.4 with density change 1961-7 (0.42), 1966 service industry employment (0.41), the proportion of economically active and retired males in Social Classes 1 and 2 in 1966 (0.44) and in the professional and managerial socio-economic groups (0.45), and the percentage of the 1966 population having moved residence within the Local Authority area 1961-6 (-0.42). Slightly higher correlations are shown with the corresponding longer distance migration variable for 1961-6 (0.60) and the total percentage mobility of the 1961 resident population in the preceding year 0.73. It is apparent from this that of the 1960-1 migrational indices, that of longer distance mobility shows a fair affinity with recent population increase and high social status variables as well as being the major determinant of total mobility 1960-1. Whilst the correlation with the corresponding variable for 1961-6 is only moderate, the different time spans both in date and (especially important) duration, must be remembered. Nevertheless, the major movements are still clearly picked out for 1960-1 with, for example, 43.3 percent of the Woolsington sample population having moved into the parish from outside Castle Ward R.D. and 25.9 percent similarly so with reference to Elton and Norton and Stockton R.D.

Quite noticeably, however, it is the migration variables for 1961-6 which show the widest range of significant connections. Thus for short distance mobility shows a moderate positive connection with renting (0.53 in 1961 and 0.75 in 1966) persons per room 1961 (0.40) and the proportion of households (0.46) and persons (0.44) renting from the Local Authority. Similar negative correlations exist with the longer distance mobility variable 1961-6 (-0.57), all car ownership indices, a terminal education age above 15 (-0.5[illegible]) and the proportions of economically active and retired males in the professional and managerial socio-economic groups and the first two social classes. Thus, one may here see the positive association of this variable with the coalfield areas, high room densities and the Local Authority housing sector. At the same time, obvious divergences from high social status indices are shown. Consequently, short distance residential movement is associated with low car ownership, low social status and a low terminal education age.

With the longer distance residential mobility variable 1961-6, a rather more interesting set of associations is shown. Again the predominant role of longer distance migration in the level of total migration is inherent in the 0.62 correlation but rather more revealing is the moderate negative correlation of -0.42 with density in 1951. By 1961 this had become -0.33 and by 1967 -0.27 thus showing the progressive increase of population in such areas, and especially when one bears in mind the many very low densities in agricultural units, the recent nature of growth in these parishes.

The connections with the Factor 3s of the factor analyses are also readily apparent in the remaining correlations, agreeing with Olsson (1965) and his general conclusion regarding the economic and educational overtones of longer distance migrations and the more specific findings of House and Willis (1967) with regard to the Northern Region. The correlations of approximately -0.5 with the two mining variables, Local Authority housing and the slightly lower association with the skilled and supervisory manual socio-economic groups shows the polarisation between such areas and the densely populated coalfield parishes of Factor 1 types (Figure 3.11). Similarly, the youth of many of these populations is shown by the moderate negative correlation with the Crude Death Rate variable whilst a similar magnitude of association is quite reasonably exhibited by an extra-British birthplace. The remaining correlations of between 0.41 (the possession of basic household facilities) and 0.59 (household access to a private car) all serve to demonstrate the relative affluence and high status of areas experiencing substantial long-distance inmovement.

4.4. Location

It will already have become apparent, that location with regard to urban areas is a factor of particular importance in the administratively rural areas. Some aspects pertaining to this have already been mentioned in Section 2.5 and again in the preceding sections of this chapter. The significance of this in the present context is well expressed in the statement "It is significant that parishes with declining populations are usually relatively remote from urban areas" (Bracey 1958 p.74). Correspondingly it has been noted that "The new mobility which the internal combustion engine and the pedal cycle have given to the twentieth century, as well as the growing demand for improved housing and living conditions, have resulted in the physical spread of towns into their surrounding country districts. This countrywards movement has offset in some measure, and to a degree has checked, the continued drift from the rural areas to the towns" (Saville 1957 p.41). At the same time, the latter concludes that the larger villages in the more remote rural areas are the main hope of increased employment opportunities with little chance of even population stability in small isolated centres. This role of size as an additional influence in rural depopulation has been investigated in depth by Hassinger (1957) and Rikkinen (1968) both of whom stress the relative disadvantage of small settlements. In its turn this has been amply verified in the North-East by Edwards (1963), Ironside (1964), Ross (1967), McKay and Stagg (1961), Guy (1969), House and Fullerton (1960) and House (1965).

Following from this, Dewdney (1970) has subdivided population increase in Durham Rural Districts into two main categories. Firstly, he notes the positive poles of attraction with especially youthful population resulting in a high natural increase rate as at Newton Aycliffe in Darlington R.D. with its trading estate and nearby urban facilities. Secondly, he uses Sunderland R.D. to exemplify a rather different type of increase. Here, the natural increased rate is relatively low whilst urban-dominated rehousing is the main factor of in-migration rather than any positive attraction.

Whilst the influence of urban centres in creating the rural suburban fringe is not a recent happening or discovery[1] it is undeniably of greater import the nearer the present day, a fact especially commented upon in its future implications by Saville (1966). The rapid population increases in many of these fringe areas have been discussed at some length above and it would now seem necessary to consider the importance of location in terms of the relevant variables relating to population potential and distance from certain size categories of settlement.

The distribution of population potential values[2] has already been analysed (see Section 2.5. and Figure 2.10). Little further comment would, therefore, seem necessary here except to emphasise the importance of the conurbation areas and County Boroughs, and the considerably higher values in rural Durham as compared to Northumberland. Any further findings of significance must come from an analysis of correlation coefficients (see below).

With regard to the change in population potentials, values increased for all units with the unweighted average for the 1967 unit value as a percentage of that in 1951 being 105.0. In consequence of the nature of population potential, taking into account all areas in any single calculation, variation about the mean is regular and, in the event, of a quite simple though not insignificant nature. Again despite the rapid loss of population over the period from nearby cities such as Newcastle and Gateshead, the urban fringe areas of rapid population increase stand out above the average values. Woolsington has a percentage increase in population potential of 7.6 whilst the corresponding figure for Peterlee in Durham was 11.1. Similarly, the average percentage increase in potential for individual parishes in Bellingham R.D. was 4.3 (no

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[1] It may for example, be pointed out that Bowley in 1914 noted that: "The influence of the towns and industrial districts is very penetrating and subtle, and the population of rural districts continually appears to increase from non-agricultural growth" (p.627)

[2] Whilst Chapter 2 saw the calculation of population potential values on an individual parish basis, estimates of unit values were obtained for use in Chapter 3 by an averaging of constituent co-ordinates weighted by individual parish populations.

parish varying by over 0.2 from this), in Castle Ward R.D. 6.1 (varying from the 7.9 of North Gosforth to the 4.6 of Matfen), in Weardale R.D. 3.5 (no parish deviating by more than 0.2), and in Stockton R.D. 8.4 (varying from the 10.7 of Egglescliffe to the 6.6. of Hart). Highest values overall are concentrated in the Teesside flanking parishes of Stockton R.D. where much suburbanisation and population growth have been noted and the lowest in the west of both Northumberland (particularly Haltwhistle R.D.) and Durham where the almost universal nature of population decline requires no further comment.

Correspondingly, correlations based upon the years 1951 and 1967 are extremely similar in nature. Thus, the population potential variables for both years show a high and increasing level of association with the density variables for 1951, 1961 and 1967 respectively. Likewise, the four distance indices show very high correlations with population potential varying from -0.80 to - 0.87. This, therefore, indicates two features. Firstly the dominance of urban population through sheer weight of numbers in the population potential totals is emphasised, and secondly the general orderly decline in potentials away from the urban areas as noted in Section 2.5. is highlighted.

Confirmation of the above analysis in terms of the small significance of changes in population potential between 1951 and 1967 is similarly given. To two decimal places the rank correlation between the two calculated potentials is 1.00 whilst the moderate negative correlation of -0.42 between change in population potential 1951-67 and distance from the estimated 1951 centre of population potential suggests the tendency for the balance of population increase over the period to occur in areas adjacent to the Tyneside and Wearside conurbations.

The remaining correlations of 0.4 or over are very similar to those already noted with regard to density. It may be seen that, like density, so population potential correlates moderately to highly with outmovement to work, mining and manufacturing and highly, although negatively, with agricultural employment. In this last case, the correlations of between -0.71 and -0.76 are a good deal lower than those between agriculture and density. This probably reflects the predominantly agricultural nature of some of the south Durham (and possibly even south-east Northumberland) units where potentials were still high. Moreover, it may not be too much to see in the increase in coefficient between 1961 and 1966 a decreasing agricultural component in some such units as urban influence becomes more pervasive. Once again, however, the intensive nature of agriculture is stressed by positive correlations of between 0.55 and 0.65 with the variables representing intensive labour usage and high output values per unit area, and by negative correlations of a similar magnitude with the proportion of land under rough grazing and common, and the average size of holdings. The small, part-time nature of some of these holdings in the near-urban areas is also shown by the moderate negative correlation with the Standard Man Day ratio variable, employment on some such holdings being insufficient to actively occupy even the owner or tenant for a full year in labour requirement terms.

Likewise, following from the obvious connection with density, units with a high population potential value tend to have below average car ownership, high household densities, and relatively large households with a marked tendency towards Local Authority housing. Moreover, though the correlations with regard to 1966 fall just below 0.4, a connection is nevertheless shown with the tendency of units possessing a high population potential value to have a high proportion of households with one family and a low proportion with no family. It is also noticeable that high values for population potential are associated with a high proportion of the workforce being aged between 15 and 44 and deaths at ages below 65 being above average in number. Finally, the two social class indices which correlate at a level of over $\pm$ 0.4 reflect the likelihood of units in Rural Districts with a high population potential possessing a high proportion of persons in the skilled and supervisory manual occupations, reflecting the lack of comparable employment in some of the remoter rural areas. On the other hand, the same units appear somewhat unattractive to persons of higher social status showing the propensity for such people to reside at a distance from the major population agglomerations. Although some of the older residential areas such as North Gosforth are exceptions to this latter point, the development of the Tyne valley commuter belt is an obvious example of its effect. Nevertheless, the tendency for society in the remoter rural areas to polarise, albeit unequally, at the social extremes, may well have a similar influence on the coefficient.

As a simple assessment of removal from urban influence, several size levels of settlement were taken and the direct[1] distance of these from the coordinates used in assessing unit population potentials then calculated. Three arbitrary 1961 size levels were chosen: a population of 7,000 and over as including the main market towns in the rural areas though not such subcentres as Rothbury, Wooler or even Barnard Castle; a population of 20,000 and over as including centres possessing a variety of substantial commercial and social facilities, and a population of 70,000 and over as including the major urban centres and all settlements of County Borough status. Consideration here was extended to include settlements outside the Northumberland and Durham county boundaries, as some external settlements were obviously of importance. Consequently, such places as Middlesbrough on Teesside, Carlisle, Hawick, Galashiels and Edinburgh were included for consideration at the relevant size level(s). In addition distance from the 1961 population potential centre was calculated as showing removal from the regional population peak.

Figures 4.6 and 4.7 portray the distance by which units were separated from settlements of 7,000 and over and 70,000 and over respectively. The picture presented is self-evident and requires little explanation. In the first case, the ubiquity of small 'urban' settlements throughout much of central and east Durham is well emphasised with few units being more than about five kilometres away from such a centre. It is not until the west of Barnard Castle and Weardale R.Ds is reached that distances begin to increase regularly. Similarly, in Northumberland, units in the south-east and, in consequence of Morpeth, Alnwick and Berwick

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[1] The labour involved in calculating road distances would have been impractically large whilst, if contemplated, it would logically seem necessary also to take into account the predominant mode of transport, congestion factors and the nature of the available road network. 'Crows' flight distance was considered a reasonable and viable approximation.

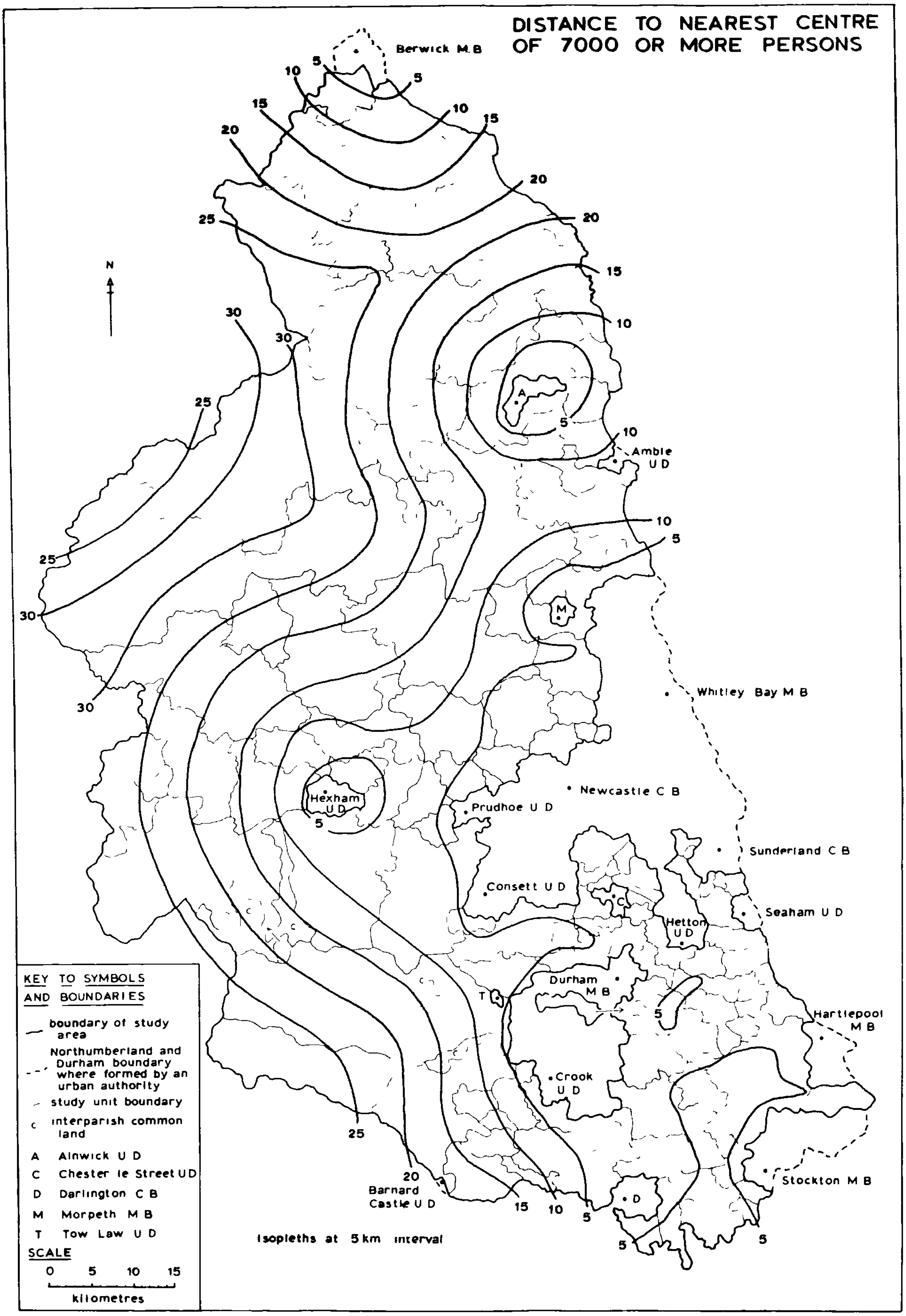
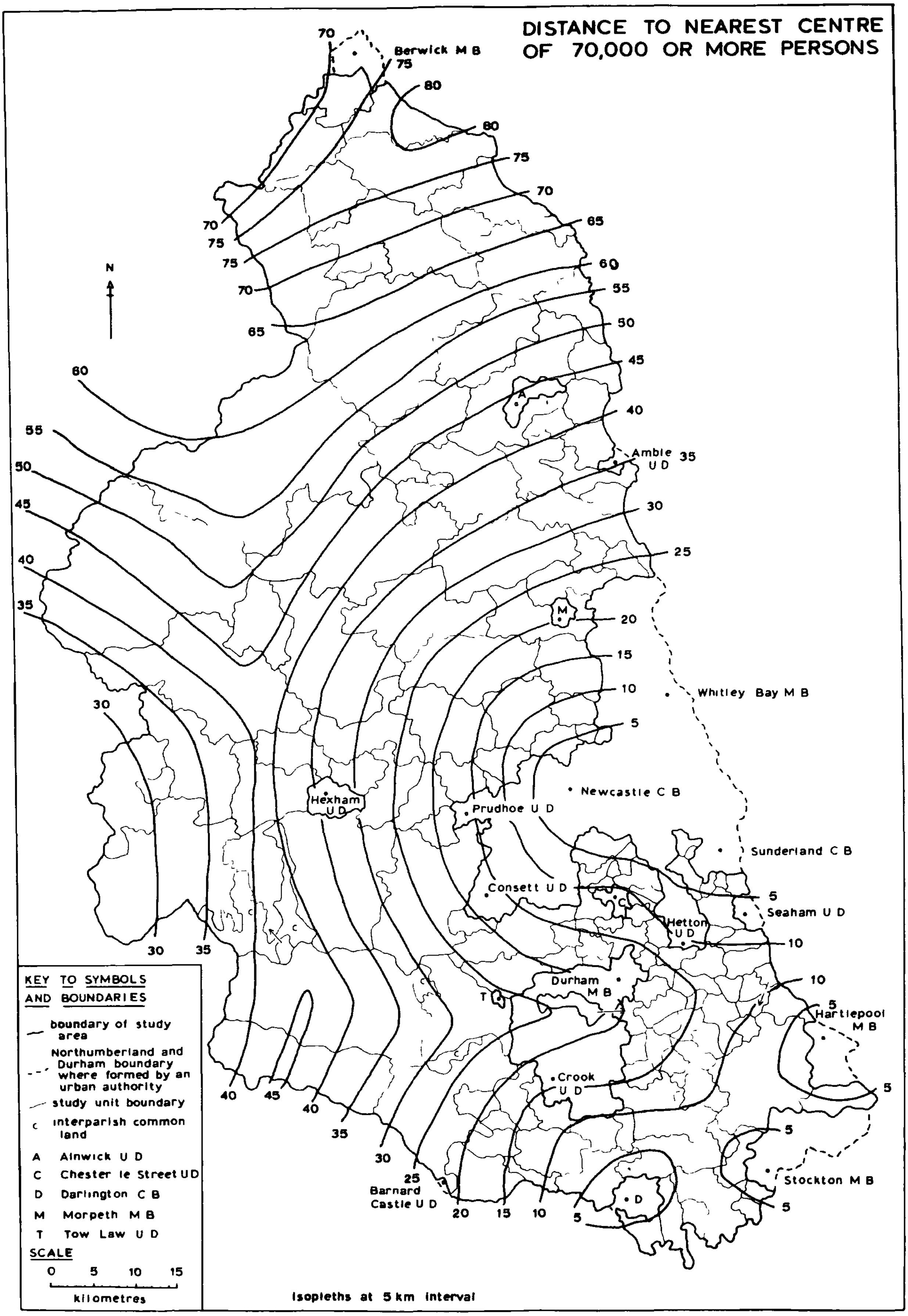

DISTANCE TO NEAREST CENTRE OF 7000 OR MORE PERSONS
Berwick M.B
Alnwick
Amble U D
Morpeth M B
Whitley Bay M B
Newcastle C B
Hexham U D
Prudhoe U D
Sunderland C B
Consett U D
Seaham U D
Hetton U D
Durham M B
Hartlepool M B
Crook U D
Stockton M B
Barnard Castle U D
N
KEY TO SYMBOLS AND BOUNDARIES
boundary of study area
Northumberland and Durham boundary where formed by an urban authority
study unit boundary
c interparish common land
A Alnwick U D
C Chester le Street UD
D Darlington C B
M Morpeth M B
T Tow Law U D
SCALE
0 5 10 15
kilometres
Isopleths at 5 km interval

Figure 4.6



DISTANCE TO NEAREST CENTRE OF 70,000 OR MORE PERSONS
Berwick M B
Amble U D
Whitley Bay M B
Newcastle C B
Hexham U D
Prudhoe U D
Sunderland C B
Consett U D
Seaham U D
Hetton U D
Durham M B
Hartlepool M B
Crook U D
Stockton M B
Barnard Castle U D
KEY TO SYMBOLS AND BOUNDARIES
boundary of study area
Northumberland and Durham boundary where formed by an urban authority
study unit boundary
interparish common land
A Alnwick U D
C Chester le Street UD
D Darlington C B
M Morpeth M B
T Tow Law U D
SCALE
0 5 10 15
kilometres
Isopleths at 5 km interval

Figure 4.7

much of the east, are never far removed from at least a small urban settlement. Again, it is only in the west that areas much over 20 kilometres thus removed are found with parts in the extreme west then coming under the influence of Hawick.

In looking at distance from the nearest centre of 70,000 persons or more (Figure 4.7), despite the larger magnitudes, one is immediately struck by the overall similarity to Figure 4.6. Central and east Durham and south-east Northumberland are again notable in their proximity to such centres. Further north and west, the disappearance of the influence of such smaller centres as Hexham and Alnwick leads to a more orderly increase in distances unbroken until the influence of Carlisle is felt in the south and west, and Edinburgh in the north.

It is not surprising, therefore, that in addition to the high correlations noted with the density and population potential variables in Section 4.2 and above, all the distance indices are highly intercorrelated, varying from 0.58 between distance from the regional population potential centre and distance from a settlement of 70,000 or over, to 0.84 between the latter and the distance from a centre of 20,000 or more persons. The former correlation is particularly interesting insofar as it reflects the influence of other major settlements especially Stockton, Darlington, Sunderland, Carlisle and even Edinburgh, whilst at the same time being sufficiently high to reflect the overall predominance throughout the region of Tyneside.

Other correlations of note tend to be a mirror image of those considered with regard to population potential. Thus, with the occasional exception of distance from the regional population potential peak, moderate to high negative correlations are shown with the agricultural intensity indices, varying from -0.54 (regular workers per hectare and distance from a centre of 20,000 or more persons) to -0.75 (distance from a centre of 70,000 or more persons and Standard Man Days per hectare 1963), and similar positive values for the measures relating to extensive agriculture (from 0.42 between the percentage of holdings with 121.4 or more hectares (300 acres) of cropland and improved grassland and distance from a centre of 20,000 or more persons, to 0.65 between distance from a centre of

70,000 or more persons and the proportion of land under rough grazing and common). It is perhaps significant that in nearly every case the correlation with an agricultural variable increases from that with the lowest centre size to that with the largest, though this feature is not reflected in the straightforward terms of agricultural and primary employment. The dominance of the largest of the urban centres in terms of regional agricultural land use would appear a strong probability.

High negative correlations are shown with mining, production and the proportion of economically active and retired males in the skilled and supervisory manual grades, whilst those of between -0.57 and -0.74 with the variable representing outmovement to work quite reasonably point to the increasing self-containment in employment terms of the remoter areas and the urban domination of employment elsewhere. A tendency towards an older population in the more remote areas is suggested by the moderate correlations which occur between at least one of the distance variables and the percentage of the population aged 60 and over; the percentage of households possessing no family unit, and the average age at death (reflecting at least in part the relative lack of more youthful persons to be exposed to the risk of death) which are all positive, and the age at death ratio, the percentage of households possessing one family unit, and the proportion of workers aged between 15 and 44, which are all negative. Likewise, the moderate negative correlations with the various density of housing occupancy variables, though they may in some ways reflect the less overcrowded nature of housing in the remoter rural areas, are probably more likely to be associated with the depleted nature of many rural populations. Finally, one may note the effect of distance from urban centres in increasing the likelihood of car possession.

Here, therefore, one can see the close interrelationships of the variables earlier found to be typical of the various factors of the Q and R-mode analyses. The strength of the Von Thunen connection between the distance and various agricultural indices is particularly notable though as appeared in Section 3.9, there is much evidence of an unfavourable age structure in many of the remoter areas also.

In conclusion, the absence of one feature from the correlation analysis deserves comment. The role of distance as a factor in depopulation has been studied and favourably commented upon by such writers as Hart and Salisbury (1965) and Lawton (1967), the latter most emphatically stating with reference to rural depopulation that "... distance from growth points was more important than the quality of soil or the type of farming in accounting for variations in the intensity or duration of loss of population" (p. 243). The fact that no correlation of $\pm$ 0.4, or above has been found here between any of the distance and population change variables may, therefore, appear surprising. However, two factors point the way to agreement in the present study, with the above mentioned authors. First, the relevant correlations in fact are only slightly below the arbitrarily chosen level of significance. Second, it is certain that high or even very high correlations would indeed have been found, had it not been that, in addition to the majority of remote rural units losing population, so too did the coalfield units, all of which are in close proximity to urban-sized settlements.

4.5 Conclusion to Chapter 4

Three elements of population dynamics have been discussed in the preceding sections of this chapter: density, stability and location. A number of significant features have been thereby discovered.

In looking at population density, evidence has been adduced to support the contention that the period between 1951 and 1967 has seen, in the rural North-East, a polarisation of the extremes. As the correlation analysis clearly pointed out, the later the date of a density variable, the higher its correlation with the various indices of distance from significant population agglomerations.

The matter of population stability was thereafter approached from three angles. First, the processes active in density change were exposed. The most persistent of all trends here is undoubtedly that of depopulation in the remoter rural areas, indeed in the whole of west Durham and Northumberland away from the south-east and the Tyne valley. All types of ~~rural~~ parish are found to be still losing population with, most critically of all, there being no sign of population stabilisation occurring even in the larger rural centres. Population loss in the administrative Rural Districts at this time is, however, clearly not confined solely to the more obviously rural units. Quite some of the most spectacular declines noted in section 4.3 (i) are in the coalfield area. The most extreme density changes of all though, are those of increase in the rapidly suburbanising urban flank units.

Second, population stability has been investigated from the point of view of the year of maximum population 1958-67 and the magnitude of the variation between maximum and minimum population in those years. This analysis clearly corroborates that undertaken on density change. Early population maxima are apparent in both coalfield and rural areas, whilst by contrast the rapidly growing urban fringe parishes do not reach their peak until the very end of the period. The Tyne valley "commuter" zone and that rural coastal area north of Amble are, however, found to be two areas of late maxima worthy of particular note. On the other hand the two outstanding areas in terms of the magnitude of population variation appear to be the suburban units of rapid population increase and, rather more surprisingly, those units along the west Northumberland border. These latter units, generally with important forestry interests, thus demonstrate their marked instability of population. Nevertheless, it must again be stressed that the relatively small variations elsewhere are not entirely reassuring. Particularly in the more rural areas they merely cloak a long-continued and persistent population decline.

Third, the nature of migration has been examined. Essentially this has served to emphasise the wider implications of these variables which were found to exist in the Factors 1 and 3 on both the R and Q-mode analyses. Short distance (intra-Local Authority area) migration appears clearly a feature of coalfield, high population density and longer distance migration a feature of recent population growth and favoured social status.

Finally, Section 4.4. continued the analysis of location that was initiated in the discussion of population potential in Section 2.5. Perhaps more than any other part of the present chapter this consideration of location can be seen to emphasise the importance of the dichotomy between the near urban units and those in the remoter rural areas. In particular the discussion of population potential change 1951-67 brings out the effect of suburban overspill in rural administrative areas, whilst the Von Thünen effect on numerous agricultural indices is vividly illustrated by the correlation structure exhibited by the various distance variables.

CHAPTER 5

Demographic Characteristics of the Rural Districts of North-East England

5.1 Introduction

The present chapter seeks to discuss the pattern of distribution presented by various demographic characteristics in the 147 parish units. As such the chapter may be considered to fall into two sections which are linked by their common demographic theme. The first part covers Sections 5.2. to 5.6. and largely concentrates upon structural aspects of the population. Age structure and sex ratio are perhaps two of the most obvious and important characteristics under this heading. In addition, the origin of the population, its marital status and household composition are also considered.

The second part of the chapter is concerned with non-structural demographic features. Attention here is focussed upon fertility, mortality and vital rates. The link between these sections (5.7 to 5.9) and the preceding ones is nevertheless clear and a logical structure would argue for a consideration of all these attributes under the all-embracing heading of 'demographic characteristics'.

5.2. Age Structures.

One of the most important characteristics possessed by a population is that of its age structure - "... there is hardly an aspect of individual or communal life which is not affected by age: economic and social activities, military service, political propensities, social attitudes, mobility ..." (Clarke 1972 p.66). Correspondingly, Dewdney (1968) stresses the importance of age structure in determining fertility, mortality and working capacity, whilst one particular aspect, that of the effects upon settlement of an ageing population, has been selected for attention elsewhere. For, "An ageing population is significant as an influence on settlement in a number of ways. The types and quantity of services required by people vary substantially with age. In many settlements in the heart of the coalfield old people's organisations are the dominant formal social organisations. The provision of special housing for old people has rapidly expanded in recent years and is still an urgent need in many places" (Thorpe 1970 p. 408). Hence, it may be seen that for many social economic and demographic features, age structure is a consideration of prime importance. Significant as an attribute in its own right, it has a number of critical ramifications relating to many other population structures.

In the present study, the objects of concern are the 147 units derived from parishes in the 20 North-Eastern Rural Districts. Consequently, attention here will be focussed upon the age structure of these units and any pattern shown by resulting distributions. For rural areas in general, it has been long held that a significant characteristic is an older than average age structure. Bowley (1914) in considering the 29 Registration Districts which he selected as being purely rural and subject to little boundary change reached the conclusion that these districts had relatively fewer persons who were young (below 45 years of age) and more who were old than the administrative Rural Districts as a whole, whilst the same was true for Rural Districts in general vis a vis Urban Districts.

Likewise, Saville (1957) in aggregating Rural and Urban District totals for 1911, held that in the 15-20 age group when the towns began to attract females from rural areas, the rural proportion of females of this age fell below that for urban areas. This did not happen until the succeeding age group (20-25) for males, but for both sexes from this point on, rural proportions were below the national average until 45-50 years of age for males and 50-55 for females. By the 1920s Ashby (1939) considered differences of age and sex between rural and urban populations in general were slight, even feeling that they would eventually be removed. However, Saville (1957), in extending his analysis to cover 1951, still noted a rural deficiency of adults aged 25-65 (male) and 15-80 (female). Although he was not unaware of the influence of urban-related developments in rural areas, he attributed the disappearance of the earlier great excess of elderly persons in the country districts as compared to the urban areas, to the fact that those then aged between 50 and 80 belonged to the generation of 1870-1900 when the rural exodus was in full flow.

Nevertheless, the overall unbalanced age structure of rural areas is beyond question. Smith and Zopf (1970) note that rural societies tend to have many persons aged below 15 and over 45 with the intermediate ages disproportionately likely to have migrated to a city, whilst Wibberley (1954) noted that an increasing proportion of those persons remaining in rural areas were old persons disinclined to change and whilst an ageing of the population was a common factor throughout Britain, its effects were far more notable in isolated country districts. One such effect noted by Bracey (1970) was the tendency of the Women's Institute in consequence of the higher rural proportion of older people to become known as a 'grandmothers' club'. More seriously, Saville (1966) noted short and long term effects of such age selective migration from rural areas. In the short term he demonstrated the absence of the physically most vigorous strata from village populations and in the longer term the more pernicious effect upon the natural increase rate.

The position with regard to the remoter rural areas of the North-East is little different from the general situation noted above. Thus, House (1965) whilst stating that the rural population was slightly more favoured in age structure terms at the end of the 1951-61 decade than it had been at the beginning, still found it necessary to point out that "... the age structure usually contains a higher than average proportion of older folk, a less than average proportion in the working age group and a fairly normal proportion of children below the age of 15 years" (p.10). This contrasts rather markedly with the regional position of Northern England where a proportional surplus of persons aged up to 45 years and deficit of older persons compared to England and Wales as a whole has been noted (Hammond 1963 and 1968).

The approach adopted here to age structure is twofold. First, the proportion of persons in four main age groupings (0-14, 15-44, 45-59, 60 and over) will be considered. Second, a composite age index has been calculated and the distribution of values will be examined.

Age 0-14

For the youngest age group, generally both economically and demographically unproductive, Dewdney (1968) has found that, in 1961, 80 percent of Local Authority areas possessed between 20 and 30 percent of their population in this group, though the overall variation was from under 10 percent to nearly 50 percent in certain cases. In the present study, the unweighted mean for the 147 units was 23.5 percent as compared to 24.2 percent for Northern England at the same date (Hammond 1968). Extreme values are, however, rare and the range is from 9.1 percent in Kelloe to 37.4 percent in Peterlee, the former being markedly lower than any other value and quite possibly attributable to the nature of the sample upon which it was based.

In all, 26 units have under 20 percent of their population aged 14 or less based upon the 1966 Census. Three main types of unit appear to be represented here. First, declining coalfield parishes such as Little Lumley (17.7 percent), Sherburn (19.3 percent) and Coxhoe (19.9 percent) show up although there is, for example, a notable lack of Easington R.D. parishes in this group. Second, parish units containing a large old-age institutional population may be noted, hence the low values for Sedgefield (13.4 percent), Heighington (17.6 percent), Stanhope (17.9 percent), Stannington (15.8 percent) and the Meldon unit (16.1 percent). Finally, the majority of low values are exhibited by the remoter rural areas, showing the effects of long continued selective outmovement upon the age structure and reproductive ability of the remaining population. Hence the poor showings of the Cartington unit (19.0 percent), Rothbury (17.5 percent), the Alwinton unit (15.1 percent), North Sunderland (18.6 percent), Longhoughton (19.4 percent), the Rennington unit (15.5 percent), the Middleton unit (16.2 percent), Belford (18.6 percent), the Branxton unit (18.1 percent), the Norham unit (16.8 percent) and the Horncliffe unit (15.2 percent). It will be noted that there is exhibited here a clustering of such units in north Northumberland with much of the west still covered by average or near average values. If this might appear somewhat surprising in parts of Haltwhistle R.D., in Bellingham R.D. and parts of Rothbury R.D. the influence of forestry in attracting youngadults in the post war period is a major explanatory factor. The restricted area of remoter rural tracts in County Durham leads to the virtual absence of examples of this third type there, with only the Archdeacon Newton unit in the west of Darlington R.D. (16.5 percent) at all notable. Even such a unit as that including Middleton-in-Teesdale in Barnard Castle R.D. (22.2 percent) appears relatively favoured as compared to many areas in north Northumberland.

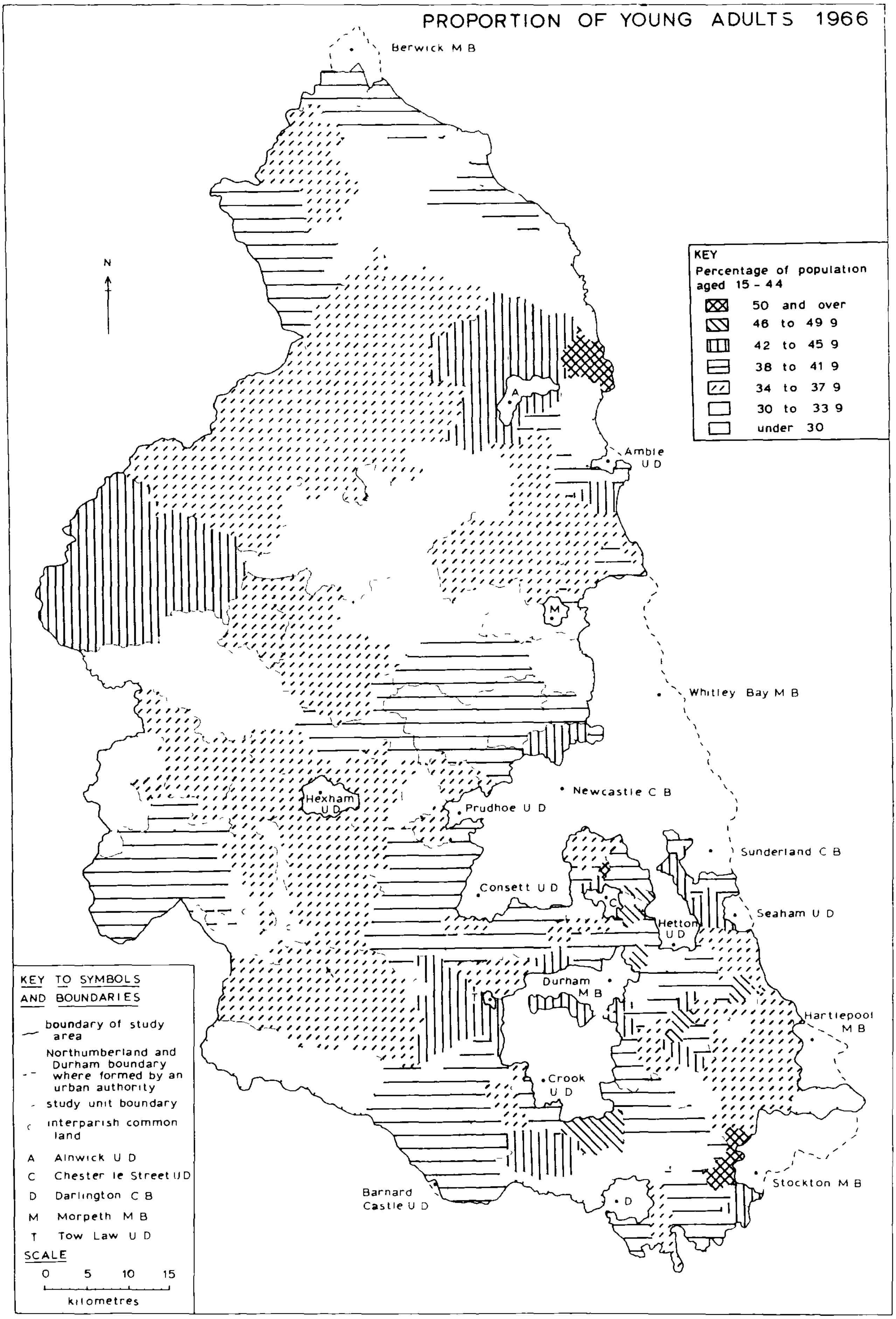
Values of over 30 percent are fewer and a mere 15 cases are to be found. Again, such values would appear to be representative of three broad cases. First, expanding residential areas, especially but not entirely those developed by the Local Authority, give rise to the values of Witton Gilbert (32.1 percent), Woolsington (34.4 percent), Ouston (33.3 percent) Egglescliffe (32.1 percent) and, most obviously, the New Towns of Peterlee (37.4 percent) and Great Aycliffe (32.5 percent). Second, some mining areas still appear to possess a very youthful age structure (hence the inclusion of this particular variable in the Q-mode Factor 1) with examples furnished by Hawthorn/ Cold Hesledon (30.9 percent), Pittington (32. 2 percent), Hylton (32.0 percent), Trimdon (30.6 percent), Hazlerigg (31.5 percent), Dinnington/Brunswick (32.7 percent) and Pegswood (30.3 percent). Finally, institutions such as special schools for young people explain the high values for the Woodham unit at 32.2 percent (Aycliffe Approved School) and the Low Dinsdale unit at 31.0 percent (Low Dinsdale Special School).

Age 15-44

The second broad age group, of persons between 15 and 44 years, is without doubt both economically and demographically of the greatest importance. The unweighted mean of 38.3 percent compares with the northern region average of 40.2 percent (Hammond 1968). Though Dewdney (1968) notes that 80 percent of Local Authority areas in 1961 fell within the range of 35-45 percent, unit values in the present case are found to vary in the extreme from 26.6 percent (Alnmouth/Lesbury) to 52.7 percent (Longhoughton). The distribution of individual unit values is shown on Figure 5.1. The obvious feature shown is the contrast between the predominantly moderate to high values of south-east Northumberland and Durham (except the west) and the moderate to low values in the remainder of the two counties. Exceptions indeed there are, for example, the high values around Alnwick U.D., explicable in part by R.A.F. Boulmer, or in the Kielder unit of Bellingham R.D. with its relatively youthful forestry labour force, and the low values of some of the declining coalfield units such as Little Lumley or Edmondsley/Waldridge. However, particularly if one removes the effects of such special cases as homes (as at Sedgefield or Sherburn House in the Shincliffe unit) or defence population (as at Otterburn, Longhoughton and in parts of Barnard Castle R.D) the impression gained from the map is strengthened. Indeed, of units with less than one-third of their population in the young adult category, 11 out of 21 are typical of the remoter areas of west and north Northumberland, with five of the remainder being Durham coalfield units and a further two, including the Middleton-in-Teesdale unit, rural units in County Durham. Correspondingly, of 28 parish units with 42 percent or more of their population in this age group, even including the atypical Kielder and Longhoughton units, a mere four are representative of the Northumberland rural zone whilst 12 are typical Durham coalfield parishes and a further 6 developing residential areas in the latter county.

Age 45-59

The third age category (45 to 59 years of age) has been taken to exemplify the older adult age category. Those aged between 60 and 65 have been included in the final grouping in an



PROPORTION OF YOUNG ADULTS 1966
Berwick M B
KEY
Percentage of population aged 15 - 44
50 and over
46 to 49 9
42 to 45 9
38 to 41 9
34 to 37 9
30 to 33 9
under 30
N
A
Amble U D
M
Whitley Bay M B
Newcastle C B
Hexham U D
Prudhoe U D
Sunderland C B
Consett U D
C
Seaham U D
Hetton U D
Durham M B
T
Hartlepool M B
Crook U D
Barnard Castle U D
D
Stockton M B
KEY TO SYMBOLS AND BOUNDARIES
boundary of study area
Northumberland and Durham boundary where formed by an urban authority
study unit boundary
interparish common land
A Alnwick U D
C Chester le Street U D
D Darlington C B
M Morpeth M B
T Tow Law U D
SCALE
0 5 10 15
kilometres

Figure 5.1

attempt to accentuate any pattern of aged person residence which might appear. In this older adult category, an unweighted mean of 19.6 percent includes a range of values from 8.4 percent (Ouston) to 33.3 percent (Meldon, Mitford and Hepscott). Low values of under 15 percent occur in many cases as might be expected. Areas of recent residential development, having attracted many young adults, are particularly prominent - Ouston (8.4 percent), Witton Gilbert (14.0 percent), Belmont (14.3 percent), Peterlee (8.9 percent), Egglescliffe (13.8 percent), Great Aycliffe (13.0percent) and Woolsington (14.2 percent), are such units. At the same time, a number of the remoter rural areas such as Rothbury (14.7 percent), Bellingham (10.4 percent), the Alnham unit (12.6 percent) and the Kielder unit (13.5 percent) also have a low proportion of older adults. In the first two cases it would appear that the bulk of people who would have fallen into this age group had already emigrated - one may note the corresponding high proportion of aged persons - and in the latter two cases a more youthful age structure than average explains the present figures. In two other cases, Esh (13.4 percent) and East Chevington (14.1 percent), special considerations would appear paramount. In the former case Ushaw Moor College does much to unbalance the age structure, whilst in the latter, R.A.F. Acklington and a relatively prosperous mining industry at this time had much the same effect.

Units with more than one-quarter of their 1966 inhabitants aged between 44 and 59 tend once more to be most characteristic of the remoter rural areas of Northumberland and 10 out of 17 examples varying from Haydon Bridge (27.3 percent) in the west of Hexham R.D. to the Norham unit (28.0 percent) in the extreme north are such. Additionally, high levels are to be found in the Ovingham unit (25.3 percent) to the north of Prudhoe U.D., the Gainford (28.6 percent) and Piercebridge (28.2 percent) units in the south of County Durham and the Sedgefield (25.9 percent), Little Lumley (28.3 percent) and Framwellgate Moor (26.5 percent) units further north in Durham. Here one sees the reasons for some of the previously low percentages found in the more youthful age groups. Finally, however, the Bywell/ Broomhaugh and Riding unit in the heart of the Tyne valley commuter belt is particularly interesting. With only 17 percent of its sampled population aged under 15 and 27.3 percent 15 to 44, a predominance towards the older age groups is shown with slightly over 27 percent in this older adult group.

Age 60 and over.

Turning to the final age group, that of persons aged 60 and over, one may look for clear corroboration of what has been said above with regard to areas of decline amidst the Rural Districts. The unweighted mean is 18.6 percent with a range from the 6.9 percent of Peterlee to the astonishingly large 37.2 percent of the Chatton unit. Areas with under one-eighth of their population in this age group are largely confined to County Durham (14 out of 19 cases). As might be expected, in many ways what is found is a reversal of what was noted relating to the youngest age group. Thus, certain mining parishes still have a sufficiently youthful age structure to possess few people aged 60 and above. Such are Hylton (11.2 percent), Tunstall (12.3 percent), Trimdon (11.9 percent), Hazelrigg (7.4 percent) and Pegswood (11.6 percent). Likewise, parishes experiencing rapid residential growth tend to have fewer aged persons as in Ouston (7.4 percent), Belmont (9.6 percent),Peterlee (6.9 percent) Elton/Norton (11.4 percent), Egglescliffe (10.9 percent), Great Aycliffe (8.2 percent), and Woolsington (8.3 percent). Finally, the existence of institutions or defence establishments attracting predominantly young adults or children have an obvious effect in reducing the proportion of elderly persons. Hence the low values in the Woodham (8.3 percent), Low Dinsdale (12.4 percent) and Longhoughton (10.2 percent) units.

Rather more interesting and significant, however, are those units in which over one-quarter of the population are aged 60 or more. In complete contrast to the above, only four out of seventeen such units are to be found in County Durham and of these, the Shincliffe unit (26.9 percent),Sedgefield (29.5 percent) and, at least in part, Stanhope (25.8 percent) may be explained by the occurrence of sizeable aged and institutionalised populations. Only the Whessoe unit to the north of Darlington C.B. is without such influences but still reaches a similar level (26.2 percent). In Northumberland on the other hand, a remarkable pattern presents itself. Much of Haltwhistle R.D. appears to be heavily biased towards this oldest age grouping from Haltwhistle with 25.3 percent of the population aged 60 and over, to the Thirlwall unit at 25.8 percent and Henshaw at 26 percent. Similarly, many areas in Rothbury R.D. are thus affected with two, Rothbury (35.7 percent) and the Cartington unit being over 30 percent.

The remaining units with a large aged population are all to be found in the west or north of Northumberland though Stannington (31.5 percent) with its hospitals and old persons' accommodation may be considered an exception. Allendale (29.4 percent), Bellingham (25.5 percent), the Alwinton unit (25.6 percent), North Sunderland (27.8 percent), the Chatton unit (37.2 percent), and Belford (33.3 percent) all serve to exemplify one of the most serious aspects of the rural problem. It is hardly surprising that this old age variable was an important constituent of the Q-mode Factor 2. Certainly the areas with a problematic age structure as discussed by Ironside (1964), Edwards (1963), House (1956) and House and Knight (1965) stand out very clearly in the above analysis, especially the examples from Haltwhistle R.D. which emphasise the problem noted in the last mentioned work. Though the coalfield too may have its problems of decline and an ageing population (Thorpe 1970) these are not nearly so acute as in the remoter rural areas. Indeed the problem in such areas is not only one of too many old people. For, whilst parts of Bellingham R.D. (forestry) and Morpeth R.D. (mining) furnish some exceptions, it has been stated that in rural Northumberland "Among the dependant age groups children form a proportion below the county average so that the foundation of this different pattern may be entirely explained by the large number of old people" (Ross 1967 p.7).

To synthesise the analysis of the various major age groups, Figure 5.2 has been drawn, showing by means of a triangular graph unit populations in the under 15, 15-59, and 60 and over categories. It clearly re-emphasizes certain of the points already made in the earlier analysis. At the graph apex are found the Peterlee, Ouston, Great Aycliffe, Woolsington and Dinnington/Brunswick units. They are the most extreme examples of units with many children but few old people. Population growth largely through Local Authority developments is a marked feature of most of these units. By way of contrast, the Sedgefield, Meldon, Eglingham, Rennington, Alwinton

UNIT AGE STRUCTURES 1966

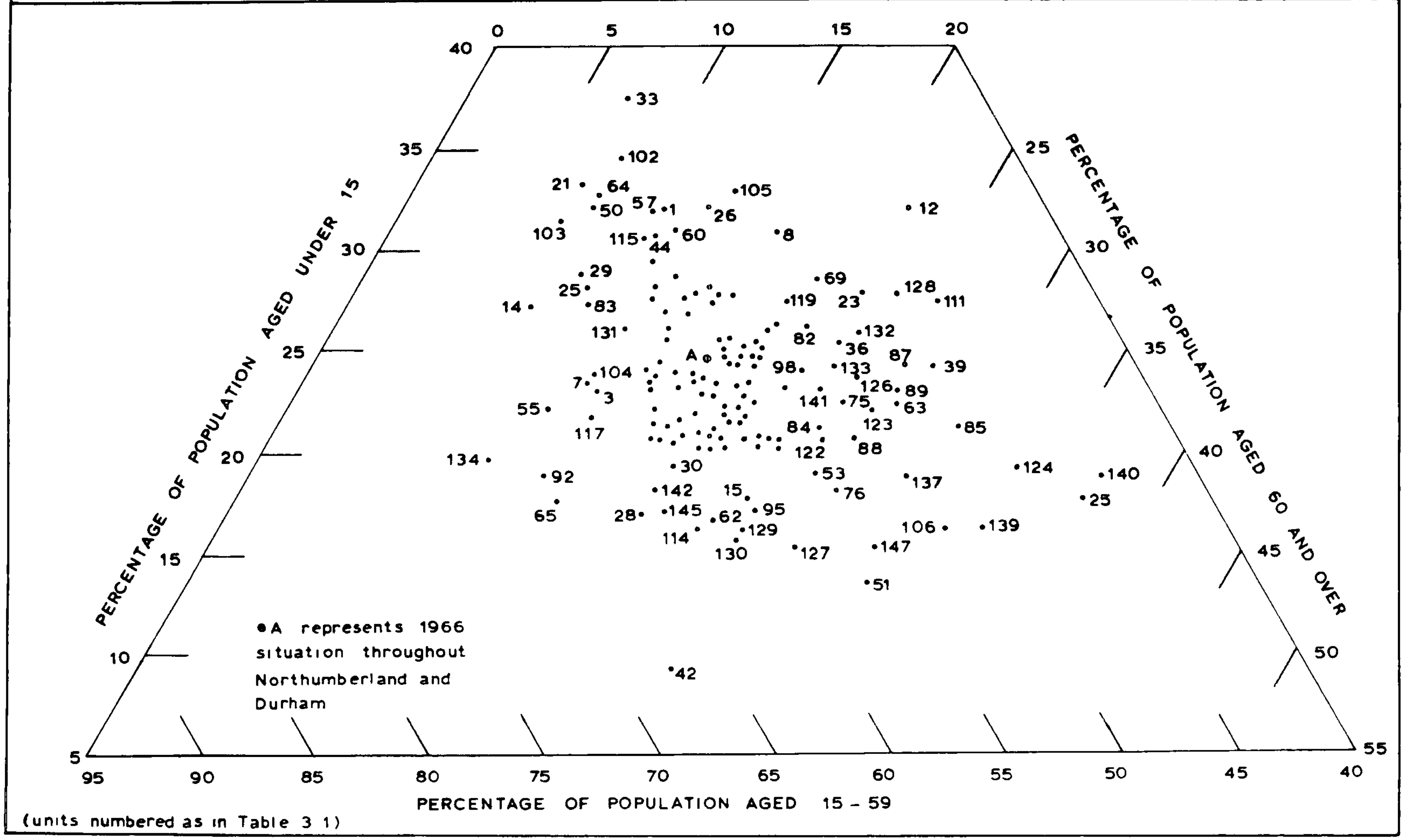


Figure 5.2

Horncliffe, Stannington and Belford units are notable for their abundance of old people but dearth of children. As was noted above, a majority of such values may be related to the remoter rural type unit or institutional influences. To complete the picture, the Kelloe, Elton/Norton, Heighington, Humshaugh and Longhoughton units may be seen to be characterised mainly by a preponderance of adults. Two of these are developing residential units (Elton/Norton and Heighington) and one (Longhoughton) a unit with a substantial defence population.

Age Index

Leading on from the above, a composite age index consisting of the sum of the number of children (under 15) and aged persons (over 60) divided by other adults (15-59 years of age) has been calculated and plotted on Figure 5.3. In many ways it may be regarded as a dependency ratio, although quite obviously not all persons aged 15 or over are economically active whilst by no means all aged 60 and above are retired. Likewise, for a true dependency ratio, it has been argued (Kleiman 1967) that weightings based on consumption should be applied to each 5 year age group in the dependant age groups (taken by him as under 20 and over 64). Nevertheless, despite these points Figure 5.3. may be regarded as portraying a modified dependency ratio with an arbitrary lower level of 15 years and upper base level of 60, the latter again in an attempt to emphasise the predominant old age structure of many units in the remoter rural areas.

Despite the occasions upon which the numbers of children and aged persons work opposing ways and, therefore, lead to an averaging effect, it is quite noticeable from Figure 5.3. that, in general, high dependency ratios tend to be characteristic of the remoter rural areas emphasising the overwhelming effects of an old age structure despite the lower unweighted mean value for aged persons (18.6 percent) as compared to children (23.5 percent). It is notable that the Q-mode Factor 2 incorporated a significant amount of this variable. Hence, whilst in Durham it is just as likely, if not more so, to be an extremely youthful population which causes a ratio of 0.9 or over, the reverse is the case in Northumberland. In the

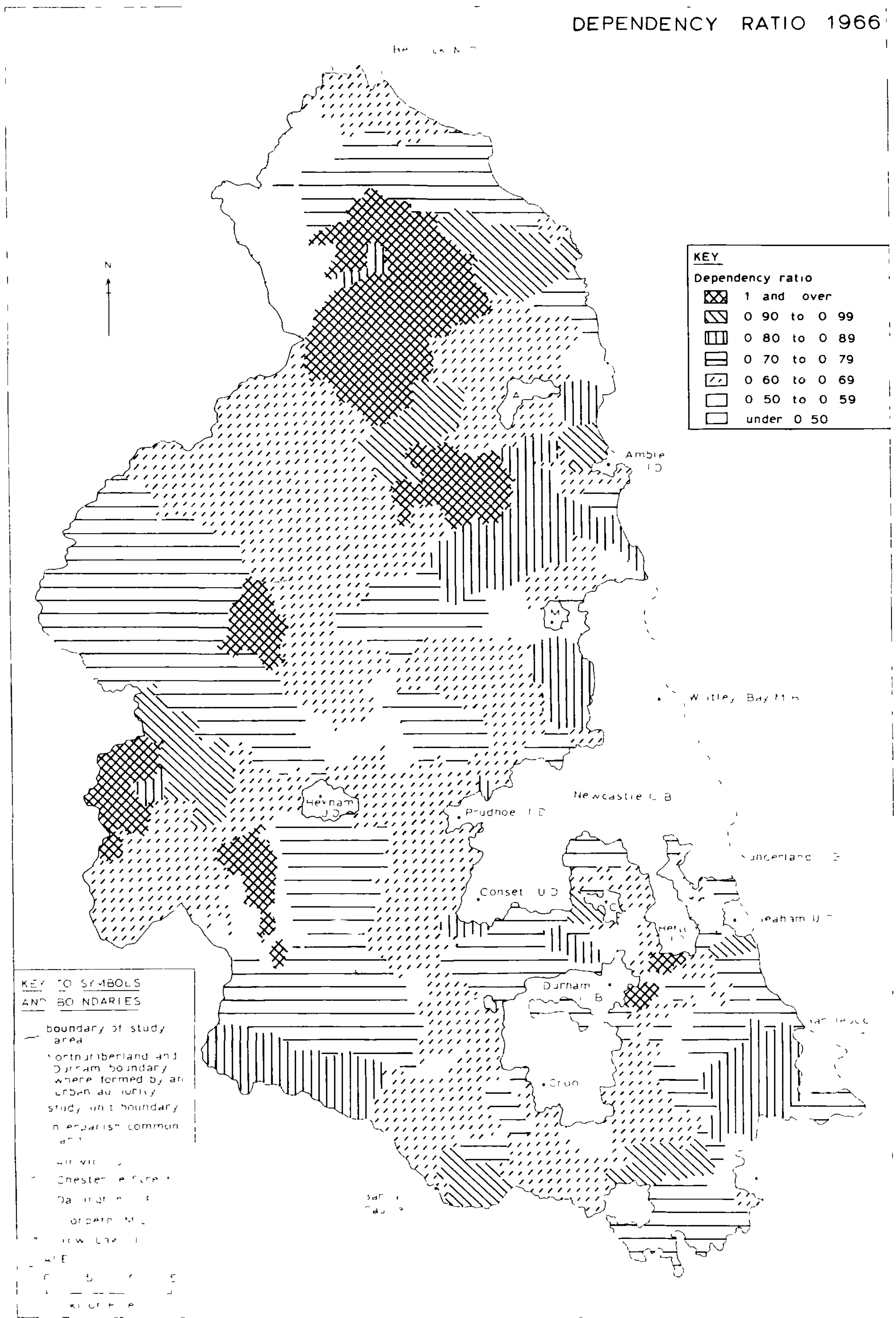

DEPENDENCY RATIO 1966
KEY
Dependency ratio
1 and over
0 90 to 0 99
0 80 to 0 89
0 70 to 0 79
0 60 to 0 69
0 50 to 0 59
under 0 50
N
Amble
Newcastle
Prudhoe
Hexham U D
Consett U D
Durham
boundary of study area
study unit boundary

Figure 5.3

former, large numbers of young children form the major cause of high indices for Hawthorn and Cold Hesledon (0.91), Pittington (1.18), Edmondsley and Waldridge (0.98) and the Cleatlam unit (0.93). An aged population is the main factor in only two cases, the Whessoe (0.95) and Shincliffe (1.04) units. In Northumberland, however, it is largely the familar units already noted to have a top heavy age structure which reach similar levels - Allendale (1.03), the Thirlwall unit (1.00), the Henshaw unit (0.95), Rothbury (1.18), Belford (0.98) and the Chatton unit (1.26). In the other cases it appears that an above average number of aged persons has combined with a near, or often slightly above average number of children to produce a similarly high index. Such areas as the Alnham unit (1.05) with 27.7 percent of its 1966 Sample Census population aged under 15 and a further 23.5 percent aged 60 and over, or the Adderstone unit (0.91) with corresponding percentages of 25.4 and 22.3 are two examples from the five units (the others being the Bellingham, Whittingham and Warkworth ones) which conform to this pattern. Such areas would appear to be in an intermediate stage of depopulation with many young and old persons, though the out-migration of young adults has not yet reached the stage at which birth rates noticeably suffer as has occurred, for example, in Allendale, Belford and Rothbury.

A mere fifteen units have a dependency ratio of below 0.6 and, as is apparent from the stippled areas on Figure 5.3., tend to be quite varied in location. Nevertheless, a number appear to be rapidly developing residential units where the present population structure is dominated by young adults as in Herrington/Offerton (0.56), Great Lumley (0.54), and Elton/Norton (0.50). In many other cases, however, a large proportion of older adults would seem to be the cause as in the units containing the parishes of Humshaugh (0.46), Heighington (0.46), Ellington (0.54), Meldon (0.58) and Norham (0.56). The low ratio exhibited by many units in the extreme north of the study area may at first appear somewhat perplexing, but it is here that above average numbers of persons aged 60 and over are offset in the index by a corresponding lack of children. The remaining areas of low index value are generally attributable to slightly below average numbers in the youngest and oldest groups as in

Fishburn (0.59) and the Dalton-le-Dale (0.55) and Framwellgate Moor (0.53) units. Kelloe (0.47) is a rather more extreme example, whilst Longhoughton (0.43) with its large proportion of young adults would seem to be a special case.

Correlation Matrix

Following the practice of Chapter 4, the correlation matrix for all variables considered in the present chapter is given below (Table 5.1). From this, it will be noted that the proportion of children in a unit population shows moderate positive relationships with the difference between the Crude Birth Rate for 1964-5 and the Crude Death Rate for 1967-8, the Crude Birth Rate itself and, equally reasonably, the percentage of the 1966 population who were single in status. Likewise, moderate negative correlations are shown with the proportion of the population in the older adult and elderly age groups, the percentage of two or less person households and the percentage of households containing at least one person of pensionable age. Higher positive correlations are shown with the two fertility indices calculated from the 1966 Census data. Such correlations, however, are much as one might expect, and the lack of any notable link with, for example, any of the employment indices is rather disappointing.

More interesting is the range of correlations shown by the age structure ratio relating the 1961 private household Census population, to the comparable electoral population for that year. In its distributional pattern it reiterates much of the above analysis with Peterlee (1.84), and Ouston (1.83), being the two values in excess of 1.8, and obviously relating to the large number of persons aged under 21 in 1961. At the same time, vast areas of the west, and Northumberland away from the south-east, have ratios of below 1.3. It is appropriate to reflect that of units 75 to 77, 83 to 91, and 125 to 147, only nine have a ratio of above 1.3, compared to 45 of units 1 to 50. This well illustrates one significant difference between the Class 3 (mainly 3c) and Class 1 (mainly 1a) units identified in Section 3.11. Many of the former nine, moreover, are to be expected in the light of earlier

Table 5.1.

Spearman Rank Correlation Matrix of Chapter 5 Variables

Variable[1]	16	80	17	18	81	19	20	82	21	83
1										
2										
75										
7										
9										
78						.52				
10										
11										
12						.41				
13										
14										
79						-.41				
16	*			-.50		-.57				
80		*	.48			-.52		-.50		
17		.48	*	-.52	.52	-.64	-.52			
18	-.50		-.52	*						
81			.52		*	-.50	-1.00			
19	-.57	-.52	-.64		-.50	*	.50			
20			-.52		-1.00	.50	*			
82		-.50						*		
22	.43	.40	.43			-.45				
23	.61									
24	.72				-.57		.56			
25		-.52								
26		-.49	-.44			.42				
27										
84	.40	.55	.45			-.49				
28	.42									
29										
31		-.44				.46				
32						-.42				

1 See Table 3.2. and Appendix C.

Table 5.1 Cont.

Variable	22	23	24	25	26	27	84	28	29
1					-.44				
2					-.50	.45			
75					-.52	.47			
7							.43		
9				-.42					
78									
10					.45	-.44			
11					.45	-.43			
12					.55	-.51			
13									
14					-.51	.50			
79					-.52	.51			
16	.43	.61	.72				.40		.42
80	.40			-.52	-.49		.55		
17	.43				-.44		.45		
18									
81			-.57						
19	-.45				.42		-.49		
20			.56			-.43			
82									
22	*	.47					.83		
23	.47	*	.51						
24		.51	*						.42
25				*			-.79		
26					*	-.78			
27					-.78	*			
84	.83			-.79			*		
28			.42				-.45	*	-.85
29								-.85	*
31				.47			-.44		
32				-.44					

Table 5.1. cont.

Variable	30	31	32	33	85	86	34
1							
2							
75							
7							
9	.40						
78							
10					.45		
11					.49	-.41	
12					.48		
13					.45		
14					-.49	.42	
79					-.50	.43	
16							-.42
80		-.44					-.51
17					-.42		-.43
18							
81							
19		.46	-.42		.46		.71
20							
82							
22							
23							
24							
25		.47	-.44				.40
26							
27							
84		-.44	.43				-.45
28							
29							
31		*	-.95			-.88	.58
32		-.95	*				-.53

Table 5.1 cont.

Variable	16	80	17	18	81	19	20	82	21	83
85			-.42							
86										
34	-.42	-.51	-.43			.71				
35										
37										
87										
39										
89										
40									.46	
44		.49	.70	-.69						
91		.52	.41			-.40		-.52		
92								.46		
45										
95										
50										
98										
100										
52										
56		.74				-.44		-.46	-.50	
57		.50						-.43		
104										
106										
61										
107										
63	-.50	-.52	-.41			.53				
64										
65		-.44				.41		.42		
70										
72										
110										
113										

Table 5.1 cont.

Variable	22	23	24	25	26	27	84	28	29
85									
86							.43		
34				.40					
35					.46	-.43			
37					.51	-.49			
87					.45	-.40			
39					-.49	.44			
89					-.40	.42	.40		
40									
44					-.50				
91	.43				-.42				
92									
45					-.43				
95					-.44				
50					-.46	.42			
98					-.45	.41			
100					-.42				
52				-.43	.41				
56					-.49	.45	.40		
57					-.46	.44			
104								.41	
106					-.44	.42			
61					-.44	.42			
107					-.44	.42			
63									
64			.41					-.49	.56
65					.41				
70									
72					.41				
110					.44	-.41			
113						.41			

Table 5.1 cont.

Variable	30	31	32	33	85	86	34
85					*	-.88	
86					-.88	*	
34		.58	-.53				*
35							
37							
87							
39							
89							
40							
44							
91							
92							
45							
95							
50							
98							
100							
52							
56		-.40			-.54	-.44	-.48
57					-.45		
104							
106							
61							
107							
63		.49	-.44				.59
64							
65					.40		
70	.42						
72							
110							
115							

analysis and include the Alwinton (1.48), Alnham (1.43), Shilbottle (1.57) and Longhoughton (1.56) units. Furthermore, the extremely low ratio of the Bywell and Broomhaugh and Riding unit (1.28) agrees well with points made in the earlier study of age structure.

It is interesting, therefore, to consider the wide range of variables correlating at a level of $\pm$ 0.4 or more with this ratio. Seven positive correlations of note occur. Two such moderate ones were noted above in relation to the proportion of the population aged under 15 and the Crude Birth Rate, and the difference between the latter and the Crude Death Rate. On the other hand, the correlations with the percentage of the labour force aged between 15 and 45 for both 1961 and 1966, though only at a moderate level, are particularly striking showing the relationship of this group both in terms of reproduction and the 15 to 21 overlap, to a large proportion of persons aged under 21. Similarly, a moderate correlation with persons per room (1961) and a higher (0.74) correlation with persons per household 1961, show the increased room density and household size quite naturally associated with a significant number of minors in 1961. The remaining positive correlation of 0.48 with the proportion of the 1966 population in the young adult age groups is similar in type to the two comparable ones with workforce age structure discussed above.

At the same time, eight moderate negative correlations reflect the non-alignment of this variable with a large proportion of aged persons, one or two person households with at least one person of pensionable age, households with two or fewer persons, 1966 households possessing no family unit, the 1961 proportion of the population aged 15 and over, and the proportion of persons in 1966 who were living at room densities of 0.5 persons per room and below. Two of the death indices are also notable, however, for their negative associations. That relating to the Crude Death Rate is quite obviously in consequence of the youthful nature possessed by units with a high census:electoral population ratio, and that of the average age at death variable reflects the likelihood of death at a younger age in such units. The latter may partly be in consequence of environmental factors but no doubt a major influence is the structural nature of the population with such a proportionately large number of young persons exposed to the risk of death in these areas. Attention will, however, be turned to this point in Section 5.8.

The proportion of the population in the young adult age group has a similar set of correlations to the above. Moderate correlations are quite reasonably, and not surprisingly, found with the Crude Birth Rate, the Crude Birth Rate/Crude Death Rate difference index, the proportion of 1961 economically active persons aged under 45, the proportion of the population aged between 15 and 60, and the 1961 Census:electoral population ratio. A rather higher positive correlation (0.70) exists between the present variable and the proportion of workers in the 1966 Census sample aged 15 to 44. Again, rather more interesting are the negative correlations. The obvious lack of association between a high proportion of young adults and a high proportion of old persons, and the ramifications of this, are shown by a rank correlation of between -0.4 and -0.6 with the proportion of two or less person households in 1966, the percentage of one or two person households in which at least one person is of pensionable age, a high average age at death, and the proportion of 1961 households possessing no family unit. A higher correlation of -0.64 is similarly found with the proportion of persons aged 60 and over. On the other hand, correlations of -0.52 with both the 1966 age structure (dependency) ratio and the proportion of that sample population in the older adult age group, are rather less obvious. In the first case, one must assume the greater influence of aged persons upon the dependency ratio, a conclusion which was approached earlier in discussing the latter variable. In the second case, the distinction, particularly in demographic terms between the two main adult age groups (15 to 44 and 45 to 59) may be seen to be emphasised. Hence, not only do units with a large proportion of young adults tend to possess few aged persons but this is also so with regard to older adults.

It is somewhat surprising to reflect that the correlation between the proportion of youn adults and children in 1966, was a mere 0.2. It may well be that a higher than average number of persons aged between 15 and 44 is more than compensated for in lower than average totals in the older age groups, whilst many older adults will still be in the position of having families, albeit completed, in which a significant number are still under 15 years of age.

In view of this, it is rather disappointing that the variable representing the proportion of the 1966 population sample who were aged between 44 and 59 exhibits merely three correlations of note. Two of these have already been pointed out in the present section: those of -0.50 with the proportion of children in the 1966 population, and -0.52 with the corresponding proportion of young adults. The third correlation, whilst higher (-0.69), is no more illuminating being an obvious inverse link with the proportion of the 1966 labour force aged between 15 and 44.

A similar situation obtains with regard to the variable representing the percentage of the population aged between 15 and 60. Correlations of between ± 0.5 and 0.6 exist with the proportion of aged persons, the modified 1966 fertility ratio (both negative), and the proportion of young adults (positive). There is additionally an obvious perfect negative correlation with the dependency ratio variable.

The most extensive list of significant rank correlations exhibited by an age structure variable, is shown by the index representing the proportion of aged persons in the 1966 Sample Census population. Many of the moderate positive correlations are as might be expected. They include those with such variables as the percentage of households with two or fewer persons; a high average age at death; the proportion of 1966 households with no family unit; the percentage of persons living at 0.5 per room or less in 1966, and the proportion of 1961-6 in-migrants entering from outside the Local Authority area of 1966 residence who were aged 60 or over. Nevertheless, these links do serve to emphasise once more, the ramifications of there being many aged persons in a population through many demographic and social sectors. Moreover, two other moderate positive correlations are of greater interest. Unlike the variable representing the proportion of children in the population the aged person index does correlate at a significant level (0.50) with the dependency ratio, confirming its prime importance in this ratio.

In addition, a correlation of 0.41 between the present variable and distance from a settlement of 70,000 or more persons agrees with previous investigations into the link between distance and age structure. Thus Gleeson (1968) hypothesised that the average age of a population increases with distance from the nearest densely populated urban settlement. Likewise, Stoeckel and Beegle (1966) found in general, that the configuration of the rural farm age structure was a function of the degree of dominance of urban centres as indicated by distance from the nearest Standard Metropolitan Statistical Area, in consequence especially of the effects of age selective migration. Whilst only one of the distance indices here correlated at a levelof 0.4 or over, this is largely due to the occurrence of occasional high proportions of aged persons in units of a semi-urbanised nature and close to urban areas. Hence, Little Lumley and Sedgefield, the latter albeit as a result of institutional elements, will serve to blur the connection between advanced age structure and distance from urban areas whilst support for such an association is clear from earlier analysis of individual age groupings.

Of the nine moderate negative correlations relating to this aged person index, a further corroboration of the above distance effect is to be found in an r_s of -0.41 with population potential for 1967. The remaining correlations are, however, predictable ranging through the Crude Birth Rate, the Crude Birth Rate/Crude Death Rate difference index, the proportion of workers aged 15 to 44, persons per household 1961, the ratio between the 1961 Census and electoral populations, the percentages of the population aged 15 to 59 and under 15, and the percentage of 1966 households with one family unit. The high positive correlation of 0.71 with the proportion of households which possess one or two persons of whom one or both were of pensionable age, is equally obvious, whilst the high negative association of -0.64 with the proportion of young adults in the population, has already been discussed.

The significant correlations shown by the two remaining age structure variables - dependency ratio and the proportion of the 1961 10% Census population aged over 14 - tend to be predictable and rather uninteresting. Three of the four concerning the former have already been discussed in relation to other age structure indices, the final one of 0.56 being with the modified fertility ratio for 1966. In the latter case, two moderate positive correlations exist with regard to the percentage of persons living at below 0.5 per room in 1966, and the percentage of the total 1961 sample population in employment or temporarily unemployed. At the same time, four moderate negative correlations exist with persons per room 1961, persons per household 1961, the 1961 Census: electoral population ratio and the proportion of the 1961 workforce aged between 15 and 44. Here again, one may see reflected the economic and demographic implications of a lack of young adults and, therefore, children in the housing and employment sectors.

5.3. Sex Ratios

Whilst the sex composition of a population owes little to the geographical environment, it owes much to social and economic factors and, furthermore, has profound social and economic implications (Clarke 1960a). At the same time, it has been noted that "... social, economic and community life are affected in many ways by large imbalances in sex composition, but large imbalances tend to be unusual and temporary ..... However, sex imbalances often are found in particular communities or even in particular neighbourhoods of a community so that the problem is more often a local than a national one" (Bogue 1969 pp 165-6). Nevertheless, it is generally agreed that three factors determine the sex composition of a population (Clarke 1960a and 1972, Bogue 1969). These are, the sex ratio at birth (often referred to as the masculinity of births), the differential mortality of the sexes, and sex-selective migration. To these we might add scale insofar as large numbers tend to lead to more normal sex ratios.

The general effects of these forces in the rural areas have been outlined in detail by Saville (1957). His most salient conclusion was that "the ratio between the sexes ... is the most striking demographic consequence of rural depopulation. In the second half of the nineteenth century, of those who stayed within the national boundaries of England and Wales, women were more migratory than men ... and since in the rural areas the occupations available to women have been declining at a faster rate than those for men, the factor of expulsion from the countryside has been stronger for women than for men. In agriculture the numbers of women employed decreased sharply in the second-half of the nineteenth century; but even more important was the decay of a number of rural industries" (p.31).

By the end of the nineteenth century he notes a sex ratio of 1010 females per 1000 males in rural England and Wales compared to the overall national average of 1068. With similar forces of selective out-migration operating in the first half of the twentieth century plus the addition of a more marked decline in domestic service employment, by 1951 the rural sex ratio had fallen to 989 though it was as low as 945 in the 20-49 age group. Thus, "By 1951 the continued outward movement from the country areas had greatly worsened the ratio between the sexes compared with the national proportion and the rural areas now have a sex composition which is nearly the opposite to that of the country as a whole" (Saville 1957 p.124). Support for Saville's views has been given by other recent research and Jones (1965) has pointed out that in the remote rural areas of mid-Wales, in the important 15-24 age group, the sex ratio is a mere 826, whilst Bracey (1970) has noted that there are areas where the ratio in general is below 850.

In terms of the above, therefore, it may be considered that the main determinant of rural sex ratios is that of sex-selective migration. Three main British areas of low sex ratio, all of significance in the present study, have been recognised (Clarke 1960a). First, many of the mountainous and moorland areas including, for example, the lands of the Scottish border. Secondly, of particular significance for County Durham, those Rural Districts on coalfields where there are few female employment opportunities. Finally, the large areas of lowland, especially in the east and extending from North-East England to East Anglia, much of which comprises increasingly mechanised arable farms requiring relatively little labour, especially female. Moreover, much of this last belt is remote from large cities, with those urban areas which there are, offering little significant female employment.

From this general view, one may turn to the specific situation in the Rural Districts of North-East England as revealed by the full 1961 Census (G.R.O. 1963a and 1963b). For comparative purposes, however, it is interesting to reflect on the recent overall position in Northern England where, largely in consequence of the nature of available employment, compared to the 1966 Great Britain averages of 1058 (total), 976 (ages 15 to 44) and 977 (ages 15 to 24), the corresponding sex ratios were 1034, 970 and 985 (Hammond 1968). It is apparent from Figure 5.4. that in the administratively rural area of the North-East, except where male-predominated institutions intrude as at Ushaw College in Esh, low sex ratios of under 950 tend to be variable in nature. Of 24 such occurrences, the effects of non-

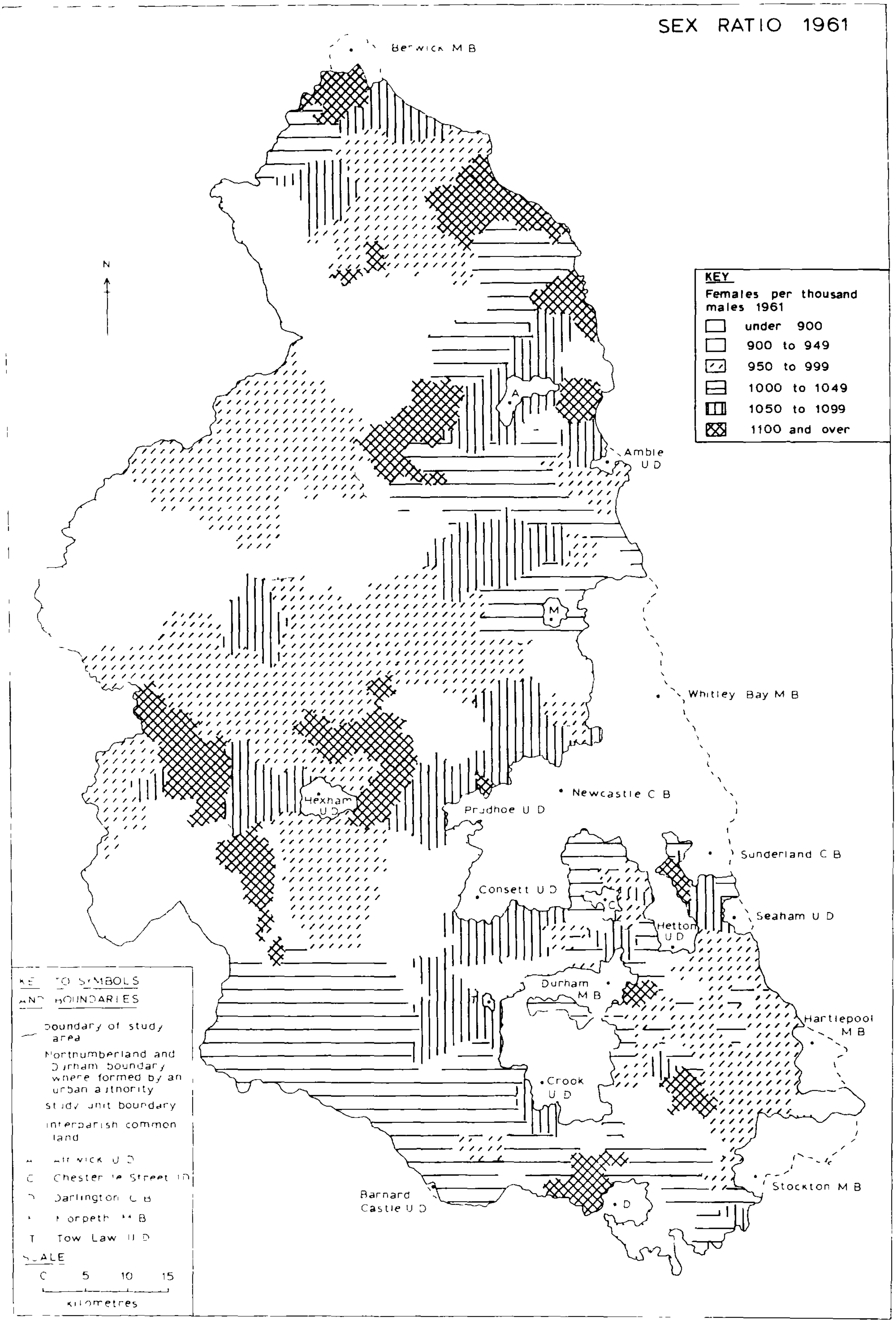

SEX RATIO 1961
Berwick M B
N
KEY
Females per thousand males 1961
under 900
900 to 949
950 to 999
1000 to 1049
1050 to 1099
1100 and over
A
Amble U D
M
Whitley Bay M B
Hexham U D
Prudhoe U D
Newcastle C B
Sunderland C B
Consett U D
C
Seaham U D
Hetton U D
Durham M B
T
Hartlepool M B
Crook U D
Barnard Castle U D
D
Stockton M B
SCALE
0 5 10 15
kilometres

Figure 5.4

private household population, appear likely to have a significant effect in 13 cases. This varies from the obviously severe influence of defence establishments such as R.A.F. Middleton St. George (unit sex ratio 766), R.A.F. Boulmer (unit sex ratio 800), Otterburn Camp (unit sex ratio 889), and R.A.F. Ouston (unit sex ratio 915) to the less extreme effects of special schools as at Low Dinsdale (unit sex ratio 900) Gainford (883) and Windlestone and Woodham (unit sex ratio 908). Certain hospitals would appear to have a similar effect to the latter as at Stannington (836), Heighington (878), Hurworth (943) and Greatham (unit sex ratio 926), though in the last mentioned case, the available employment is also likely to be a significant influence. In the eleven cases where the sex ratio is below 950 and unaffected by non-private household population, there would appear to be an equal division between mining units (Shilbottle 926, Pegswood 930, Shadforth 944, Ellington/ Lynemouth 948, and also including Carlton/Whitton 939) and the obviously rural units containing the parishes of Hedley (917), Plenmeller (882), Kielder (946), Alnham (941) and Branxton (926). The remaining case is the rather indeterminate one of the Satley unit (941) in Lanchester R.D.

With regard to low sex ratios, therefore, one may make two main points. Firstly, as one would expect, the lowest normal ratios are exhibited by mining and rural parishes with, despite their contrasts in other fields, a similar basic cause of economic decline and predominantly male employment. Secondly, however, it is noteworthy that throughout most of the coalfield and truly rural areas, the sex ratio, though usually below average is nearly balanced with, especially in the rural zone, several examples of a significant female surplus. In both areas, low ratios are isolated and in response to specific local conditions whether forestry as in the Kielder unit or mining as in parts of Morpeth R.D. in particular. Nevertheless, although it has been stated that "The mining settlements do not show the male surplus that might have been anticipated. Marriage rates are high and though there is little local employment for women there is proportionately less female out-migration than from the rural areas" (House and Willis 1967 p.63), in the Rural

Districts there would seem to be little to choose between truly rural and coalfield areas with the latter characteristically showing a slight male surplus.

If one next considers ratios in excess of 1050, a rather more revealing pattern of female predominance presents itself. The parishes exhibiting such sex ratios fall into several main classes. First, there is again the effect of institutional populations where these are likely to be mainly female. One may postulate this as being the reason for the high sex ratios of Corbridge (1222), Warkworth (1098), Belford (1123, though consider also the effect noted below of this being a rural node), Horncliffe (unit sex ratio 1302), Wolsingham (1065), Edlingham (unit sex ratio 1060), Bamburgh (unit sex ratio 1185) and Sedgefield (1128).

Secondly, one of the most evident features from Figure 5.4 is the high ratios of many of the notable residential/commuter areas in the rural zone. These tend on the whole to be the rather more established residential areas and such new developments as Elton/Norton or Ouston usually do not stand out thus. The high value axis of the Tyne valley commuter belt is particularly noteworthy and no fewer than 12 parish units between North Gosforth and Haltwhistle (excluding Allendale) have ratios which vary between the 1060 of the Ovingham unit and 1127 of Wylam, though Corbridge, possibly with an added institutional effect reaches an even higher figure. This closely corresponds with Duncan and Reiss' (1956) statement as to the high sex ratios of urban and rural nonfarm fringe tracts. Elsewhere, residential influences with urban proximity and a more varied employment structure important, are the probable causes of high ratios from the 1051 of the Lanchester unit through the units containing or consisting of Herrington, Bournmoor, Egglescliffe, Framwellgate Moor and Healeyfield to the 1192 of the Shincliffe unit[1].

Thirdly, many rural nodes also exhibit high sex ratios whether through being the focus of retirement aspirations of retired persons, with their female majority, or more simply, through possessing

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[1] Sherburn Hospital Old Persons' Home is an insignificant influence here and the major part of the female excess is to be found in the private household population of Shincliffe.

a wider range of female employment opportunities in service occupations. Typical examples here are Bellingham (1089), Rothbury (1216), North Sunderland (1138), Wooler (1132), Ford/Milfield (1078) and Allendale (1135).

Finally a number of parishes of varied nature have locally high ratios for no single apparent reason, though all are within relatively easy reach of at least small market towns with their more varied employment opportunities, such as Berwick and Alnwick, if not major urban centres. The possible effect of Berwick, in this regard, upon Norham and Islandshires R.D. has been noted previously (Ironside 1964). Similarly, though none reaches 1100 such industrial or mining units as Ford, Silksworth, Tunstall, Bishop Middleham and Etherley all have a sex ratio in excess of 1050. Elsewhere, some of the less isolated rural units have even higher ratios varying from 1060 (the Nunnykirk unit) to 1148 in the Piercebridge unit and 1160 in the Lesbury one.

To conclude the discussion of the distribution of sex ratio values, two other general features appear worthy of note from Figure 5.4. First, despite the influence of some institutional populations, the Northumberland coast to the north of Amble, appears as a discontinuous but obvious belt of high ratios again reflecting its unique position in rural Northumberland and almost certainly betokening its influence as an increasingly popular holiday/retirement zone in the North-East. Second, the near average and in every case above unity ratios in the Teesdale and Weardale units are worthy of comment. House and Willis (1967) considered that this might well result "... where the range of male employment in farming and quarrying is perhaps offset by ..... growing importance for retirement" (p.62), to which one might add the importance of County Council old persons' homes and geriatric accommodation with their female surplus in Wolsingham. This would appear to run contrary to Ironside's (1964) assertions of continuing, if not increasing, male surpluses in Weardale R.D.

Of the two sex ratios which were calculated, the main one based upon 100 percent 1961 Census data and the other upon the 1966 10 percent Sample Census, only the former shows any rank correlations of $\pm$ 0.4 or more with other variables. Even here, only two such associations exist: 0.46 with the proportion of 1966 employment in services and -0.50 with persons per household in 1961. The first reflects the importance of service employment for female labour and the correspondingly higher sex ratios in many areas offering such work, whilst the second demonstrates the predominance of females in small, often aged and single person households.

The very low (0.28) rank correlation between the ratios for 1961 and 1966 is at first somewhat disturbing, but when it is remembered that sex ratio is a particularly sensitive value with the range being particularly limited, such a low level of association may very easily result from otherwise slight differences between the 100 percent and 10 percent data. The sparsity of significant correlations and the failure of the sex ratio variable to show up in the earlier factor analyses (with, for example, the respective percentage explanations of the variance of each of these two variables being approximately equal to the total variance explained by each of the first three R-mode factors) argues the overall lack of significance in terms of the other characteristics considered in the present analysis.

5.4. Population Origin

Data concerning the birthplace (i.e. mother's usual residence) of enumerated population normally resident in Great Britain is obtainable from the enumeration district data of the 1966 Census. Generally the relevant figures are so small that, bearing in mind the sample nature of the data, little can safely be read into them. Coates (1968) whilst commenting upon the inadequacy of such Census material and its limitations even at a 100 percent coverage level has made two points which, nevertheless, appear to be corroborated here. Thus, coalmining parishes with the possible exception of Dinnington/Brunswick (estate development at Dinnington may be the important factor) have a very low proportion of overseas born whether Irish or from outside the British Isles. On the other hand, particularly high values tend to be registered by some of the units with defence populations, hence the 5.6 percent of Longhoughton, the 3.4 percent of Matfen/Stamfordham, the 3.2 percent of East Chevington, the 3.2 percent of the Cleatlam unit and the maximum of 7.5 percent of Middleton St. George.

It is, however, not surprising that much diversity is still shown. Zero values are to be found in ten of the Northumberland and one (the Bolam unit) of the Durham rural units compared to the thirteen other units in Durham which have the same value and some employment in mining, Likewise, many rural units in Northumberland have values of over 2 percent though this may not mean more than that two or three of the enumerated sample, resident in Great Britain, were born outside the main island. It is noticeable, however, that many of the 34 units with percentages in excess of 2 tend to be largely residential, often with some connotation of quite high social status. Indeed, in the Tyne valley between units 95 (Bywell/Broomhaugh and Riding) and 104 (North Gosforth) the only parishes with values of below 2 percent are Woolsington and Hazlerigg.

Certainly it would appear that the major lineaments of the factor analysis bear out the above general trends. Consequently, despite the remarkably low communality (a reflection of the low statistical significance of such small figures), almost 63 percent of the variance of this variable explained by the R-mode analysis was incorporated into the high social class/residential Factor 3, and a further 32 percent into the defence function Factor 5. Similarly, in the Q-mode analysis this variable appeared as an important constituent of Factor 3.

From Table 5.1 it may be seen that only two correlations of significance are to be found. These are those of 0.40 with the 1966 longer distance migration variable and 0.48 with the percentage of economically active and retired males in 1966 who were grouped in Social Class 1. From what has been said with regard to the statistical uncertainty of the figures, the lack of correlation is to be expected.

5.5. Marital Status

A rather more important component of a population is its marital status. It has been remarked that : "The proportion of the population that marries, the age at which it marries and the extent to which marriages are dissolved by death and divorce (and the age at which dissolution occurs) all can affect the birth rate. Moreover death rates and migration rates both vary substantially according to marital status, so that marital status conditions all aspects of population dynamics" (Bogue 1969 p.312). Likewise, Cox (1950), Glass (1968) and Grebenik and Rowntree (1964) have stressed the influence of marriage upon fertility. Hence marital status is a particularly important consideration and it may be expected that the proportion married will vary particularly with the age and sex structure of the population. In addition, Clarke (1972) has stressed social influences affecting the proportion of a population marrying and the age of marriage, whilst Grebenik and Rowntree (1964) remarked that despite a narrowing in difference over time, "... the grooms and brides of high-status categories continued on average to marry later than their lower-status contemporaries" (p.194).

It may, therefore, be expected that age, sex, social, socio-economic and economic influences will all be reflected in the proportions of the population which are married and single. Figure 5.5. would seem to confirm this insofar as age structure is concerned. Indeed, the most marked variations obviously refer to age structure considerations. Units with the highest proportion of single persons tend to have a large youthful element or a proportionately large institutional population containing many single people. Thus, the Brunswick, Alnham, Kielder and Hedley units all possessed a markedly higher than average proportion of their population aged under 15 whilst in the Hebron, Woodham, Low Dinsdale, Heighington and Stannington units, institutional influences are obviously paramount. Only Langley of the ten units with the highest proportion of single persons on Figure 5.5. fell into neither category. Seven of the above units are also to be found amongst the ten with the lowest proportions of their populations which were married. The three additions, quite significantly, are the Shincliffe, Sedgefield and Allendale units. Of these, the first two possess considerable institutional populations whilst the top heavy age structure of the

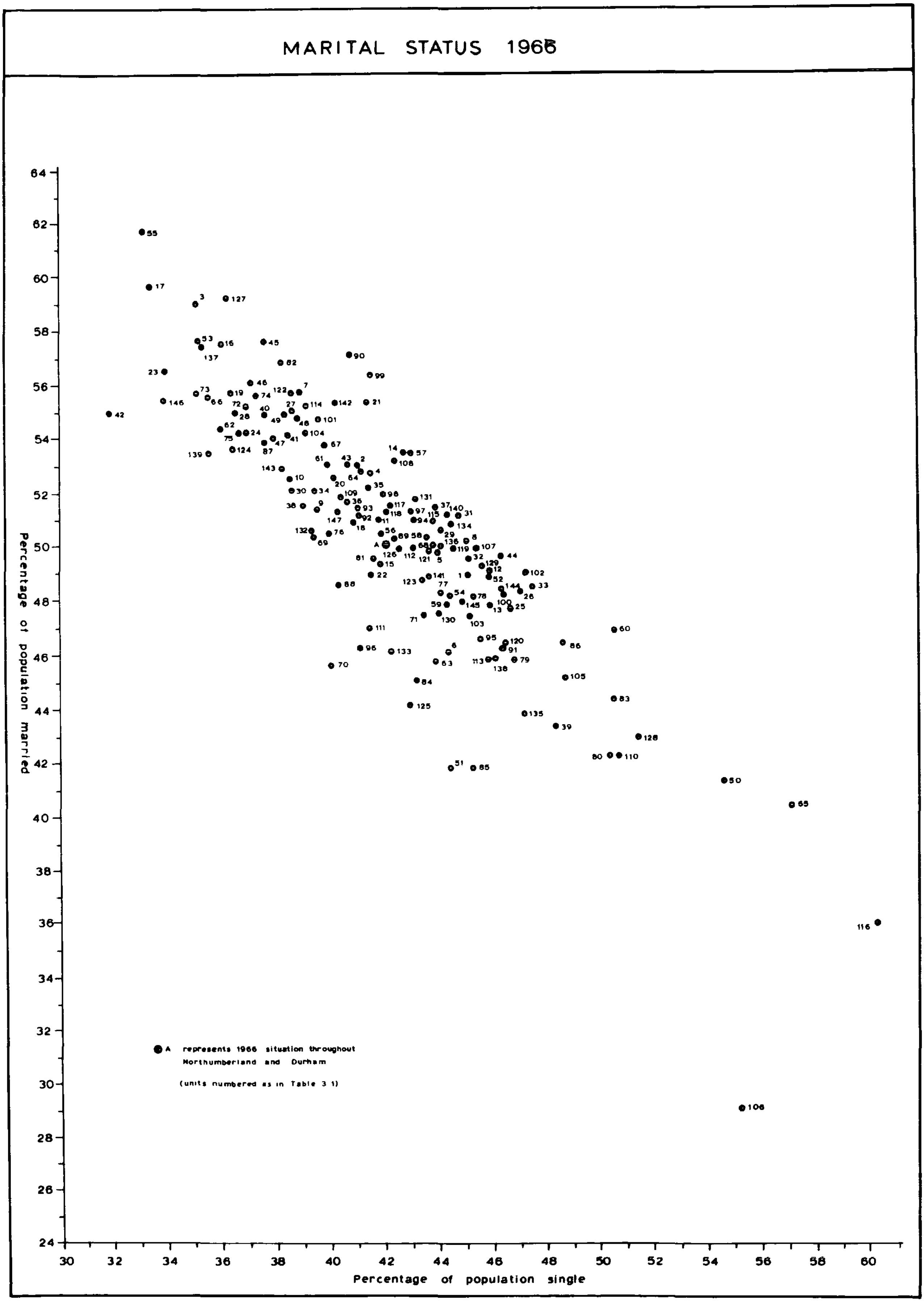
MARITAL STATUS 1966
Percentage of population married
Percentage of population single
A represents 1966 situation throughout Northumberland and Durham
(units numbered as in Table 3.1)

Figure 5.5

last mentioned has already been noted.

A rather greater variety of parishes have high married proportions. Many, however, appear to be units which have experienced in recent years a marked influx of young adults into new residential areas. Thus, amongst the ten units with the highest percentages of their population married, Herrington/Offerton, Bournmoor/Lambton, Harraton/South Biddick, Elton/Norton (the most extreme at 61.8 percent), Healeyfield, and Haydon Bridge would appear to fall into this category. Additionally mining/industrial areas have their representatives in Fishburn and Greatham/Seaton, whilst the remoter rural areas are exemplified by North Sunderland and the Alwinton unit. Very much the same pattern is shown by units with particularly low proportions of their populations of single status, although some additions do occur such as Belford with its old-age structure and presumably quite large widowed element.

In view of the multitude of influences upon the marital status of a population, it is not possible to extract any further individual elements. Both the married and single proportion variables show up slightly in the Factor 1s of the two factor analyses reflecting the tendency for higher values of each to occur in the less rural areas. At the same time, neither variable shows many significant correlations. Quite naturally there is a very strong relationship between them (-0.85) reflecting the relatively small differential influence of widowed and divorced people. The proportion of single persons also correlates with the modified fertility ratio (0.42), the percentage of the population aged under 15 (0.42) and the percentage of households of six or more persons (0.56). These obviously reflect the association between large numbers of children and a high proportion of single persons. Likewise, the proportion married, correlates negatively with six or more person households (-0.49) but positively with the 1966 percentage of persons living in private households (0.41)

5.6. Household Composition

Data are available from the 1966 Census for the number of households which contained -

a) no family unit,

b) one family unit,

c) two or more family units.

A family is regarded as being comprised of a married couple with or without single child(ren) or a lone parent with his/her single child(ren). Thus, no family households will tend to reflect old persons living alone, or single persons of any age, whilst two family households will reflect multiple occupancy insofar as two (or more) families may live together, at least in the sense of benefitting from common housekeeping.

The one family household is quite obviously the norm (Figure 5.6) and the unweighted mean gives 81.3 percent of households possessing one family unit. It is noticeable that amongst the units with 88 percent or more of their households so constituted, many are growing residential areas reflecting the normal one family nature of in-migrant households. Great Lumley, Ouston, Egglescliffe, Great Aycliffe, Wylam, Ponteland, North Gosforth and Peterlee are all to be found in this category. At the same time it is apparent that high values are shared by a number of coalfield units particularly Fishburn, Pegswood, Shilbottle, Bishop Middleham, Shadforth and the Burdon unit. Considerable variation is, however, exhibited here and certain other mining units have quite low values. The small number of households in some of the unit sample populations may, at its extreme, be important here and, in this respect, it is similarly difficult to read much significance into the remaining three values in excess of 88 percent for the Branxton, Warkworth and Great Burdon units.

At the other end of the scale, there is an obvious tendency for values of 72 percent or less to be found in units with a particularly aged population as noted above. This is so in the Allendale, Chatton, Rothbury, Bywell, Rennington, Alnmouth, Newton by the Sea and Whessoe units. Elsewhere, a combination of no and two family households, serves to give low values in the Bowsden, Capheaton, Milfield, Hedley and Thirston units. No typical features may be deduced from this except a possibly significant absence from this extreme of major residential and typical coalfield units.

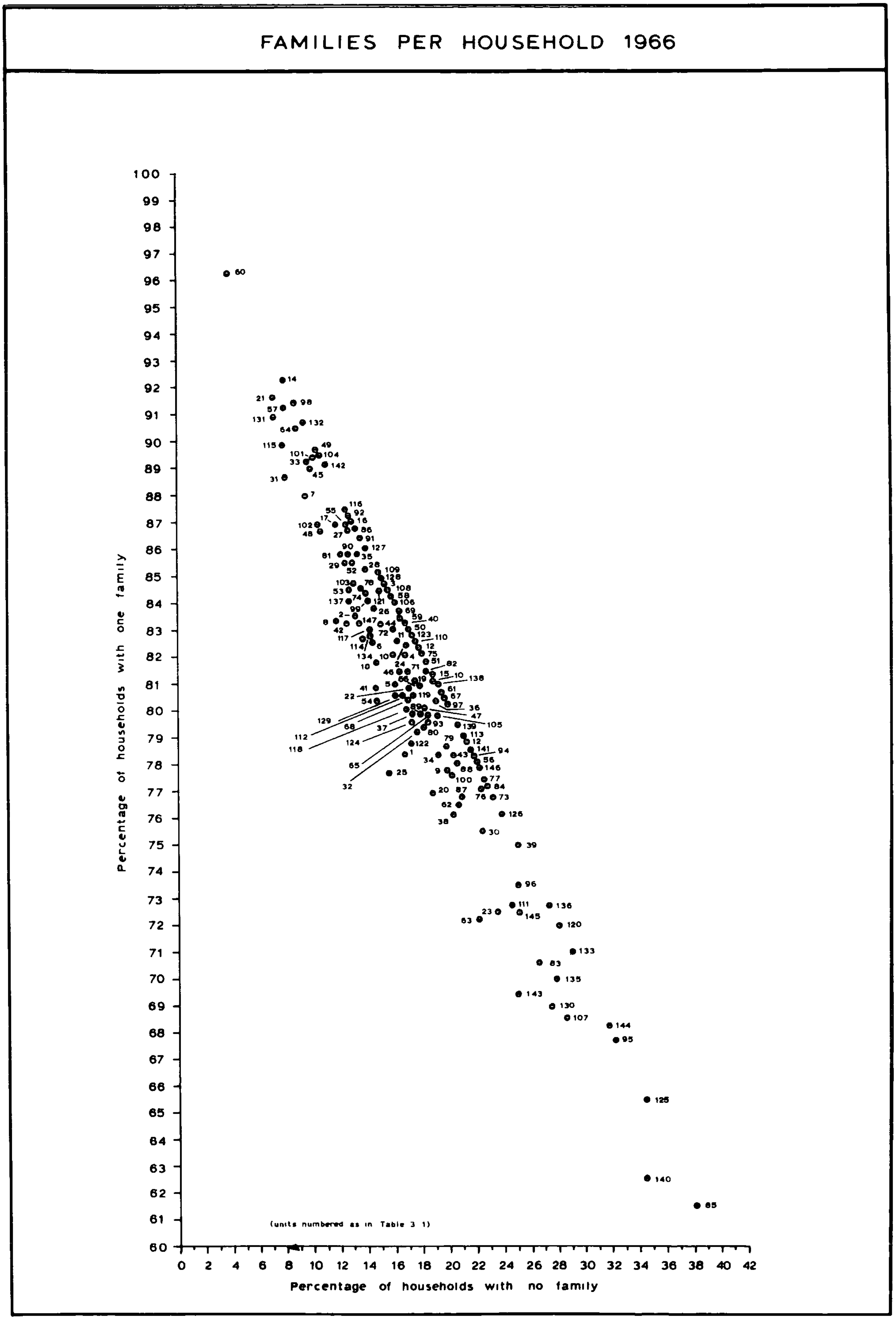
FAMILIES PER HOUSEHOLD 1966
Percentage of households with one family
Percentage of households with no family
(units numbered as in Table 3 1)

Figure 5.6

From Figure 5.6. the lack of two or more family households is apparent and any consideration of particularly low or high values for no family households is entirely unnecessary in view of the reciprocal nature of this and the one family household variable. Likewise, only a brief discussion of two or more family households is necessary insofar as these are often based upon extremely few occurrences, if any, with variation between numerous values of nought and one value of 6.7 percent. Whilst of the eight values in excess of 4 percent, seven are to be found in County Durham, with six relating to units with significant mining employment (Hylton, Hawthorn/Cold Hesledon, Plawsworth, Coxhoe, Kelloe and Carlton/Whitton) it is evident that several only slightly lower values occur in the remoter rural areas.

Finally, it is interesting and relevant to consider the distribution of households of one or two persons of whom at least one was of pensionable age, expressed as a percentage of all households. This variable was found to have an unweighted mean of 23.3 percent, such a high value obviously reflecting the larger numerical importance of such households as compared to their contained proportion of the total population. The pattern found reflects earlier analysis with values of under 15 percent found in eighteen units generally with young age structures and reflecting recent residential developments (Great Lumley, Ouston, Belmont, Peterlee, Elton/Norton, Egglescliffe, Great Aycliffe and Woolsington) some mining communities (Plawsworth, Shadforth, Kelloe, Ulgham and Shilbottle) and a few residual cases. In this last category are included the Kielder unit with its attraction of young adults to forestry employment, Middleton St. George with its defence population and even Stannington stripped of its institutional elements.

Correspondingly, particularly high values in excess of 30 percent are mainly typical of the rural problem areas. The major rural settlements of Belford, North Sunderland, Lesbury, Warkworth, Rothbury (exhibiting the astonishing level of 50.8 percent of all its sampled households consisting of one or two persons of whom at least one was of pensionable age), Bellingham, Haltwhistle, Allendale, Wolsingham, Stanhope and Middleton-in-Teesdale are all to be found, forming over one-half of such examples. The remainder are largely situated in the rural zone being formed of the Whessoe, Slaley, Denwick, Cartington, Akeld, Horncliffe and Cornhill units with those of Edmondsley/Waldridge, Shincliffe and Evenwood and Barony providing the only exceptions.

This general analysis finds agreement in the correlation structure of Table 5.1. No family households in 1966 are shown to correlate moderately with the percentage of the population aged 60 and over, the Crude Death Rate variable, the proportion of households with two or fewer persons and the small household with person(s) of pensionable age variables (all positive and the last mentioned reaching 0.58), and the Crude Birth Rate - Crude Death Rate difference factor, persons per household 1961, and the ratio of 1961 Census to electoral population (all negative). All these correlations, therefore, reflect the paramount effects of age structure as a causal factor either directly or indirectly. The one very high correlation of -0.95 with one family households shows the unimportance of two or more family households and is itself reflected in the five moderate correlations shown by the one family household variable. These are the same, although in the opposite direction, as those mentioned above except that the 1961 Census:electoral population ratio and persons per household variables fail to reach the arbitrary significance level. It is, perhaps, not surprising that the two or more family households variable fails to uncover any correlation in excess of $\pm$ 0.4.

In the correlation analysis two variables were also included from the 1961 Census Scale D tabulations to represent the proportions of no and one family households respectively. Though showing remarkably little correlation with their 1966 counterparts, both associations narrowly failing to reach r_s = 0.4, similar patterns of correlation are produced but with important additions. Age structure is again prominent whether directly or indirectly, with the no family household variable showing moderate positive correlations with the aged proportion of the population and the 1966 percentage of persons living at densities of below 0.5 per room. Moderate negative correlations are shown with 1961 persons per household, 1961 persons per room and the proportion of the 1966 population aged between 15 and 44. Additionally, however, all four main distance indices show a positive correlation of between 0.45 and 0.49 whilst the two population potential variables show similar negative associations. Certainly in this case age structure and distance from urban centres appear closely linked.

Fewer correlations are shown by the 1961 percentage of households possessing one family unit, with positive links between this variable and 1961 persons per household and population potential (1951 and 1967) and a negative link with distance from the nearest centre of 20,000 or more persons. The inclusion of distance in this discussion would appear to add a particularly important dimension to the rural problem.

In concluding this section, it is no surprise to find the small household with person(s) of pensionable age variable showing its utter dependence upon age structure. Thus positive correlations exist with the Crude Death Rate (0.40), the proportion of two or less person households (0.59), households with no family unit in 1966 (0.58) and the proportion of the population aged 60 and over (0.71), whilst negative correlations exist with persons per household (-0.48), the proportion of one family households in 1966 (-0.53), the proportions of the population aged under 15 (-0.42) and 15 to 44 (-0.43), the 1961 Census:electoral population coefficient (-0.51) and the Crude Birth Rate-Crude Death Rate difference factor (-0.45).

5.7 Fertility

Without doubt one of the main demographic characteristics of a population is its fertility "... it usually exceeds mortality ... and migration and is therefore the main determinant of population growth and a principal influence upon population distribution" (Clarke 1972 p. 109). Fertility particularly influences the age structure, demands upon the social services and aspects of the economic situation by controlling the flow of young adults into the labour force (Bogue 1969).

Many measures have been devised to assess the fertility of a population. Three are used in this section. The first is the simplest - the Crude Birth Rate (the number of live births per 1000 persons of the total population per annum). This can only be used to assess the general magnitudes of the fertility of a population, severely affected as it is by variations in the age and sex structure. The second fertility measure used is the fertility ratio (also known as the child-woman ratio) which is the quotient of children under 5 years of age and women aged 15 to 44, the resultant figure usually being multiplied by 100 or 1,000. Unlike the Crude Birth Rate, therefore, this ratio is part age standardised and may be regarded as a measure of effective fertility that remains after the bulk of infant mortality has occurred (Cho 1968). Nevertheless, the measure is still quite sensitive to marked variations between populations in the nature of the age structure distribution within the female reproductive age groups. Thirdly, a variation of the previous method has also been used (children under 15 per 1000 women aged 15 to 44) in an attempt to measure fertility through children per potential mother. This obviously is not so sensitive as the previous standard measure but provides an interesting comparison. The advantages of using this modified fertility ratio with regard to sample census data have been documented by Jackson (1968). The draw-backs are also mentioned particularly the measure's insensitivity to age structural differences within the female reproductive group. This causes the ratio to be depressed when there is a high proportion of young women who have been at risk for a relatively short period of time or who are still unmarried, and overestimated where the reverse is true.

Outside the major structural influences many variables have been noted as having a significant effect upon fertility. One of the most obvious of these is that of marital status and it has been stated that "... in modern European countries it is no longer legitimate to study fertility in terms of female age distribution alone. In this country the bulk of reproduction takes place within marriage ... The amount and timing of marriage is therefore important in the study of fertility" (Grebenik and Rowntree 1964 p.178). Secondly, educational attainment would appear to have a strong influence upon fertility, and Bogue (1969) considers that throughout the world there appears to be a strong inverse correlation between the level of educational attainment and fertility. Thirdly, the same author notes a link between fertility and occupational status, something which has been confirmed in research with respect to the relevant effects of income levels (Friedlander and Silver 1966, Beegle 1966). More broadly, Silver (1966) has attempted to establish a link between fertility and the general level of economic activity, though Heer (1966) has stated that whilst the direct effects of economic development may promote fertility, indirect, especially social effects, are able to more than cancel this out.

In addition, other authors have mentioned further variables which they consider affect fertility and which are relevant here. Thus, both Duncan and Reiss (1956) and Smith and Zopf (1970) mention an inverse relationship between fertility and size of place, the latter also noting a positive correlation between increasing distance from a city and fertility. At the same time, Dewdney (1970) in a local study, has noted that for crude measures of fertility such as the Crude Birth Rate, the major determinant of comparative levels tended to be the result of migrational movements, differences in age-specific fertility and even mortality rates being considerably less important.

One of the most often mentioned influences upon fertility is, however, the question of residence. Anderson (1960) in looking at the general world picture has stated that "... whether countries are more urban or less, urban birth rates are lower than rural birth rates" (p.140). He notes rural child-woman ratios, for example, of 506 (Australia), 505 (U.S.A.), 308 (Sweden) and 358 (U.K.) compared to the respective urban levels of 353, 383, 301 and 332. His conclusions with regard to the United Kingdom are interesting in that he held, "The least urban-rural difference for the countries shown is in the United Kingdom .... In that country there are almost no rural places that are not embraced by the urban way of life" (p.140). Similarly Friedlander and Silver (1966) repeat the argument that since farmers have a comparative cost advantage in raising children, as well as in obtaining foodstuffs, they would tend to be more fertile even without any differences in the 'taste' for children which again, is popularly held to be more highly developed in rural areas. Researching further into this rural-urban differential, Beegle (1966) in the United States found a consistent and substantial difference in fertility. Furthermore, he noted sizeable intra-residence group differences which meant, for example, that lowered rural-farm fertility for white women was found to be associated with proximity to large centres.

The urban-rural fertility differential is, however, not always so clear and obvious. Zelinsky (1962) for instance has pointed out that in the United States "... there is no doubt that in the past two decades massive out-migration from the rural farm and from parts of the rural non-farm population has strikingly depressed fertility and thus accelerated an already rapid contraction of rural numbers" (p.518). In the same way Mann (1965) has recognised that, with the severe effects of depopulation, rural birthrates are often below their urban counterparts although when allowance is made for the population structure, the situation is reversed. Clarke (1972) attributes generally lower urban fertility mainly to unbalanced sex ratios, high living standards and costs, social capillarity, social classes, income groups, occupational status, female employment, and educational facilities and attainments. At the same time he notes that rural fertility is often considerably higher than birth rates imply, in consequence of migration having reduced the numbers in the reproductive age groups.

Further evidence on this score is furnished by Glass (1968) who analysed the number of live births per married woman under 45 years of age for uninterrupted marriages according to place of residence. For two marriage durations (10 to 14 and 15 to 19 years) he found the number of live births in the rural areas outside the conurbations was at the same level or slightly below that for urban areas of over 100,000 persons (again outside the conurbations) though above the other three urban categories. For marriages of 20 to 24 years duration it was, however, higher than any urban category. In terms of occupation, the highest numbers of live births amongst three agricultural classes were the 2.22 (10 to 14 years marriage duration), 2.25 (15 to 19 years marriage duration) and 2.30 (20 to 24 years marriage duration) for wives of farmers (employers and managers). This was above twelve other occupational groups but below the levels for unskilled manual workers (2.30, 2.35 and 2.30 for the respective marriage durations). Nevertheless, it should be remembered that Glass does point out that of the twenty European countries for which figures are given, Scotland has the lowest value when urban and rural child-woman ratios are compared. This level of 105 percent (rural to urban) is followed by Albania at 107 percent and England and Wales at 110 percent. Greece at 154 percent heads the table.

Before turning from the above general analysis to the specific pattern of fertility in the rural areas of North-East England, the position of Northern England within the country as a whole may be noted. From a 1951 Crude Birth Rate of 17.3°/oo compared to the national average (England and Wales) of 15.6°/oo, by 1963 the North was on a par (18.3°/oo) with the remainder of the nation (Hammond 1968). By 1965, however, the national birth rate of 18.2°/oo had surpassed the regional level of 17.8°/oo. Hence ..."In the past the North has held the advantage of a higher birthrate .... which has helped it to maintain growth despite an outflow of migrants. Now this differential has largely disappeared. The Northern Region in particular has shown a remarkable falling-off here ..." (Hammond 1968 Table 1.2.1.).

Crude Birth Rates

How do the Rural Districts of North-East England appear amidst this background? The first pattern to be examined is that of the Crude Birth Rate for 1964-5 in each of the 147 parish units. Data regarding births in the then twenty Rural Districts of North-East England were obtained from birth records (birth cards and registers) for each of the above two years, from the Health Departments of Northumberland and Durham County Councils.[1] Births (live) were noted by the location of occurrence and subsequently assigned by one of four methods, to a civil parish. First, it was possible in some cases to immediately assign a birth to a parish, especially if, for example, as occasionally happened in Northumberland, an isolated farm appeared on the administrative map. Second, where a road ran through two or more parishes or where a village (for instance Windlestone in Sedgefield R.D.) was bisected by a parish boundary, relevant streets and street numbers were obtained from the electoral register to enable allocation to a parish. This necessitated some considerable work especially in the more densely peopled areas as in Chester-le-Street R.D. where many parish boundaries do not separate physically distinct settlements.

Thirdly, especially in the more lightly populated rural areas, the name of the parents and their address had to be noted and looked up in the electoral register. This often necessitated searching several parish divisions especially where, as was not an infrequent occurrence, the name of the parents was not on the register, probably in consequence of their recent arrival in the parish of residence. In such cases every address had to be compared to that given in the birth record. Such a process was particuarly laborious especially insofar as it soon became apparent that many addresses were not self-evident. Thus 2 West Farm Cottages, Craster, was found to be situated in the parish of Longhoughton. Moreover it was also discovered that the records were not entirely reliable. For example, it was found that Elford Farm Cottages, Elford, registered under Alnwick R.D. was situated in the parish of Beadnell in Belford R.D. Likewise, the use of the minimum postal address possible, for example, Station House, Ewesley, Morpeth (Nunnykirk C.P. in Rothbury R.D.) or even Bishop Auckland for a St. John's Chapel (Stanhope C.P. in Weardale R.D.) address caused added complications. Consequently none but the most obvious and certain addresses were allocated immediately, the remainder

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[1] 1964 and 1965 were the two most recent years prior to the boundary changes of the late 1960s for which data on births could be obtained for both Durham and Northumberland

being referred to the electoral register. As a result of this necessary checking, together with that which was required by the corresponding data obtained for deaths, the monotonous work of parish allocation occupied the period November 1970 to April 1971 when linked with the establishment of relevant population totals for the years in question. Finally, the very few addresses which still remained untraced were referred to the offices of the Rural District Councils concerned and the necessary information for allocation thus obtained.

The pattern presented by Figure 5.7 is the result of the above work when portrayed on a unit basis, the relevant population totals having been estimated in the manner noted in Appendix A. Institutional populations were discounted except those attached to a defence installations when the indistinct nature of the division between private and non-private household population where families were located in the same parish as the defence establishment, made non-inclusion of this population impractical. This was so, for example, in Middleton St. George and Stamfordham where an unknown number of the recorded births may be attributed to the respective R.A.F. stations.

The unweighted mean C.B.R. for the 147 parish units was 17.3^{o}/oo compared to the England and Wales average for the corresponding two years of 18.3^{o}/oo and one of 17.9^{o}/oo for the counties of Northumberland and Durham as a whole. The variation between the various parish units is, however, large and, with a few exceptions, no entirely clear themes emerge from Figure 5.7. Nevertheless, most of the highest values do fall into two main classes: those caused by rapid recent residential inmovement and development and those caused by defence installations. Hence, of the ten units with birth rates in excess of 25^{o}/oo, Herrington/Offerton (26.3^{o}/oo), Ouston (25.4^{o}/oo), Belmont (27.2^{o}/oo), Peterlee (32.6^{o}/oo), Elton/Norton (26.6^{o}/oo), Eggescliffe (29.0^{o}/oo) and Great Aycliffe (25.2^{o}/oo, a surprisingly low figure for this New Town) fall into the former category. All three remaining units are conveniently of the latter type. Of these three units the extremely high C.B.R. of 37.1^{o}/oo was achieved by the Cleatlam unit in which the influence of Streatlam Camp and the associated settlements of Stainton Grove and Stainton Grove Caravan Site was paramount. Middleton St. George (26.0^{o}/oo) and East

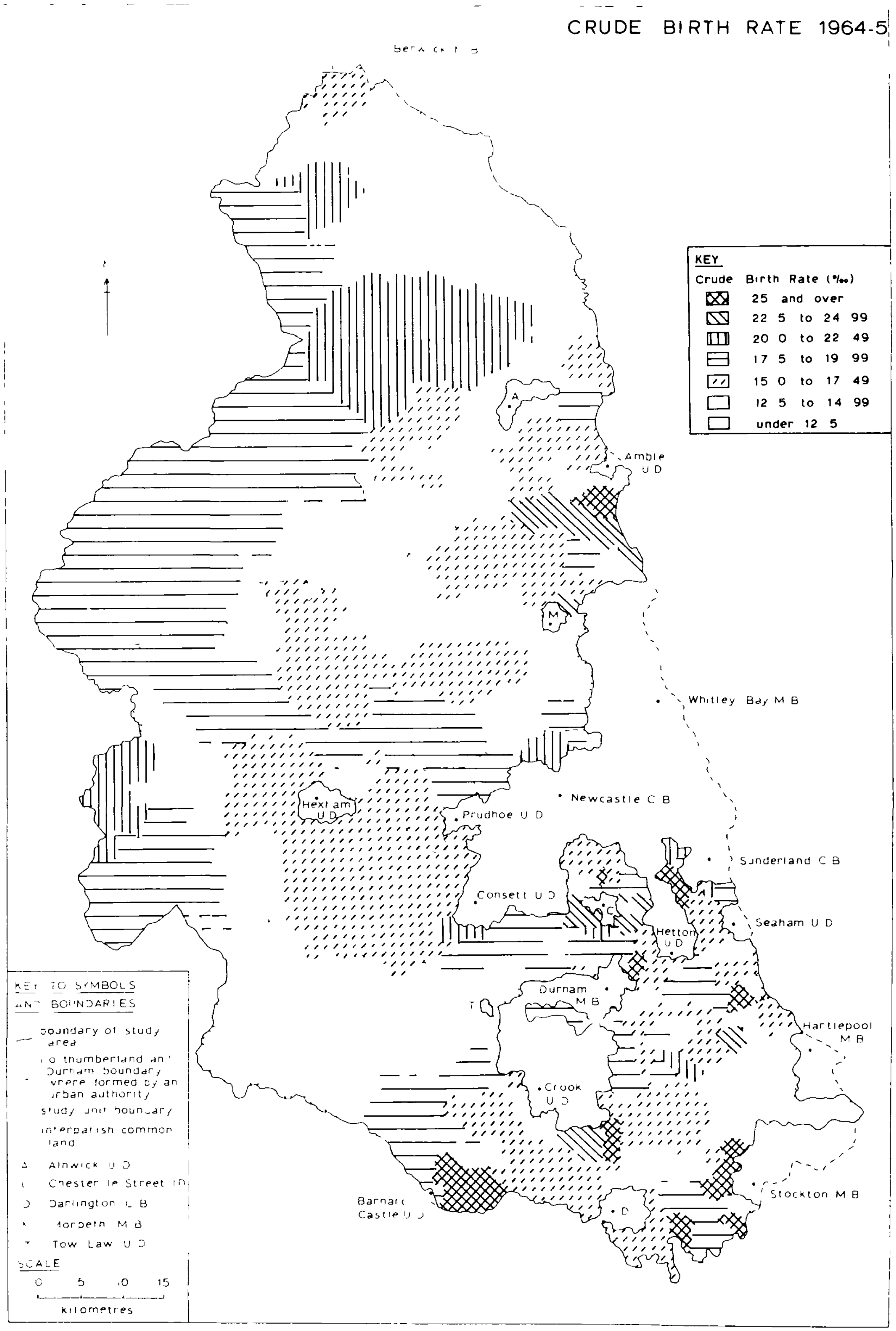
CRUDE BIRTH RATE 1964-5
KEY
Crude Birth Rate (‰)
25 and over
22 5 to 24 99
20 0 to 22 49
17 5 to 19 99
15 0 to 17 49
12 5 to 14 99
under 12 5
Amble U D
Whitley Bay M B
Newcastle C B
Prudhoe U D
Sunderland C B
Consett U D
Seaham U D
Hetton U D
Durham M B
Hartlepool M B
Crook U D
Barnard Castle U D
Stockton M B
KEY TO SYMBOLS
AND BOUNDARIES
boundary of study area
Northumberland and Durham boundary where formed by an urban authority
study unit boundary
interparish common land
Alnwick U D
Chester le Street U D
Darlington C B
Morpeth M B
Tow Law U D
SCALE
0 5 10 15
kilometres

Figure 5.7

Chevington ($26.5^{\circ}/oo$) are the remaining two examples, though one may note also the possibility of the traditionally high fertility amongst mining communities affecting the latter.

At slightly lower values, this dichotomy is perpetuated though, in addition, one has a number of coalmining units such as Tunstall ($21.5^{\circ}/oo$), Edmondsley/Waldridge ($23.4^{\circ}/oo$), Hutton Henry ($24.2^{\circ}/oo$) and Pegswood ($22.6^{\circ}/oo$), as well as the occasional rather exceptional rural units such as those including the parishes of Thirlwall ($21.8^{\circ}/oo$) Alnham ($22.2^{\circ}/oo$) and Milfield ($21.1^{\circ}/oo$). Few purely rural units, however, reach such levels whilst even in Easington R.D. the C.B.R. for many mining units is, at best, only moderate. Hawthorn/Cold Hesledon at $10.5^{\circ}/oo$ is the extreme example of this, though such birth rates as $15.2^{\circ}/oo$ in Easington, $15.4^{\circ}/oo$ in Thornley, $16.0^{\circ}/oo$ in Wingate and $14.1^{\circ}/oo$ in Horden/Castle Eden reinforce the impression.

Quite naturally, amongst parish units where the birth rate is below $15.0^{\circ}/oo$, rural examples with a long history of depopulation are abundant. West Durham with the Northumbrian intrusion of Allendale is one such area with birth rates varying from $10.1^{\circ}/oo$ in Wolsingham to $13.9^{\circ}/oo$ in the Satley and Allendale units. Likewise, rates are low in parts of Haltwhistle R.D. an area which was commented upon in this respect by McKay and Stagg (1961). Haltwhistle C.P. itself had a mere 13.2 birthsper 1000 base population at this time, whilst parts of central and north Northumberland furnish the most extensive examples of low birth rates. From the Bellingham ($13.9^{\circ}/oo$), Elsdon ($14.7^{\circ}/oo$), Hartburn ($11.7^{\circ}/oo$) and Hepscott ($12.5^{\circ}/oo$) units, a tract of low birth rates goes north-east to the coast at the Craster unit ($14.6^{\circ}/oo$), then once again expands to cover most of the extreme north. The coastal tract often noted previously as an anomalous area amongst its landward neighbours again appears particularly extreme with, indeed, all Belford R.D. experiencing notably low birth rates which fall to $11.1^{\circ}/oo$ in the parish of Belford itself.

Moreover, it is noticeable that the larger settlements in the remoter rural areas such as Haltwhistle, Bellingham, Belford, Wooler, Ancroft and Rothbury have birth rates at or below the surrounding values. Indeed, of the parishes mentioned, the highest C.B.R. was that of $15.4^{\circ}/oo$ experienced by Rothbury. As one might imagine, the influence of the age structure no doubt resultant upon continued depopulation and also some inmovement to retirement, is paramount here.

Elsewhere, no clear pattern is shown by areas experiencing a low birth rate. Units noted to have an old age problem such as the Whessoe (26.2 percent aged 60 and over in 1966) and Staindrop (20 percent aged 60 and over in 1966) units, often as a corollary also have low birth rates ($12.6^{o}/oo$ and $10.6^{o}/oo$ respectively). Some mining parishes, particularly those in the process of decline also exhibit low rates, for example, the $10.7^{o}/oo$ of Little Lumley, the $11.4^{o}/oo$ of Langley, the $13.3^{o}/oo$ of Urpeth, the $14.6^{o}/oo$ of Etherley, the $12.9^{o}/oo$ of Ellington/Lynemouth and the lowest C.B.R. of all, the $9.3^{o}/oo$ of the industralised Greatham/Seaton unit.

Rather more interesting, however, are the quite low birth rates shown by some of the higher social class units (those identified as category 2 in Section 3.11) especially those where population was already established at a high level in 1961 with subsequent growth nowhere near as great as in other developing residential areas. Thus, there would certainly appear to be a social class differential causing the rates of $14.5^{o}/oo$ in Preston-on-Tees, $14.6^{o}/oo$ in Ponteland, $14.8^{o}/oo$ in North Gosforth and even the $12.8^{o}/oo$ of the Shincliffe unit. Although the last example given discounts the effects of Sherburn House Hospital (Aged Persons Home), a substantial number of retired persons living in Shincliffe C.P. will have a similar depressing effect upon the birth rate.

Finally, it would appear relevant to note the prevailing low level of the birth rate in parts of relatively rural south Durham. The Whessoe example is the most extreme, but rates not much higher are to be found nearby, for instance, the $13.1^{o}/oo$ of the large unit including the parish of Grindon west of the Hartlepools. Likewise one may note in passing the $14.8^{o}/oo$ rate in Stannington (Castle Ward R.D.) which would appear likely to be an indirect effect of the institutional establishments in this parish though the direct effects as regards the non-private household population have been discounted. It is still likely that many single persons attached especially to the various hospitals are not included here.

Child-Woman Ratio

Because of the more precise nature of the measure and the character of the available statistics, too much can not be gleaned from the child-woman ratios calculated for 1966. However, it is likely that any general pattern will appear from a consideration of particularly low and high values. Fertility ratios of under 300 (per thousand base) compared to the unweighted mean of 431 occur in 25 units. These would largely appear to fall into three main classes if one ignores the possibility of chance occurrences. First, many examples are found amongst the more obviously rural units both in Durham and Northumberland typical values being 286 for the Piercebridge unit, 191 for the Bolam unit, 268 for the Eggleston unit, 211 for the Rothley unit, 147 for the Rothbury unit, 250 for the Cartington unit, 222 for the North Sunderland unit, 188 for Belford and 168 for the Branxton unit. However, though many other units in rural areas, such as Stanhope, Wolsingham and Wooler barely exceed 300, no obviously continuous pattern of low values appears from the above and the general trend is the only point of significance. Second, the influence of institutional populations where these are likely to contain women in the reproductive age groups is again obvious in such parishes as Heighington (238), Stannington (258) and Hebron (unit ratio 285).

Finally, a variety of other units possess low ratios. These include the industrial units of Ford (254) and Greatham and Seaton (250); the coalmining units of West Rainton (256) and Kelloe (111 - though once again the small sample base must be remembered particularly in this case) and units with a known high proportion of older persons such as Little Lumley (214) and Bywell/Broomhaugh and Riding (188). The character of the last mentioned unit is particularly interesting. With a high proportion of its economically active and retired males being of a high social class and with it obviously forming part of the Tyne valley commuter belt, it has nevertheless been demonstrated that the unit contains a remarkably high proportion of older persons with, indeed, one-half being over 44 years of age and 22.7 percent over 59.

The pattern presented by areas of high ratio is similarly indistinct although it serves to corroborate much of the foregoing analysis. High child-woman indices are apparent in those units having experienced particularly marked population growth 1961-6 and which have already been seen to possess a high birth rate. Elton/Norton at 600, Bournmoor/Lambton at 633 and Peterlee at 627 are the main examples. Moreover, some mining units which Figure 5.7 shows to possess birth rates in excess of 20°/oo also possess high ratios. Hylton at 612, Pittington at 611 and Edmondsley/Waldridge at 810 are the most extreme of these. The effect of defence population upon the ratio is no less marked than in the case of the Crude Birth Rate and the Cleatlam unit, with the important defence installation of Streatlam Camp together with its associated population, which had such a high birth rate, has an equally extreme child-woman ratio based on the 1966 Census of 880.

Remaining values in excess of 600 are mainly restricted to the more obviously rural units, though few quite naturally rise so high. In Durham the Woodham unit is the sole example, reaching 722, whilst in Northumberland high values are attained by the units containing the parishes of Newbrough (609), Kielder (632), Lesbury (619), Alnham (722), Chatton (909) and Thirlwall (905). The respective Crude Birth Rates for these units were: 16.1°/oo, 19.2°/oo, 19.3°/oo, 22.2°/oo 13.2°/oo and 21.8°/oo. The child-woman ratio for the Kielder unit quite obviously reflects the influence of forestry employment in attracting young adults in the reproductive age groups, whilst those ratios for the Alnham and Thirlwall units emphasise the unique nature of these areas when compared to their neighbours. This has already been noted with regard to Figures 5.3 and 5.7. On the other hand, the high ratios for the Newbrough and Chatton units must be seen against the questionable background of a denominator of 17 in the former case and 11 in the latter.

<u>Modified Fertility Ratio</u>

The modified fertility ratio (see above) had an unweighted mean value of 1239. Although, for the same reasons as were considered with regard to the previously discussed measure, individual figures based on the 1966 Census are liable to a possible wide margin of error[1], interesting similarities and differences do present themselves.

For units with a modified fertility ratio of below 1000, a majority again fall into the obviously rural categories with typical

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[1] This is not so great, however, as with the previous measure because of the larger numerical size of the numerator in this case.

examples being those units containing the parishes of Piercebridge (809), Raby (964), Eggleston (902) Rothbury (912), Alwinton (813), Rennington (565), Branxton (833), Norham (955) and Horncliffe (737). Whilst the majority of such examples come from north Northumberland, only eight of the units numbered 125 to 147 (inclusive) on Figure 3.1. are thus included, these tending to be grouped around Alnwick U.D. or along the western borders of the county to the north of Rochester. Institutional populations are again of major importance in some units, particularly Sedgefield (840) and Heighington (809) but whilst other low values are comparable with those for the child-woman ratio (for instance 896 at Ford, 930 at Preston-on-Tees, 938 for Bywell/Broomhaugh and Riding and 976 for Ellington/Lynemouth) the remainder appear rather less straightforward.

The exceptionally low value of 333 for Kelloe is a further manifestation of the remarkable nature of this parish at least in terms of the 1966 Sample Census, whilst the 968 of the Burdon unit, the 873 of the Framwellgate Moor unit and the 879 of the Fishburn unit appear rather more perplexing especially in view of the quite normal birth rates (see Figure 5.7). Two values for the modified fertility index are, however, particularly remarkable. These are the 950 and 862 ratios for the rapidly developing units of Bournmoor/Lambton and Elton/Norton respectively. Having high Crude Birth Rates (24.6°/oo and 26.6°/oo) and child-woman ratios (633 and 600), the present figures at first appear to be extremely surprising. Looking rather more closely at them, it would appear that in both cases the vast majority of women aged 15 to 44 are in fact to be found in the first half of that age group. This is quite markedly reflected in the age groups of persons under 15 with, in the former unit, 38 aged between 0 and 4 but only 19 aged between 5 and 14 and, in the latter unit, corresponding figures of 39 and 17. Hence it would appear that one characteristic of rapidly developing parish units with a high percentage of adults aged 15 to 29, is an overwhelming proportion of children in the 0 to 4 age group as compared to the 5 to 14 one.

Nevertheless, there is quite naturally a marked measure of agreement between the two fertility ratios. Thus, nine of the fourteen units with a child-woman ratio in excess of 600 have a modified ratio above 1500. Of the 24 parish units above the latter figure, all would appear to fall into one of four classes. First, a number of mining units exceed this level, though by no means sufficient to redress the developing conclusion that levels of fertility amongst the mining populations are by no means universally high and, indeed, in probably a majority of cases, nothing more than average. Here, Hylton, Hawthorn/Cold Hesledon, Pittington, Edmondsley/Waldridge, Plawsworth, Horden/Castle Eden, Pegswood and Ulgham have modified fertility ratios which vary between the 1520 of the Horden unit and the 2111 of the Pittington one.

Second, three developing residential units with substantial Local Authority building in the past decade just reach 1500 - Witton Gilbert (1605), Peterlee (1550) and Woolsington (1529). Third, one has the locally dominant effects of institutional and similar populations. The cases of the Woodham (2167), Low Dinsdale (1591) and Cleatlam (1560) units have been referred to elsewhere whilst the effects of educational establishments in Bellingham and Ellingham will have similar results in the 1526 and 1737 values relating to the respective units.

Finally, a varied selection of eight rural units have similar ratios. The effects of forestry appear likely to be dominant in the Kielder (1632) and Greystead (1714) units whilst the Alnham (1833) and Lesbury (1762) units have already been noted in a similar regard above. In addition, high values are now shown by the Rothley (1526), Nunnykirk (1500), Whittingham (1556) and Bowsden (1524) units. None of these much exceed 1500 and it will be noticed that the first mentioned had a particularly low child-woman ratio and, indeed, unlike the other three units, a very low birth rate (11.7°/oo). However, it would merely appear to be an extreme example of what is to be found in the other cases, namely a larger than average proportion of children aged between 5 and 14. In the Rothley[1] unit, for 19 women enumerated aged 15 to 44, there were a mere 4 children under 5 years of age but 25 between 5 and 14 years. On such tenuous evidence it would be questionable to postulate a recent marked decline in the viability of some remote rural populations, but as will be seen in Section 5.9 there is further reason to consider that something of this nature has occurred whether it be a temporary or more long-lasting phenomenon.

None of the three fertility measures discussed above appeared as a particularly diagnostic element in the two factor analyses though rather more of their variance than average was explained by Factor 1 in the R-mode analysis (up to nearly 50 percent in the case of the modified fertility ratio). Only in terms of the Crude Birth Rate did the rural-oriented Factor 2 show a marked deficiency in terms of the amount of the individual variable included in the factor as compared to the overall variance explanation of the factor. With regard to the Q-mode analysis none of the above variables scored at a level of $\pm$ 1.00 or above in any of three main factors.

Despite this poor showing each of the variables correlates at a level of $\pm$ 0.4 or above with several others (Table 5.1). The Crude Birth Rate shows moderate correlations of 0.4 or slightly over with four age indices (percentage of population aged 15 to 44, and aged under 15 in 1966, the proportion of workers aged 15 to 44 in 1961, and the 1961 Census:electoral population ratio). It similarly correlates at -0.45 with the proportion of the population aged 60 or over, at 0.47 with the child-woman ratio and at 0.83 with the C.B.R. - C.D.R. difference variable. The lack of high correlations is, however, somewhat disappointing together with the predictability of many of the relationships which do occur.

The child-woman ratio has a mere three correlation of significance: 0.47 with the Crude Birth Rate, 0.51 with the modified fertility ratio and 0.61 with the proportion of the population aged under 15 in 1966. On the other hand, the modified ratio exhibits several more significant correlations and some of these are rather more interesting, if only slightly less predictable, than the above. Despite the differences noted between unit showings on the two fertility ratios in the preceding analysis, it still appears that the correlation between them is higher than the association of either with the Crude Birth Rate, the modified fertility ratio even failing to reach a correlation of 0.4 here. The correlation of -0.57 with the proportion of the population formed by persons aged 15 to 44, and 0.56 with the dependency index for 1966 are both quite predictable results of high proportions of children whilst the higher r_s of 0.72, with the proportion of the population aged under 15 is no less than might be expected. In addition, however, this variable correlates at

0.41 with the proportion of households containing six or more persons[1] and 0.42 with the proportion of the population who were single in status. The overall level and extent of correlation is, even so, disappointing and serves to reflect the lack of diagnostic properties possessed by those elements in relation to the total variable complex. It would seem that the occurrence of high and low birth rates throughout the 20 Rural Districts in often quite heterogeneous parishes is sufficient to render this, and related fertility measures, considerably less useful as diagnostic properties than would seem to be suggested by the often stated views of high mining but low rural (in consequence of age structure) birth rates.

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[1] A link between overcrowding and the birth rate has been postulated by Friedlander and Silver (1966). Despite this correlation with large households no supporting evidence was found in the present investigation. The relevant levels of r_s between the 1961 overcrowding variable and each of the Crude Birth Rate, the child-woman ratio and the modified ratio were 0.01, 0.18 and 0.15 respectively.

5.8 Mortality

The complement of fertility is quite naturally mortality, these processes being the two most directly involved in the growth of a population. Though by no means so violent in its fluctuations as fertility, the variation of mortality is equally interesting and similarly suited to a geographical treatment. Cox (1950) has noted a number of factors which serve to determine some of the differences in mortality rates. These he termed 'environmental' influences, citing climate, weather, standard of living, housing conditions, population density, industrial development, sanitation, medical facilities, occupation and habits of life. He continues to consider regional variations in the death rate, holding "There will probably have been environmental forces such as climate and soil; these in turn may have determined the principal local occupations, with their attendant risks, and the geography of the area may also have had a bearing upon the degree of urbanization and consequently upon population density" (p.103).

It is, therefore, no surprise that many authors have commented upon a mortality differential between urban and rural areas, especially in the past. The first specific investigation into rural mortality in modern times is probably that of Hill (1925) with regard to the effects of internal migration upon the death rate in Essex. He noted that though the rural areas tended to have lower death rates, the reverse position obtained on occasions amongst the rural residues of the most migratory age groups. More recently Clarke (1972) has stated that "Urban-rural differentials in mortality have long been evident. At one time large cities in Britain were far less healthy than rural areas and suffered from higher mortality..... Now the former urban-rural differential has been either greatly attenuated or removed by improvements in urban living conditions ... regional contrasts in rural rates are also apparent especially between the lower rates of the more prosperous agricultural counties of Lowland Britain and the higher rates of the lower quality farming areas of Highland Britain" (p.124). This conclusion is largely echoed by Murray (1962).

Nevertheless, another recent study (Mann 1965) has concluded that the Crude Death Rate in rural areas is lower than in urban areas, a difference which continues even when allowance is made for age and sex structure. This conclusion has been reiterated in America by

Smith and Zopf (1970) who give five possible causes varying from the lower rural population density, and therefore less infectious disease to the better adaptation of the human organism to a rural area! Whatever the truth of this may be, an investigation solely into urban-rural mortality differentials in England and Wales has concluded: "There is a continuing gradient in favour of rural districts with the large urban districts showing the highest mortality ... The range within which such differences operate has, however, become much less significant in terms of the wastage of human life" (Glass 1964 p.265).

Little analysis of rural mortality has, however, been undertaken at the regional or subregional level though Young (1970) in primarily considering the causes of mortality has noted that in County Durham, age specific mortality rates for Lanchester, Sunderland and Darlington R.Ds were significantly above the county mean, whilst the reverse situation obtained in Barnard Castle R.D. Generally, however, studies of rural population in the North-East have restricted themselves to such generalities as: "Today the birth rate in the rural areas is slightly below the national average and the death rate is above, a reflection of the less favourable age structure of rural areas in general..." (House 1965 p.8). Whilst such a statement may be perfectly accurate as a general view, it will have become apparent from the analysis of fertility that there are wide variations and many exceptions within this overall truth.

Crude Death Rates

Data for deaths by place of normal residence in the twenty Northumberland and Durham Rural Districts were obtained from the monthly returns of the local Registrars to the County Health Departments. Unfortunately, direct comparability with births was not possible in consequence of data for 1964 and 1965 being unobtainable for Northumberland. To obtain a full set of death records for the same two years[1], 1967 and 1968 had to be used. In County Durham, previous boundary changes were complicating factors and here, as a

[1] As with births a two year period was taken in an attempt to reduce minor fluctuations attributable to small populations over a short time span.

best estimate, the two years prior to the alterations were taken. Hence, the rates on Figure 5.8. for units in Sunderland R.D. refer to 1965 and 1966 and those for Elton and Norton in Stockton R.D. to 1966 and 1967. The only other unit significantly affected, however, was Hurworth/Blackwell in Darlington R.D., all the remaining modifications concerning only small parts of parishes and still allowing rates to be calculated for 1967-8, where necessary on a slightly reduced population base.

The procedure for allocating deaths to a parish was identical to that for births. In this instance it was particularly necessary to exclude institutional populations (excluding those attached to defence establishments where full families were present) especially those relating to hospitals and old persons' homes, and the corresponding deaths[1]. Based on lists of institutions whether geriatric hospitals, old persons' homes, approved schools or the like, it is hoped that this has been successfully done[2].

Figure 5.8 shows the resultant pattern. It can be seen that a diverse pattern presents itself as was the case with the birth rate. It is, however, noticeable that a preponderance of units in the three top classes are to be found in the coalmining areas of Durham, particularly Chester-le-Street and Easington R.D. and in a broad tract throughout Northumberland and away from the coalfield and in west Durham. The obviously exceptional belt along the Anglo-Scottish borderlands in Bellingham and Rothbury R.Ds may be related to the low Crude Death Rate in some of the forestry parishes with their rather youthful age structure.

The unweighted mean death rate was found to be 11.1°/oo though the range was particularly large for such a variable being from 2.6°/oo

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[1] This is especially necessary when it is remembered that all deaths in such institutions are considered as having occurred at the place of normal residence where the person has been a patient for six months or more.

[2] Despite the seemingly unimpeachable nature of the data sources, it is interesting to reflect that a fair number of obvious errors were detected. Thus a Carlton (Stockton R.D.) address was found amongst the 1968 returns and transfers for Sedgefield R.D, whilst quite a large number of similar mistakes appeared in some of the more rural parts of Northumberland.

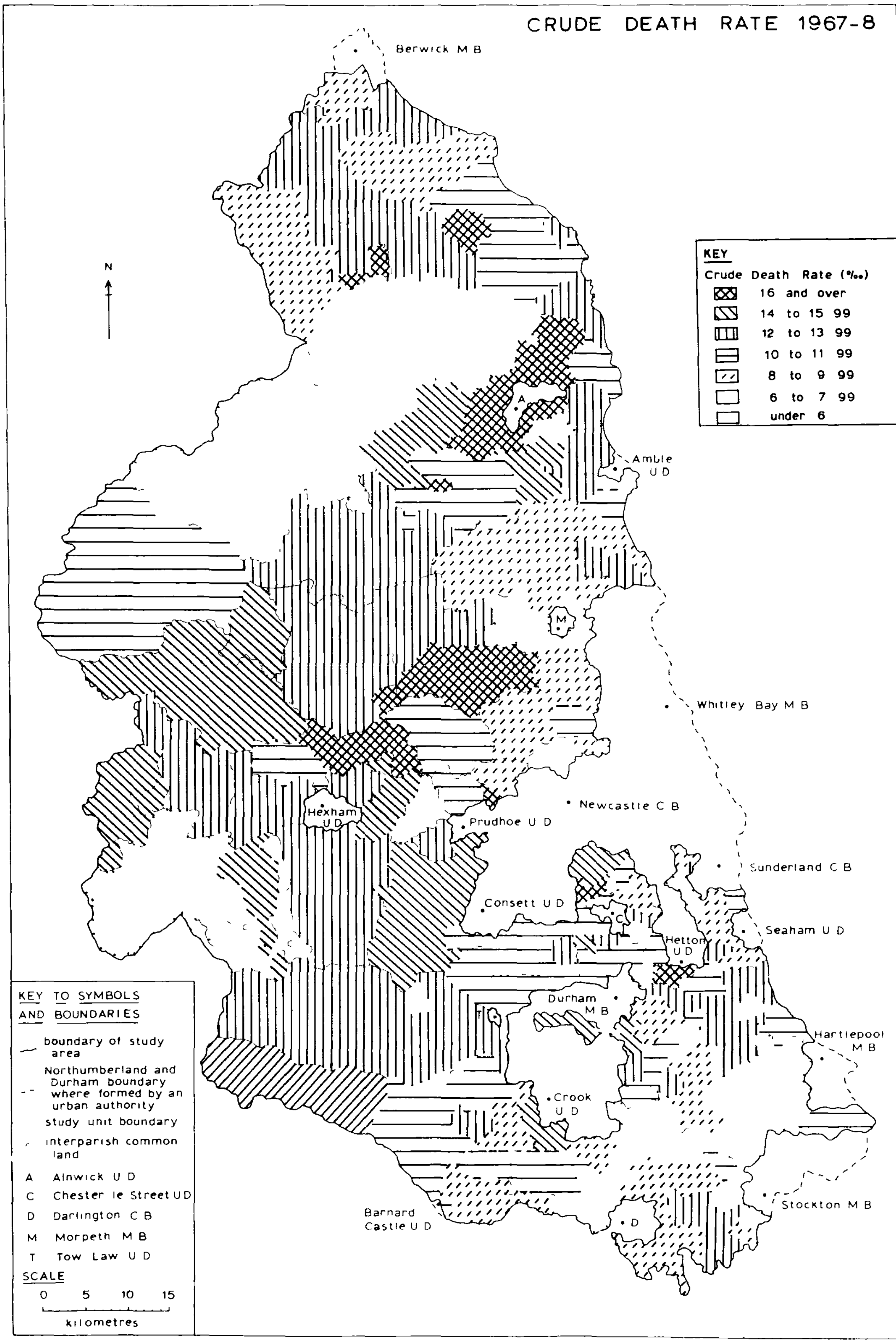
CRUDE DEATH RATE 1967-8
KEY
Crude Death Rate (‰)
16 and over
14 to 15 99
12 to 13 99
10 to 11 99
8 to 9 99
6 to 7 99
under 6
N
Berwick M B
Amble U D
Whitley Bay M B
Newcastle C B
Hexham U D
Prudhoe U D
Sunderland C B
Consett U D
Seaham U D
Hetton U D
Durham M B
Hartlepool M B
Crook U D
Stockton M B
Barnard Castle U D
KEY TO SYMBOLS AND BOUNDARIES
boundary of study area
Northumberland and Durham boundary where formed by an urban authority
study unit boundary
interparish common land
A Alnwick U D
C Chester le Street U D
D Darlington C B
M Morpeth M B
T Tow Law U D
SCALE
0 5 10 15
kilometres

Figure 5.8

to 20.2^{0}/oo. The very lowest rates were quite naturally to be found in units which had typically experienced a large influx of young adults in the recent past. Consequently the lower value noted above was that experienced (1966-7) by Elton/Norton whilst other comparable rates were 6.8^{0}/oo for Offerton/Herrington, 6.1^{0}/oo for Great Lumley, 6.4^{0}/oo for Ouston, 6.2^{0}/oo for Belmont, 4.9^{0}/oo for Peterlee, 5.7^{0}/oo for Great Aycliffe and 6.0^{0}/oo for Woolsington. It will be noted that none of these units had a birth rate for 1964-5 of below 21.9^{0}/oo. Other units with a less marked or earlier population influx show less extreme death rates. Bournmoor/Lambton, Harraton/S. Biddick, Silksworth, the Shincliffe unit, Sedgefield, Preston-on-Tees, Hurworth/ Blackwell, Heighington, Heddon-on-the-Wall, Ponteland and North Gosforth had rates which were generally between 8 and 9^{0}/oo, though in the last mentioned case only 6.5^{0}/oo.

Other units with Crude Death Rates of below 9^{0}/oo tend to be considerably more varied. Thus, units with a high birth rate and partly in consequence, a high proportion of persons in the younger age groups, are represented here. These vary from mining parishes such as Hylton (8.1^{0}/oo), Fishburn (8.4^{0}/oo), Hazlerigg (8.4^{0}/oo) and Pegswood (7.7^{0}/oo), to the purely rural units containing the parishes of Plenmeller (7.9^{0}/oo), Eglingham (8.0^{0}/oo), Alnham (5.9^{0}/oo) and Alwinton (4.8^{0}/oo). In addition, the defence and related populations of the Middleton St. George and Cleatlam units are sufficiently numerous and youthful to reduce the death rate below the average, though only to 8.3 and 8.8^{0}/oo respectively. Other units with a low or average birth rate but higher than normal proportion of the 1966 population aged under 45 also appear with low death rates. Such are the Cold Hesledon (8.5^{0}/oo), Great Burdon (8.0^{0}/oo) and Shilbottle (7.7^{0}/oo) units. On the other hand a residue of units with a higher than average proportion of their populations in the older age groups also appear with low Crude Death Rates. These, however, tend to be relatively few and, in terms of the nature and coverage of the data source, quite explicable thus. The main examples are the Piercebridge (7.2^{0}/oo), Whessoe (8.2^{0}/oo) and Evenwood and Barony (8.8^{0}/oo) units in Durham, and the Hepscott (7.7^{0}/oo, when shorn of institutional influences) and Cornhill (8.2^{0}/oo) units in Northumberland. Finally, however, two units noted in previous sections of this analysis to have possessed paradoxical features, again appear noteworthy. Kelloe with its particularly low proportion of children, still possesses the low death rate of 6.8^{o}/oo, whilst the Tyne valley unit of Bywell/Broomhaugh and Riding with its large proportion of older persons still has the only slightly higher rate of 7.5^{o}/oo.

An individual unit analysis of high death rates shows that they tend most typically to be associated with the truly rural areas confirming the impression gained from Figure 5.8. For example, of the 36 units with a Crude Death Rate in excess of 13.0^{o}/oo, only 14 are found in County Durham. The very highest rates, too, tend to be a rural preserve though it is extremely interesting that Urpeth C.P. (Chester-le-Street R.D.) previously shown to have a low birth rate (13.3^{o}/oo), despite a quite average age structure in the 1966 Sample Census, has the astounding Crude Death Rate of 20.2^{o}/oo, this being the most extreme value in all 147 units after allowances have been made for institutional deaths and populations.

Other rates of 16^{o}/oo or over were found in the Wooler (17.0^{o}/oo), Belford (19.8^{o}/oo[1]), Denwick (16.5^{o}/oo), Rothbury (19.0^{o}/oo), Belsay (16.4^{o}/oo), Wylam (16.1^{o}/oo), Humshaugh (16.4^{o}/oo), Forest and Frith (17.2^{o}/oo) and Pittington (16.5^{o}/oo) units. Of these, only two units lack obvious affinities with the truly rural area. Wylam and Pittington both with a high proportion of persons aged 60 and over form these two obvious exceptions. The inclusion in the above list of a number of the most important settlements in the remoter rural areas (note the inclusion of Middleton-in-Teesdale in the Forest and Frith unit) is particularly noteworthy, reflecting their unbalanced age structure. This may possibly be in part a reflection of Ogle's (1889) view that some high rural death rates are to some extent attributable to "... a slight return current from the towns into the country, consisting of age persons who come back, when their working days are over, to spend their last years in their native air" (p.216).

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[1] This, of course, is after deductions have been made for the Belle View Home. If the population and deaths attributable to this source be included, the Crude Death Rate reaches 24.4^{o}/oo.

Many of the other larger rural settlements have Crude Death Rates which are not much lower, for instance, Ancroft (13.7°/oo), Bellingham (14.2°/oo), Corbridge (14.8°/oo), Haltwhistle (15.3°/oo), Allendale (14.5°/oo), Wolsingham (13.0°/oo), and Stanhope (13.5°/oo). It will be apparent that this forms, together with the above, a fairly comprehensive list of the larger rural centres. Such high death rates are, however, not the prerogative of the larger rural settlements and similar levels of mortality are reached in the Akeld (14.0°/oo), Alnmouth (13.6°/oo), Callaly (15.6°/oo), Felton (14.1°/oo), Greystead (15.8°/oo). Thirlwall (14.6°/oo), Hexhamshire (13.7°/oo) and Healey (14.0°/oo) units. Of these, five units had birth rates well below the average though three were above. All the latter three possessed a higher than average proportion of old persons enumerated in the 1966 Census.

Of the remaining eleven units, mainly in County Durham, five would appear to have high death rates as a direct complement of large proportions of their populations being aged 60 and over, and low birth rates. Easington, Lamesley, Etherley, Acomb /Sandhoe and Broomley and Stocksfield vary between 13.1 and 14.1°/oo and exemplify this category. There does, however, remain a residue of six County Durham units all with population employed in coalmining where the high death rates are not connected with a sizeable proportion of elderly persons or even, necessarily, a low birth rate. Hence, whilst Sherburn and Cockfield have the high Crude Death Rates of 13.7 and 14.9°/oo respectively and have at the same time low birth rates, Ferryhill (C.D.R. of 13.0°/oo), Sacriston (14.4°/oo), Plawsworth (13.9°/oo) and the Sunderland Bridge unit (15.3°/oo) all combine above average death rates with birth rates slightly above normal.

<u>Average Age at Death.</u>

As an extension of this analysis, the average age at death was calculated for each unit over the same period. This particular index is important in its own right for "... the amount of loss to a society, in terms both of potential population growth and of financial loss, is determined to a great extent by the age at which death takes place" (Bogue 1969 p.550). The pattern presented by this index is shown on Figure 5.9. Unlike the distributions found in the analysis of the Crude Birth Rate and Crude Death Rate variables, a clear tendency

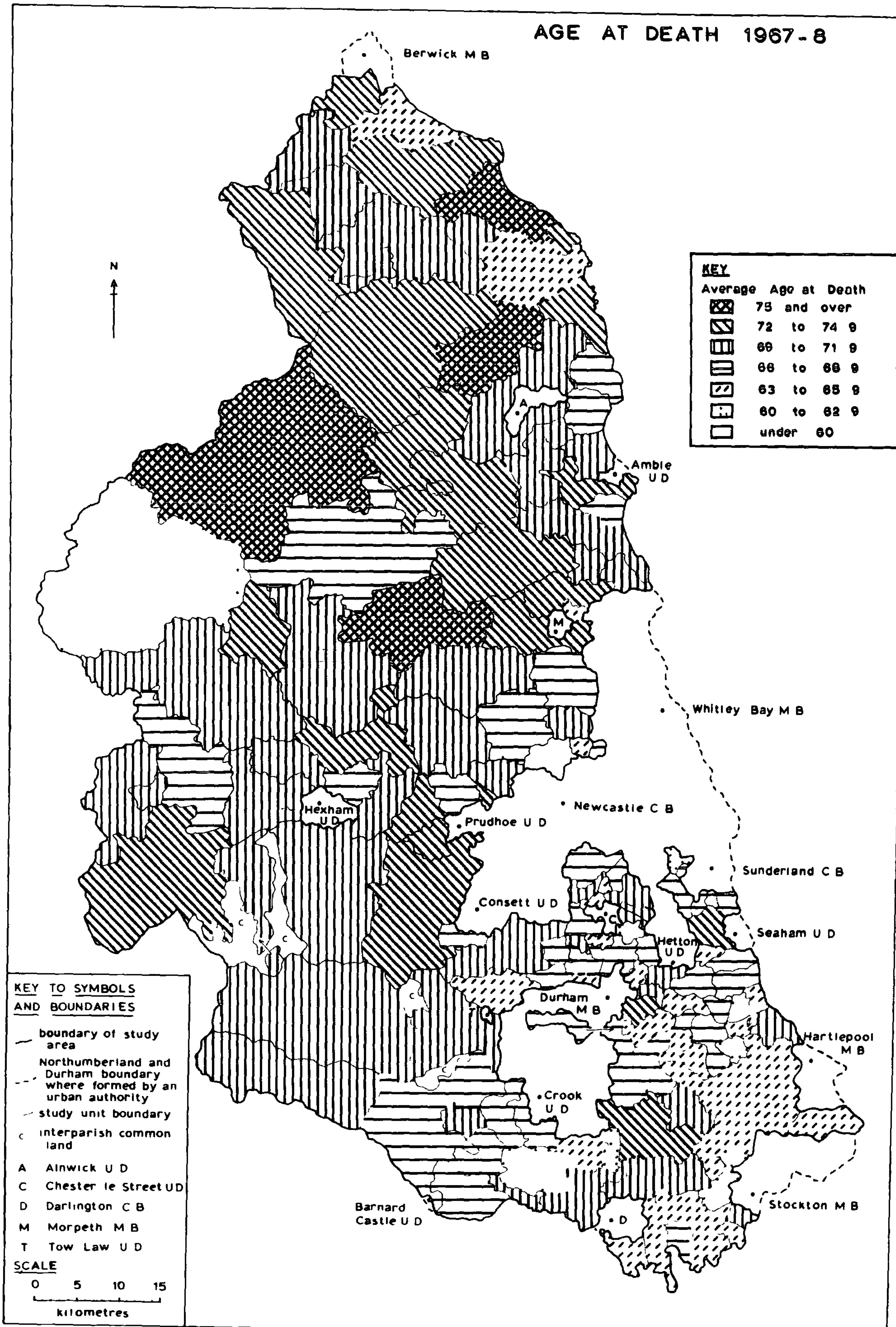
AGE AT DEATH 1967-8
KEY
Average Age at Death
75 and over
72 to 74 9
69 to 71 9
66 to 68 9
63 to 65 9
60 to 62 9
under 60
N
Berwick M B
A
Amble U D
M
Whitley Bay M B
Newcastle C B
Hexham U D
Prudhoe U D
Sunderland C B
Consett U D
Seaham U D
Hetton U D
Durham M B
Hartlepool M B
Crook U D
Barnard Castle U D
Stockton M B
D
C
T
KEY TO SYMBOLS AND BOUNDARIES
boundary of study area
Northumberland and Durham boundary where formed by an urban authority
study unit boundary
c interparish common land
A Alnwick U D
C Chester le Street U D
D Darlington C B
M Morpeth M B
T Tow Law U D
SCALE
0 5 10 15
kilometres

Figure 5.9

is expressed here for the remoter rural areas to have a higher age at death than industrialised or urban-fringe parishes.

The unweighted mean value was 68.4 years of age. However, of the 27 units with an average age at death in excess of 72 years, only three are to be found in County Durham, whilst eighteen are located no further south than Bellingham. This tendency for the remoter rural areas to have a high average age at death has already been noted in earlier correlation analysis (see Section 5.2), when it was hypothesised that differential age structure of the populations may well be the major cause rather than socio-economic or environmental reasons. Such associations will be pursued further in the correlation analysis below. For the moment one may note that of the above 27 units, over half (14) had below average Crude Death Rates whilst one-third had below average proportions of aged persons in their populations[1].

Similarly of 34 parish units experiencing a mean age at death of below 66 years, only six are to be found in Northumberland and of these it may be seen that the urban fringe and mining units of Woolsington (59.8), Hazlerigg (65.1) and Pegswood (63.0) form one half of the occurrences. Only in Ancroft (65.0), the Beadnell unit (64.8) and the Kielder unit (59.7) did values fall below this level in the remoter rural areas. Likewise, in Durham, only the Bolam (55.0) and Grindon (63.7) units may be considered as being truly rural examples of a low average age at death. Far more typical are the increasing values of the west.

Many mining units have below average values with those of Hylton (60.3), East Murton (63.8), Pelton (65.5), Plawsworth (65.3), Bearpark (65.4), Shadforth (64.0), Horden/Castle Eden (64.8), Cassop-cum-Quarrington (65.0), Kelloe (64.8), Hutton Henry (62.9), Trimdon (63.9) and Fishburn (63.4), being the main examples. In addition, developing residential units tend to have lower than average ages at death as in Great Aycliffe (61.9), Hurworth/Blackwell (64.3), Egglescliffe (65.5), Elton/Norton (60.9), Peterlee (53.5),

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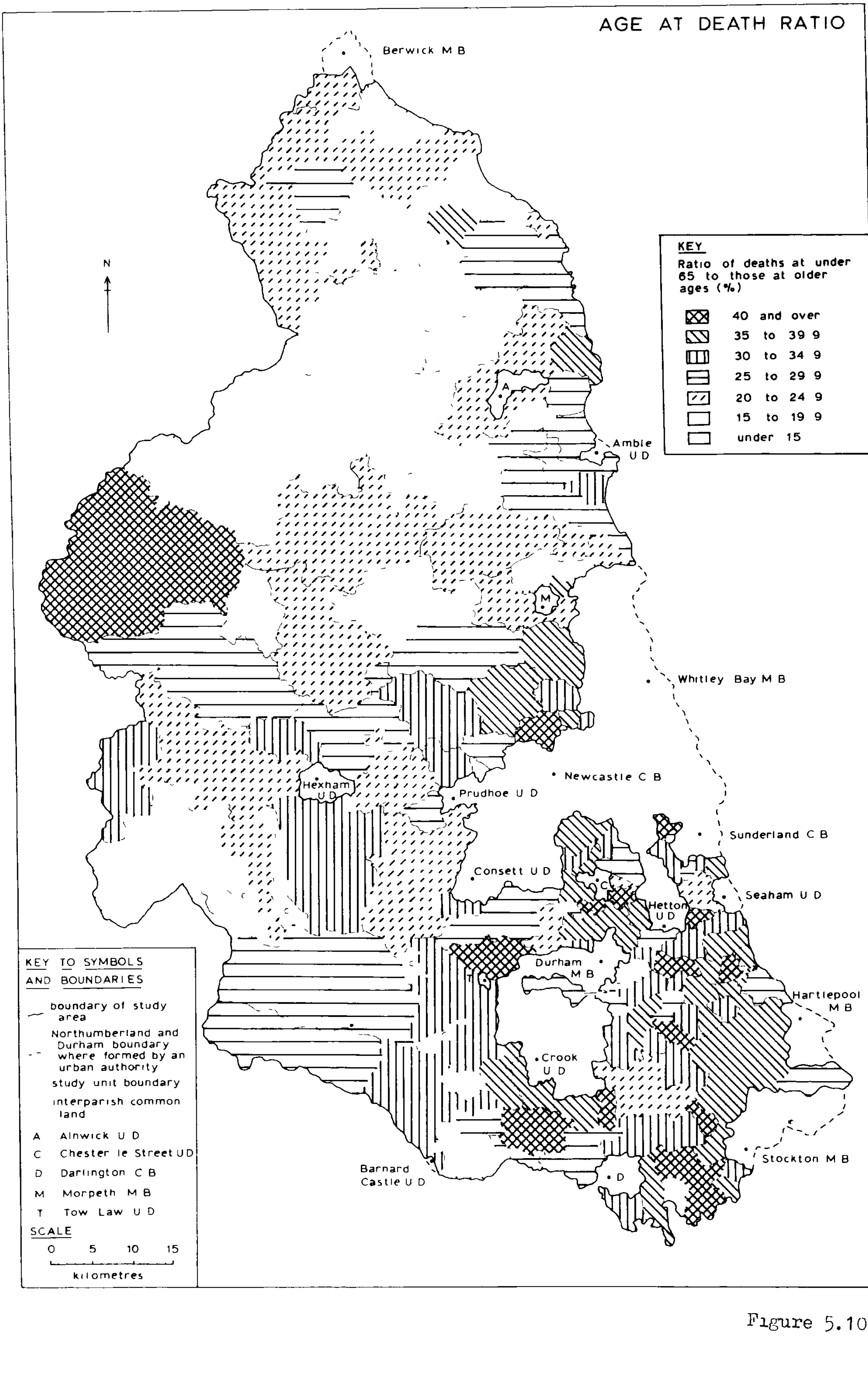
[1] It must, however, be remembered that these proportions are based upon the total 1966 Census sample, including institutional populations, whilst the latter (except for some defence establishments) have been eliminated from consideration with respect to the mortality indices.

Belmont (64.4), Ouston (65.5) and Great Lumley (62.7). To some extent this is only to be expected with such areas having high proportions of young people compared to most of the rural areas. Thus, numerically more deaths may be expected amongst this young population in such developing units, and numerically less amongst the older population, with the average age at death consequently lowered. However, it is interesting to note that similar examples from Northumberland with the one exception of Woolsington are absent. The relationship between age at death and age structure of the population is again, therefore, shown to be unclear and with the comment that eleven and eight of the above 34 units still had higher than average death rates and proportions of elderly people in their populations respectively. Further analysis of this must again be postponed until the discussion of the correlation matrix.

Age at Death Ratio

As a further angle on the above study, the ratio between the number of deaths at below 65 years of age and the number at older ages was calculated, and the resultant percentages may be seen portrayed on Figure 5.10. This ratio has the effect of separating deaths into these two broad categories and showing, as a result, the major differences in the age structure of deaths. A large measure of agreement may be seen to exist between Figures 5.9 and 5.10 with the one being the mirror image of the other. Nevertheless, it is interesting to reflect that whilst all the fourteen units with a ratio above 0.40 (i.e. 40 percent) had an average age at death of below 66 years, the two highest values of 0.53 (Hylton) and 0.55 (the Bolam unit) represent over one-half of all deaths being at an age below 65. In the remoter rural areas values tend to be low although again an anomaly is presented by the forestry unit of Kielder, Falstone and Tarset where 8 out of 20 recorded deaths occurred before the age of 65.

A similar close agreement is shown between units with a death age ratio of below 0.2 (20 percent) and units with an average age at death of 72 years or more. Of the 19 in the former category, 13 are also in the latter, although in one case (Ancroft) the reverse situation obtains. Above it was noted to be one of only two rural



AGE AT DEATH RATIO
Berwick M B
Amble U D
Whitley Bay M B
Newcastle C B
Prudhoe U D
Hexham U D
Sunderland C B
Consett U D
Seaham U D
Hetton U D
Durham M B
Hartlepool M B
Crook U D
Stockton M B
Barnard Castle U D
N
KEY
Ratio of deaths at under 65 to those at older ages (%)
40 and over
35 to 39 9
30 to 34 9
25 to 29 9
20 to 24 9
15 to 19 9
under 15
KEY TO SYMBOLS AND BOUNDARIES
boundary of study area
Northumberland and Durham boundary where formed by an urban authority
study unit boundary
interparish common land
A Alnwick U D
C Chester le Street U D
D Darlington C B
M Morpeth M B
T Tow Law U D
SCALE
0 5 10 15
kilometres

Figure 5.10

Northumberland units having a particularly low average age at death. Now, however, it joins 14 obviously rural units in that county (the remainder being the Shincliffe, Middleton St. George, Cleatlam and Lynesack units in Durham and Wylam in Northumberland) as having one-fifth or less of recorded deaths at below age 65. The difference in the two ratings is solely explicable in terms of two deaths at below age 1 and an accident to a child aged 11, which accounted for three of the five deaths at below age 65 and were sufficient to lower the average age at death to 65.0.

Several pointers to the correlation analysis have already been noted especially the nature of associations with regard to the average age at death. The Crude Death Rate itself has few significant correlations. Those of 0.40 with one or two person households with at least one person of pensionable age (as a proportion of all households); 0.47 with the proportion of 1966 households possessing no family unit, -0.52 with the ratio of 1961 Census to electoral population and -0.44 with the proportion of 1966 households possessing one family unit, obviously exist in consequence of age structure considerations. Thus, for example, households containing no family unit tend to be in this position because of the advanced age of the occupants, in many cases this correspondingly rendering them more liable to death. The correlation of 0.43 with the percentage of agricultural land under rough grazing and common reflects the higher rural Crude Death Rates noted above again caused largely, it would appear, through age structure considerations. Similarly, the correlation of -0.42 with the 1966 longer distance in-migration variable would appear an indirect one but again most likely associated with age structure. The areas experiencing most of this type of inmovement tend to be rapidly developing or recently developed parishes, such as North Gosforth or parishes with defence interest such as Middleton St. George. In both cases, a youthful age structure is the result with the Crude Death Rate correspondingly low. The highest correlation of all (-0.79) is, however, the least interesting reflecting the obvious relationship of the death rate and the difference between itself and the Crude Birth Rate variable.

It is with regard to the average age at death that the most interesting set of relationships appears. Fully 33 variables correlated with this index at, or above, $\pm$ 0.4, although only one reaches above $\pm$ 0.55. This one exception (-0.78) is not unexpected in view of the close relationship already observed between Figures 5.9 and 5.10 and refers to the respective indices. Many of the mass of associated variables relate to age structure, to some extent confirming earlier opinions of this being the major influence on differential average age at death. Thus the percentage of workers who were aged 15 to 44 in both 1961 and 1966; the proportion of the population aged between 15 and 44 and the ratio of 1961 Census to electoral population, all show moderate negative correlations with the average age at death. Likewise, a positive correlation of 0.42 exists with the proportion of the population aged 60 or over. At the same time, however, equally high and some even higher correlations are shown with other critical indices. Density 1961 and 1967 and population potential for 1951 and 1967 all correlate at least at the level of -0.50, whilst distance from the nearest centre of 70,000 or more persons has a coefficient of 0.55 and agricultural employment in 1966 one of 0.51. Other distance and primary employment variables correlate at only slightly lower levels. Despite these slightly higher levels of correlation as compared to the age structure variables, the difference between the two is insufficient to more than suggest very tentatively that the differences in age structure are not entirely the explanation of differences in the average age at death.

Consequently, a number of partial rank correlation coefficients were calculated by use of the formula

$$r_{xy.z} = \frac{r_{xy} - r_{zy}\, r_{xz}}{\sqrt{(1 - r_{zy}^2)\ (1 - r_{zx})^2}}$$

where $r_{xy.z}$ represents the rank correlation of two variables x and y with the influence of a third, z, held constant (Siegel 1956 p.226). Table 5.2 gives the results:

Table 5.2
Results of Partial Correlation

Variable x	Variable y	Variable z	r'xy	r'xy.z
Average Age At Death	Distance from 70,000 or larger Centre	% Population aged > 59 in 1966	0.552	0.458
Average Age At Death	1967 Population Potential	% Population aged > 59 in 1966	-0.520	-0.421
Average Age At Death	Density 1967	% Population aged > 59 in 1966	-0.521	-0.432
Average Age At Death	1966 Agricultural Employment	% Population aged > 59 in 1966	0.506	0.431

It may be seen that although there is a marked drop in the correlation coefficient when the age structure variable is held constant, it still remains above ± 0.4[1]. This would appear to suggest that a considerable proportion of the differences in the average ages at death found in the 147 units can not be explained in terms of differential age structure. There is scope for much further research here.

The remaining correlations of note may largely be related to the above analysis. One may still see the correlations between average age at death and the proportion of the population living at 1966 person per room densities of below 0.5 (0.41); persons per room 1961 (-0.46), and persons per household 1961 (-0.49) as reflecting the older age structure, in many rural areas leading to small household sizes and low room densities, though out-migration, whether age selective or not, would have a similar effect. Other agricultural and employment variables likewise show correlations of ± 0.40 or over; a positive association is shown with the percentage of agricultural land under common and rough grazing, and negative ones with such measures of agricultural intensity as Standard Net Output, all these reflecting the increased age at death in the remoter rural areas

[1] Significance levels for the Kendall partial correlation coefficient are not generally available (Siegel 1956).

where extensive use of poor quality land is paramount. Alternatively, variables typical of the more industrialised parishes in the Rural Districts show negative correlations as in the cases of employment in production 1961 (-0.40), outmovement to work (-0.43), percentage of households renting from the Local Authority (-0.44) and percentage employment in production 1966 (-0.49).

Finally, it is interesting to note that the variables representing the proportion of economically active and retired males in the professional and managerial socio-economic groups in both 1961 and 1966, show moderate correlations with the average age at death. This is noteworthy insofar as many of the units found to have above average values for these variables (for example, Ponteland, Elton/Norton, North Gosforth and Egglescliffe) also have relatively young populations in view of their recent development. Other things being equal, therefore, one would have expected a higher number of deaths among the younger age groups solely in consequence of their numerical preponderence, causing the average age at death to fall. This, however, does not appear to be the case overall, though in some cases (for instance Elton/Norton with its average age at death of 60.9), it is certainly true.

The age at death ratio variable has already been noted to have a high (-0.78) correlation with the average age at death and it is, therefore, not surprising that its correlation structure is very similar to that noted above although in a mirror image form. Perfect correspondence is obviously lacking. Thus some variables which appeared in the average age at death correlation analysis (for example, the proportion of the 1966 population aged 60 or above) now disappear and others (for example the percentage of economically active and retired males in Social Classes 4 and 5) enter, whilst most which appear in relation to both differ by usually 0.02 or 0.03. Despite this, there is sufficient similarity to make further extended analysis unnecessary.

5.9 Vital Rates: An Alternative View.

The analysis of the Crude Birth Rate and Crude Death Rate in the preceding two sections has served to extract the main variations found in the Northumberland and Durham Rural Districts. It will, however, be apparent that the significance of the recorded levels is to a great extent dependent upon the number of occurrences and the size of the base population. Consequently more significance may be read into the Crude Birth or Death Rates for Peterlee, where the base population for 1964-5 and 1967-8 were both over 30,000 as compared to Kelloe where the corresponding figures were only slightly in excess of 1,600.

It is, therefore, considered relevant to explore the significance of the calculated rates. A simple method of effecting this has been described by Howe (1963). He notes that it may be assumed that the standard error of a local Standardized Mortality Ratio is approximately that ratio divided by the square root of the actual number of occurrences. This applies equally in relation to the Crude Birth Rate and Crude Death Rate. A local rate may be taken as being significantly different at the 5 percent level from the national figure when the difference between them is more than twice the standard error of the local rate.

Figure 5.11 reflects the significance of the calculated Crude Birth Rates. Following from the above, the two extreme classes at either end of the scale may be regarded as having significance in terms of local deviations from the corresponding national birth rate. Of the 16 units which deviate positively by two standard errors or more (i.e. had a significantly high birth rate in national terms for 1964-5) none appears to be a purely rural unit. Such high birth rates indeed, fall neatly into three classes. First, one has those units in which the traditionally high fertility of mining areas still shows through. The parishes of Tunstall, Hutton Henry, Pegswood and East Chevington (though note here also the influence of defence and associated population) comprise this category. Second, one has those parishes where much recent building has attracted youthful populations - Herrington/Offerton, Great Lumley, Bournmoor/Lambton, Ouston, Belmont, Peterlee, Egglescliffe, Elton/Norton, Great Aycliffe and Woolsington. Finally, the service populations of the Middleton St. George and Cleatlam units produce significantly high values.

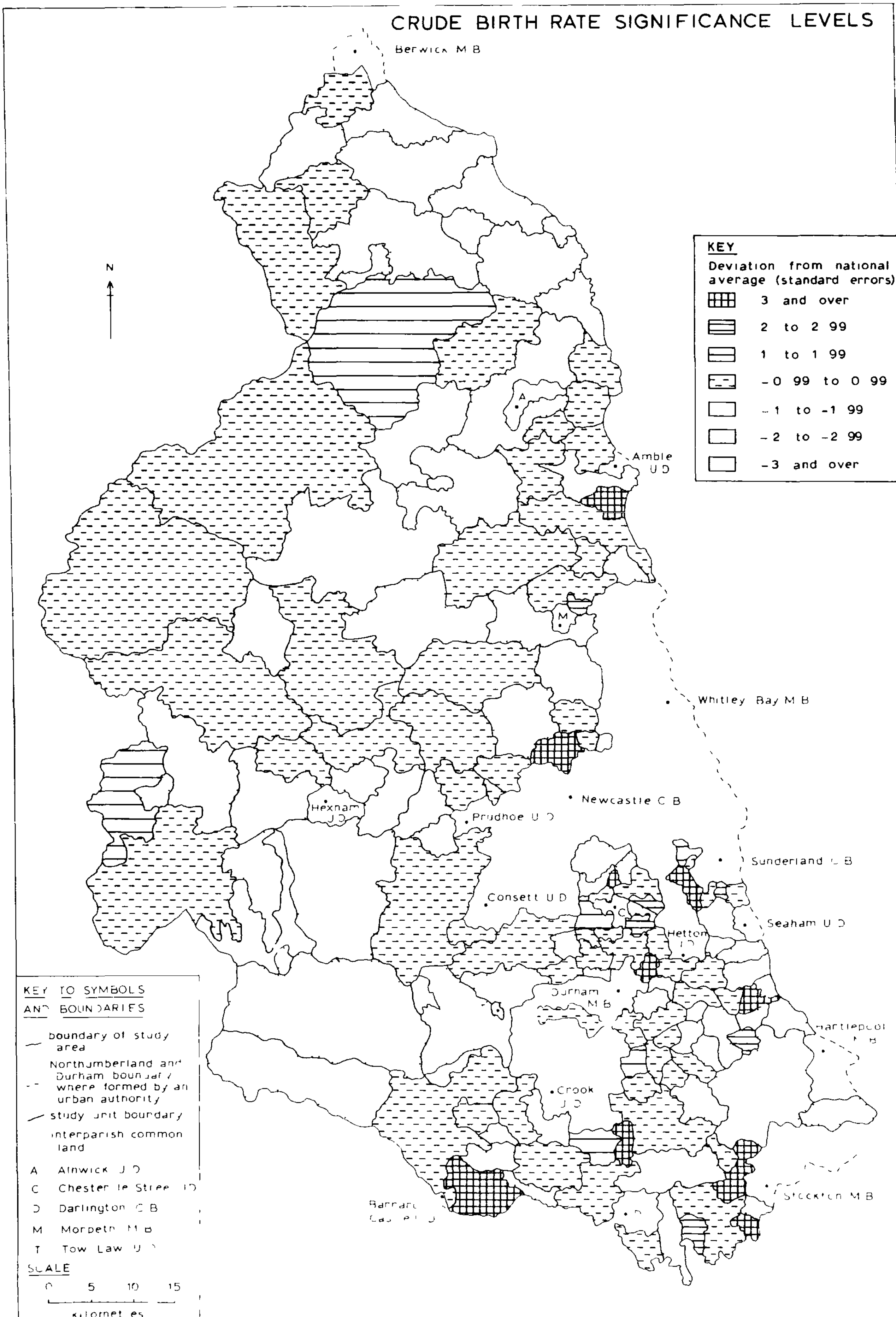

CRUDE BIRTH RATE SIGNIFICANCE LEVELS
KEY
Deviation from national average (standard errors)
3 and over
2 to 2 99
1 to 1 99
-0 99 to 0 99
-1 to -1 99
-2 to -2 99
-3 and over
N
Berwick M B
Amble U D
Whitley Bay M B
Newcastle C B
Prudhoe U D
Hexham U D
Sunderland C B
Consett U D
Seaham U D
Hetton U D
Durham M B
Crook U D
Stockton M B
KEY TO SYMBOLS AND BOUNDARIES
boundary of study area
Northumberland and Durham boundary where formed by an urban authority
study unit boundary
interparish common land
A Alnwick U D
C Chester le Street U D
D Darlington C B
M Morpeth M B
T Tow Law U D
SCALE
0 5 10 15
kilometres

Figure 5.11

It is, however, obvious from Figure 5.11 that the high rural birth rates noted in Section 5.6. in such units as those containing the parishes of Alnham, Milfield and Thirlwall are not sufficiently high to achieve a significant level in view of the actual number of births. Significantly low values on the other hand, are more equally distributed. The Crude Birth Rate in certain of the obviously rural areas appears so, with the Ancroft, Cornhill, Wooler, Akeld, Belford, Bamburgh, North Sunderland, Adderstone, Denwick, Hepscott, Hartburn, Haltwhistle, Allendale, Wolsingham, Stanhope, Forest and Frith, Staindrop, Whessoe and Grindon units forming 19 of the 33 cases. Without doubt tracts in north Northumberland, central Northumberland and the dales' areas of south-west Northumberland and west Durham stand out most clearly as areas of significantly low birth rate on Figure 5.11.

Additionally, however, a number of industrial and mining units have notably low birth rates. Ellington/Lynemouth, Easington, Hawthorn/Cold Hesledon, Lamesley, Horden/Castle Eden, Little Lumley, Wingate, Urpeth, Thornley, Birtley, Greatham/Seaton and the Cornsay unit fall into this category. The remaining two cases are those of Ponteland and North Gosforth where Crude Birth Rates of slightly under 15°/oo are adjudged to be sufficiently low in view of the large base populations to be classed as having statistical significance. Nevertheless, it is apparent that whilst significantly high birth rates are restricted to residential fringe zones, except possibly those with very high proportions of persons in the top social classes and having experienced the major part of their population growth prior to 1961, and mining and service units, correspondingly low birth rates are to be found in many rural areas as well as certain mining-industrial ones.

The comparable significance levels for the Crude Death Rate are shown on Figure 5.12. Significantly low death rates as compared to the national are, as with high birth rates, to be found largely restricted to the less rural areas. Of the 33 occurrences of death rates significantly lower than the national at the 5 percent level, only two are to be found in the remoter rural areas of Northumberland (the Alnham and Alwinton units) though these are well above the critical limit of $\pm$ 2 standard errors. Even in that largely rural

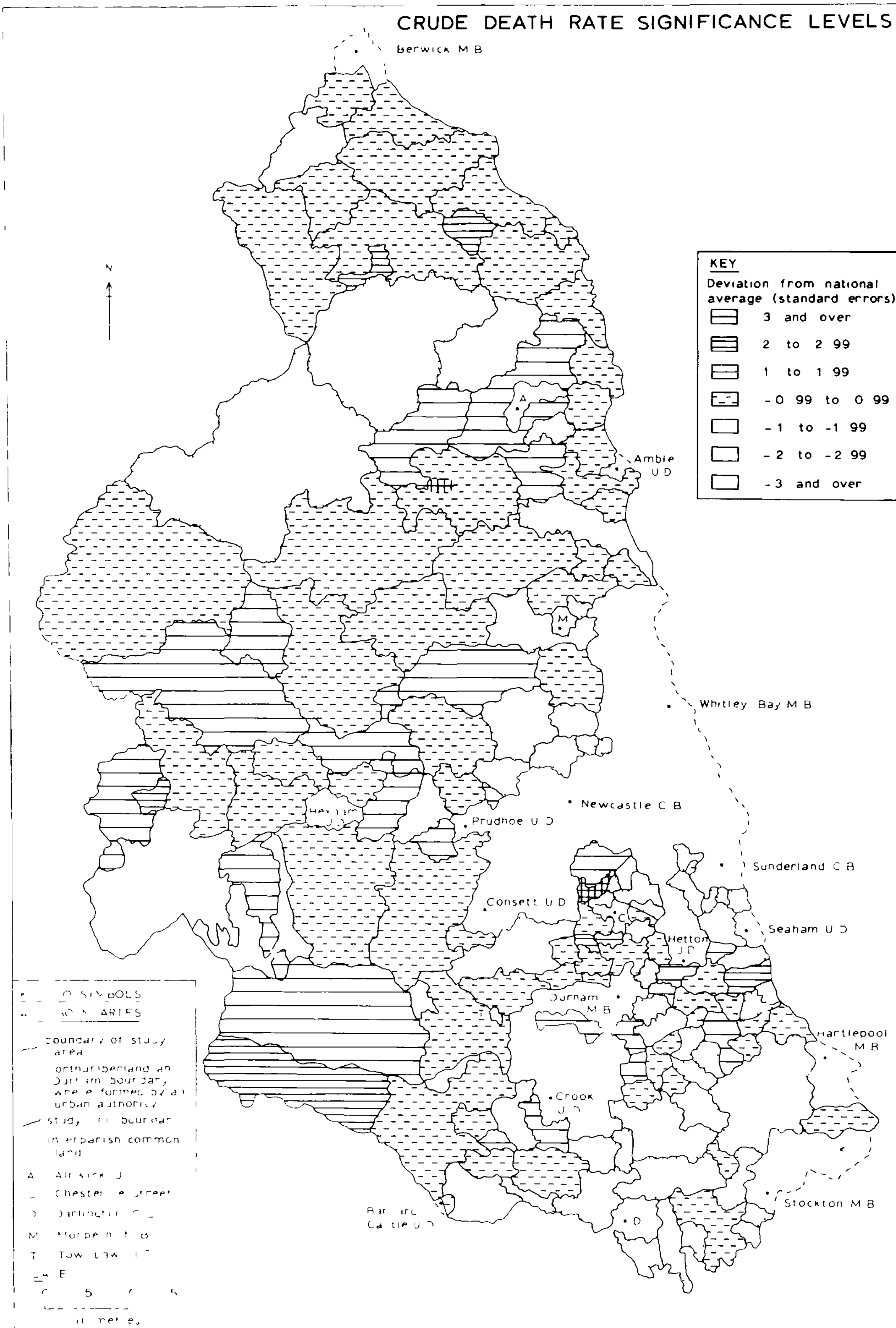

CRUDE DEATH RATE SIGNIFICANCE LEVELS
Berwick M B
KEY
Deviation from national average (standard errors)
3 and over
2 to 2 99
1 to 1 99
-0 99 to 0 99
-1 to -1 99
-2 to -2 99
-3 and over
N
A
Amble U D
M
Whitley Bay M B
Newcastle C B
Prudhoe U D
Sunderland C B
Consett U D
C
Seaham U D
Hetton U D
Durnam M B
Hartlepool M B
T
Crook U D
Stockton M B
D
A
M
T
5

Figure 5.12

county, the majority of occurrences are restricted to residential parishes such as North Gosforth, Woolsington, Ponteland, Heddon-on-the-Wall, and Bywell /Broomhaugh and Riding. The two mining parishes of Pegswood and Shilbottle also intrude. This tendency is reflected in County Durham where only thePiercebridge, Grindon, Woodham and, possibly, Sedgefield units are rural examples. The vast majority is once again formed by growing residential parishes such as Herrington/Offerton, Great Lumley, Ouston, Belmont, Peterlee and Great Aycliffe, though the mining interest is present particularly in Hylton, Silksworth, Tunstall, Cassop-cum-Quarrington, Kelloe, Trimdon and Fishburn.

Significantly high Crude Death Rates are considerably less widespread with a mere eight largely isolated occurrences. Introducing the concept of significances into the analysis undoubtedly militates against many of the quite high rural rates with relatively low base populations and actual numbers of deaths. Even so, rates are still sufficiently high in Wooler, Belford, Rothbury , Allendale and the Middleton-in-Teesdale unit to pick them out as being particularly disfavoured. In addition, three parishes in the coalfield are likewise noted to have death rates above the critical value - Easington, Urpeth and Sacriston.

It would be incomplete if mention were not also made more fully of the relationship between the Crude Birth Rate and the Crude Death Rate. In consequence of the time spans over which the two rates were calculated being different, one can not regard their difference as being a true reflection of natural increase. Nevertheless, the ten parish units with the largest positive difference show a familiar pattern all being situated in County Durham and comprising Peterlee, Elton/Norton, Belmont, Great Aycliffe, Herrington/Offerton, Egglescliffe, Ouston and Great Lumley with, additionally, the two defence dominated areas of the Cleatlam unit (difference 28.3$^{0}/_{00}$) and Middleton St. George (difference 17.7$^{0}/_{00}$). All units with a difference between the birth and death rates in excess of 10$^{0}/_{00}$ show a similar pattern though, in the 16 additions to the above list, nine have a significant mining interest and four are purely rural. These four are, not surprisingly, formed by the units which contain the parishes of Plenmeller, Alnham, Alwinton and Eglingham.

Correspondingly, 21 units had higher 1967/8 death rates than 1964/5 birth rates. Seven of the ten most extreme examples were rural units in Wooler, Belford (the most extreme at -8.5°/oo) Rothbury, Haltwhistle, Wolsingham and the Denwick and Middleton-in-Teesdale units. The remaining three were the declining industrial and mining units of Little Lumley, Urpeth and Greatham/Seaton. It is interesting to reflect that in the remaining eleven units with a death rate excess, Bellingham, Allendale, Stanhope, North Sunderland and Ancroft, are all included showing the critical demographic position in the larger rural settlements.

Because of the defects of the measure, little may be said of the correlation structure relating to it. It is sufficient to note that, except for the obvious close relationships with the Crude Birth and Death Rates, the ten moderate positive and negative associations nearly all reflect population age structure. However, one positive one, that with persons per household 1961, clearly relates directly to the number of births and, therefore, the tendency for areas with a high birth rate to possess larger households, whilst another with the total percentage mobility 1961-6 reflects the connection between high birth rates, low death rates and in-migration to new housing development.

Natural Increase and Decrease.

The rate of population growth is one of the most important single facts concerning the demography of a population affecting both size and composition (Bogue 1969). Though Webb (1963) has noted that from 1921 migration has replaced natural increase/decrease as the major determinant of a population's growth, it is still true that the relationship between births and deaths is of profound importance to a population in terms of its immediate viability. Beale (1964 and 1969) has noted the emergence of the phenomenon of natural decrease in parts of the United States holding that although it may merely be a temporary phase of local population adjustment to resources and being largely caused by age selective out-migration, it would probably last for at least a generation. Moreover "... the stark contrast in population trends and future prospects between the natural decrease counties and the Nation as a whole stands as a reproach to those who tell us that rural and urban differences are no longer meaningful or important". (Beale 1969 p. 99).

Whilst the above analysis of birth and death rates does not give a sufficient base either statistically or temporally to allow further analysis of natural increase/decrease, it will be worthwhile to momentarily depart from the micro-scale in an attempt to assess over a longer period the levels, individual and comparative, of both birth and death rates in the twenty Rural Districts at present under consideration. Figure 5.13 plots the progress of Crude Birth and Death Rates for the Rural Districts between 1951 and 1969. In addition, based upon the Registrar General's Comparability Factors, the rates have been age/sex standardized and North-Eastern urban and national figures given for comparative purposes.

Looking first at the basic crude rates, a fundamental division appears amongst the Rural Districts. In only eight Districts over this period has the Crude Death Rate always been below the Birth Rate - Barnard Castle, Chester-le-Street, Darlington, Durham, Easington, Stockton, Sunderland and Morpeth. Of these, only Barnard Castle is largely rural in character and there the influence of a defence population with associated married quarters is a key factor. Of the remaining twelve Rural Districts, one may discount Sedgefield and Castle Ward insofar as both possess large long-stay hospitals and institutions which contribute significantly to the respective death rates. This, for example, in relation to Castle Ward R.D. is far more likely to be the cause of the remarkable death excess almost throughout the entire period, than the previously stated idea of low fertility through in-migrant populations largely entering when their families had already been completed (Edwards 1963). To some extent, Lee Hill Hospital in Lanchester is likely to exert a similarly misleading influence on the death rates there.

In the nine Rural Districts which have not so far been mentioned, variation is exhibited between the short periods of natural decrease shown especially by Hexham and Alnwick and the much longer periods of decrease in Norham and Islandshires, Haltwhistle, Belford and Weardale. Indeed, the last named has shown a consistent excess of deaths from 1951 to 1969. In many of these areas, moreover, the situation has deteriorated quite markedly in the last few years of the 1951-69 period. Thus, whilst House (1965) was able to note that the

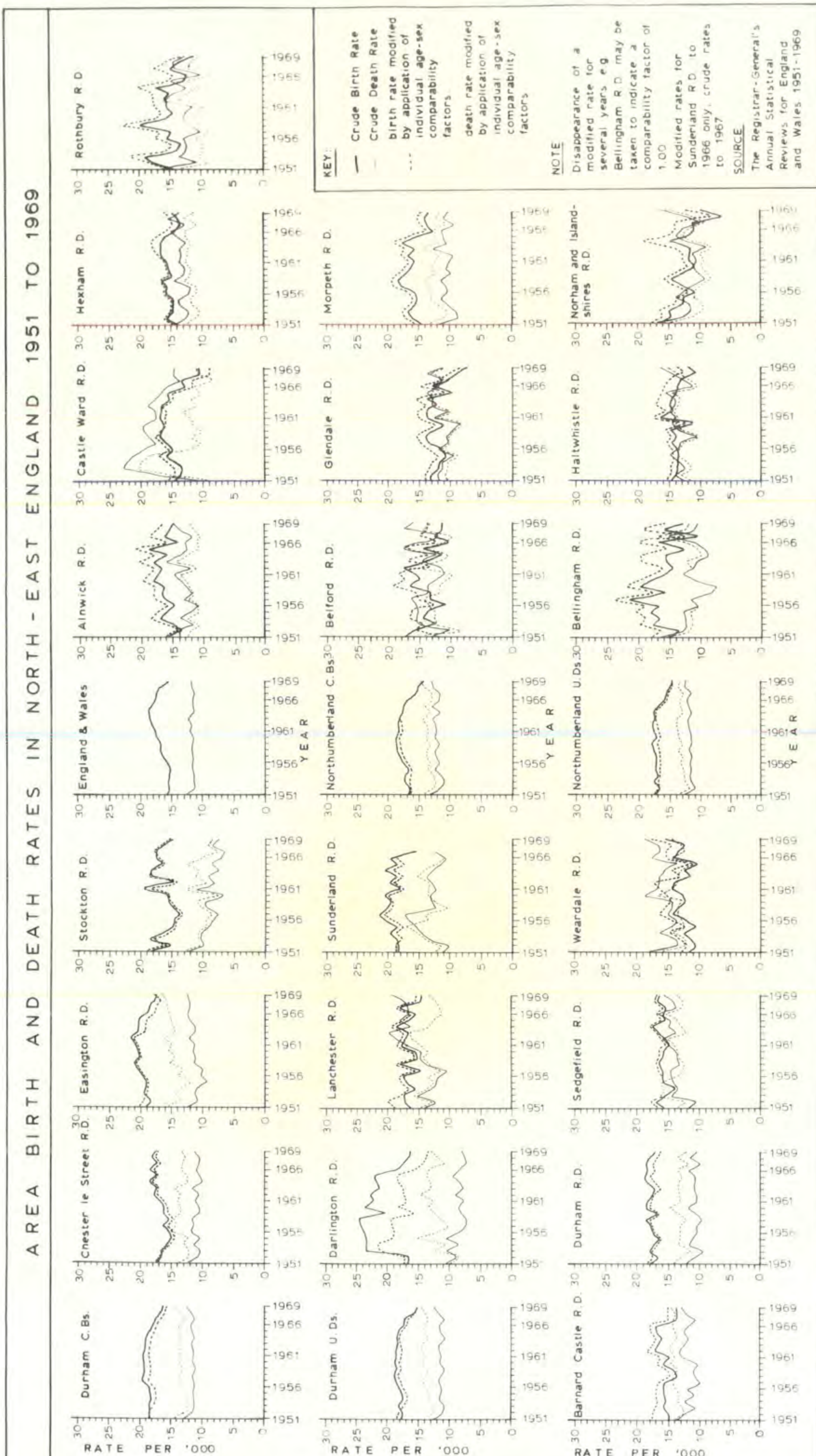

AREA BIRTH AND DEATH RATES IN NORTH-EAST ENGLAND 1951 TO 1969
Durham C.Bs.
Chester le Street R.D.
Easington R.D.
Stockton R.D.
England & Wales
Alnwick R.D.
Castle Ward R.D.
Hexham R.D.
Rothbury R.D.
Durham U.Ds.
Darlington R.D.
Lanchester R.D.
Sunderland R.D.
Northumberland C.Bs.
Belford R.D.
Glendale R.D.
Morpeth R.D.
Barnard Castle R.D.
Durham R.D.
Sedgefield R.D.
Weardale R.D.
Northumberland U.Ds.
Bellingham R.D.
Haltwhistle R.D.
Norham and Island-shires R.D.
RATE PER '000
YEAR
KEY:
Crude Birth Rate
Crude Death Rate
birth rate modified by application of individual age-sex comparability factors.
death rate modified by application of individual age-sex comparability factors
NOTE
Disappearance of a modified rate for several years e.g Bellingham R.D. may be taken to indicate a comparability factor of 1.00
Modified rates for Sunderland R.D. to 1966 only, crude rates to 1967
SOURCE
The Registrar-General's Annual Statistical Reviews for England and Wales 1951-1969

Figure 5.13

population structure of Northumbrian Tweedside was ageing and the Natural Increase Rate declining, Figure 5.13 demonstrates the recent passage into an appreciable decrease. Likewise of other problem areas mentioned by previous authors in this regard (House and Dow 1952, Ironside 1964), Haltwhistle, Weardale and Glendale have recently shown a marked worsening of the situation and only in Bellingham R.D. with its forestry settlements would there appear scope for optimism.

When the crude measures of fertility and mortality are multiplied by the respective Comparability Factors to standardize for age and sex, a remarkable picture emerges (Table 5.3.). Excess modified death rates occur in very few instances. Again, excluding Castle Ward and Sedgefield R.Ds where the standardization procedure almost certainly does not offset the effects of major long-term hospital facilities, such occurrences are largely restricted to Norham and Islandshires, Haltwhistle, Glendale, Belford and Weardale R.Ds. Thus, as Carter (1965) noted in Wales, the more remote areas with much age selective out-migration produce particularly acute problems in terms of their vital rates. If the Registrar General's Comparability Factors can be relied upon in these Rural Districts, it would certainly seem that sporadic decline is occurring both absolutely (ignoring age/sex structure) and relatively (taking age/sex structure into account). Moreover in Glendale, Norham and Islandshires and Haltwhistle R.Ds the excess of the modified death rate over the birth rate has been a feature of the very end of the considered period. In addition, it may be seen from Figure 5.13. and Table 5.3. that it is the least densely populated and more remote Rural Districts which have experienced long periods during which the modified birth rate has been below the national average, although the urban administrative areas have shown a remarkable trend towards the same situation since 1960. High modified death rates, on the other hand, appear to be a particular feature of the urban areas and more industrialised Rural Districts, although Haltwhistle and Sunderland R.Ds provide two different types of exception.

It would seem, therefore, that two main conclusions may be suitably drawn at this point. First, except in isolated areas, as seen in Section 5.6. high rural birth rates have largely disappeared

Table 5.3

Standardized Birth and Death Rates 1951-69

Area	No. of years when S.D.R. ≥ S.B.R.	No. of years when S.D.R. > national[1]	No. of years when S.B.R. < national[1]
County Durham			
Barnard Castle R.D.	0	19	11
Chester-le-Street R.D.	1	19	12
Darlington R.D.	0	13	9
Durham R.D.	0	18	7
Easington R.D.	0	18	5
Lanchester R.D.	0	14	11
Sedgefield R.D.	3	18	9
Stockton R.D.	0	3	12
Sunderland R.D.[2]	1	3	13
Weardale R.D.	5	18	17
All County Boroughs	0	19	6
All Urban Districts[3]	0	19	8
Northumberland			
Alnwick R.D.	0	8	7
Belford R.D.	3	11	13
Bellingham R.D.	0	6	5
Castle Ward R.D.	4	8	14
Glendale R.D.	3	6	19
Haltwhistle R.D.	3	15	19
Hexham R.D.	0	10	16
Morpeth R.D.	0	14	8
Norham & Islandshires R.D.	2	3	15
Rothbury R.D.	0	5	10
All County Boroughs	0	19	8
All Urban Districts[3]	0	19	10

[1] England and Wales

[2] Covers the years 1951-66 only

[3] Includes Municipal Boroughs

and even when subject to age/sex standardization they are often still below the national level. Second, it would appear that high rural death rates (though not the high average age at death) are largely a product of their unfavourable age structure. When standardisation is undertaken it is the more industrialised Rural Districts, which stand out as having the particularly high death rates, though as seen in Section 5.7. some of the parishes in these areas had notably high Crude Death Rates also.

5.10 Conclusion to Chapter 5

The analysis of various demographic characteristics has, in many cases, further exemplified the differences in unit type earlier noted in Chapter 4 and originally postulated in the factor analyses of Chapter 3. Thus, in age structure, there is a clear contrast between the remoter rural units and the rapidly developing urban fringe residential units, with the more industrialised parishes of the coalfield generally falling in between. The particularly disfavoured nature of many rural type units in terms of age structure is a most significant feature of the analyses undertaken here with, furthermore, the large number of old persons often overwhelming the relatively few children to still give a high dependency ratio.

Likewise, the remoter rural units have been found to possess relatively few single persons (lack of unmarried young adults) but many households with no families (aged single person households being quite common). On the other hand, the residential and commuter type parishes tend to show opposite tendencies. Even a characteristic such as sex ratio which appeared not to have diagnostic properties in the analysis of Chapter 3, nevertheless here still shows similar differentiation between unit types. The highest sex ratios are obviously a feature of the residential/commuter type parish whilst the lowest (though often balanced) ratios are to be found in the more obviously rural areas - though note again the higher values along parts of the Northumberland coast north of Amble - and coalfield parishes.

These distinctions continue in the analyses of fertility and mortality undertaken in the present chapter with the breadth of the rural problem in particular becoming clearer. Rural birth rates have been shown to be generally low although many of the coalfield units are not especially favoured in this regard either. In the consideration of the modified fertility ratio in Section 5.7 there is seen a notable lack of children in the youngest ages in the remoter rural areas, this perhaps showing a deteriorating situation in these areas.

Similarly, when mortality is considered, it is consistently found that the highest rates are those of the remoter rural areas though again, coalfield values are not much more favourable. The pattern is only ameliorated by the fact that, compared to the coalfield and residential type units, those in the remoter rural areas appear to have a higher average age at death, a feature which still persists when age structure is held constant through partial correlation. In contrast, the rapidly developing urban fringe units have high birth rates and low death rates, the latter (though generally not the former) shared to a slightly lesser degree by other commuter type parishes of favoured social status which had already an established and substantial population by the beginning of the 1960s.

Perhaps the most serious comment of the present chapter on the demographic situation in the truly rural units is to be found in Section 5.9. The analysis of birth and death rate significance levels reiterates and stresses much of the earlier work on absolute rates. In addition, at Rural District level it is clearly established that by the end of the 1960s those Rural Districts predominantly possessing truly rural type units showed a critical and deteriorating position when a comparison is made of death and birth rates, unstandardised or otherwise.

CHAPTER 6

ECONOMIC ASPECTS OF RURAL POPULATIONS IN NORTH-EAST ENGLAND

6.1 Introduction

It is not difficult to justify the inclusion of a section on economic aspects in a study of rural population, for "....there are economic questions that are so fundamental for any community or nation that they......are of basic concern to all branches of social science" (Bogue 1969 p.213). Amongst the relevant factors, industrial/occupational structure and unemployment are of particular importance. Indeed, as Bogue further notes, much may be inferred about a community if its industrial/occupational composition and other basic facts about its work-force are known. At the individual level, it is undoubtedly true that no other single characteristic reveals so much about the social and economic status of a person as does his occupation.

Moreover, in many rural areas, employment characteristics are of particular importance as "....the most fundamental causes of rural depopulation lie in employment difficulties" (Ross 1967 p.69). The general lack of any alternative employment to agriculture (and occasionally forestry) in many of the remoter rural areas, together with the declining rural labour force, has meant a contraction in employment opportunities. It has long been clear, however, that rather than become apparent through actual unemployment, the problem usually manifests itself in terms of out-migration. Furthermore, the decline in primary employment, which will be discussed in detail in section 6.2, is not to be regarded in isolation, for it has important repercussions throughout the secondary and tertiary sectors. It has been estimated that "....no more than seven men need leave for one more man to lose his job" (Archibald 1967 p.36). Such multiplier effects make it apparent that the decline in rural employment opportunities has a self-reinforcing effect, and a spiral of events may well result.

The present chapter seeks to examine economic aspects of rural populations in North-East England from five points of view. First, the employment structure of the various unit populations will be discussed under the major industrial headings of agriculture, mining, production and services. Second, a brief consideration will be given to unemployment in rural areas. Third, various other structures pertaining to the labour force will be noted, particularly in relation to its age structure. Fourth, aspects of the journey to work in rural areas will be developed. Finally, a number of agricultural factors will be selected for further study.

6.2 Rural Employment Structure

Data for this consideration of employment have been derived from three sources. The vast majority is, of course, related to the two Censuses of 1961 (Schedule D statistics) and 1966, whilst, in addition, the June Agricultural Census returns of the Ministry of Agriculture have been utilised particularly for the discussion of agricultural employment change.

(i) Agricultural Employment

Employment data from the two censuses (1961 and 1966) mentioned above relate to the industry concerned. For this purpose agriculture incorporates the normal adjuncts of forestry and fishing in addition to orthodox farming. Various elements of the primary employment structure were discussed in section 2.3 with the relative influences of agriculture, forestry and fishing noted, though the last mentioned could only be subjectively assessed being entirely omitted from the available parish employment figures. Moreover, whereas in section 2.3, the agriculture and forestry employment statistics related to workplace, here the corresponding figures deal with resident population.

It is naturally impossible to separate out the relative importance of the constituent elements (agriculture, forestry and fishing) from the available data. However, once again reference may be made to section 2.3 on this matter. A number of general points regarding forestry and fishing employment in the rural North-East may nevertheless be made here. It has been estimated that slightly over 12 percent of Northumberland and slightly under 5 percent of Durham were covered by effectively managed woodland in 1967 (NEPC 1967). Both in terms of location and employment such areas are very localised particularly along the Northumberland Anglo-Scottish borderlands where planting began at the major Kielder Forest in 1923. When compared to agriculture the volume of employment generated through forestry is small. Thus, compared to a regular whole-time agricultural labour force of nearly 9,000 in the geographical counties of Northumberland and Durham in 1966, it has been estimated that the comparable forestry labour force consisted of about 2,000 full-time employees (NEPC 1967). Moreover, the former figure would quite naturally be considerably augmented if account were also taken of part-time and casual workers and farmers themselves.

Nevertheless a number of authors have regarded forestry employment as a possible partial palliative for rural depopulation. Many, for example, note the greater per acre employment of forestry as compared to agriculture (Taylor 1949, Mobbs 1955, DES 1966, Openshaw 1966). It would, however, appear that this can do no more than very marginally lessen the net volume of rural depopulation. Some early estimates as to the numbers likely to be employed in the developing forestry areas of Northumberland were considerably overestimated. Thus, looking solely at the North Tyne area, House (1952) considered that forestry would soon take over from agriculture as the main employer with a labour force of about 2,000. However, as Ironside (1964) later pointed out, such figures as this were soon proved far too optimistic ; he considered a 50 percent lower level more realistic. Similarly, House (1965) soon realised that his earlier figures (based upon official estimates) were considerably in error. Moreover, in reviewing the progress of forestry in the Northern Region, the Report "Challenge of the Changing North " (NEPC 1966) saw a small rise in the planted area likely by 1981 with far greater rises in output as the woodlands reached maturity. Despite this, the conclusion reached was not encouraging in employment terms : "...with rising productivity , increased mechanisation and the streamlining of output for new bulk markets, forestry employment is expected to remain relatively steady despite larger output programmes " (NEPC 1966 p.18). Consequently, though forestry may employ five or six times as many men as hill sheep farming, Ross (1967) is of the opinion that ".. potential employment offered by forestry is specialised and limited and is unlikely to solve the major rural problems following upon declines in agricultural manpower " (p.36).

Little may be added by way of comment to what was said in section 2.3 regarding fishing employment in rural areas. One may merely note that only Seahouses, Boulmer, Holy Isle, Beadnell, Craster, Newton-by-the-Sea and Alnmouth have a fishing concern of any importance in the rural study area. Though in the mid-1960s it is likely that a fair amount of activity albeit very localised took place from these ports (Ross 1967) it is important to note that decline has here been evident in more recent years particularly at Seahouses where pleasure trips relating to the developing tourist industry have assumed some importance.

Finally, therefore, one may come to consider rural North-East England in terms of its overall primary (agriculture, forestry and fishing) employment, within which agriculture is the undoubted predominant influence. Figure 6.1 depicts the proportion of the workforce employed in agriculture (in its full primary employment sense). Despite the

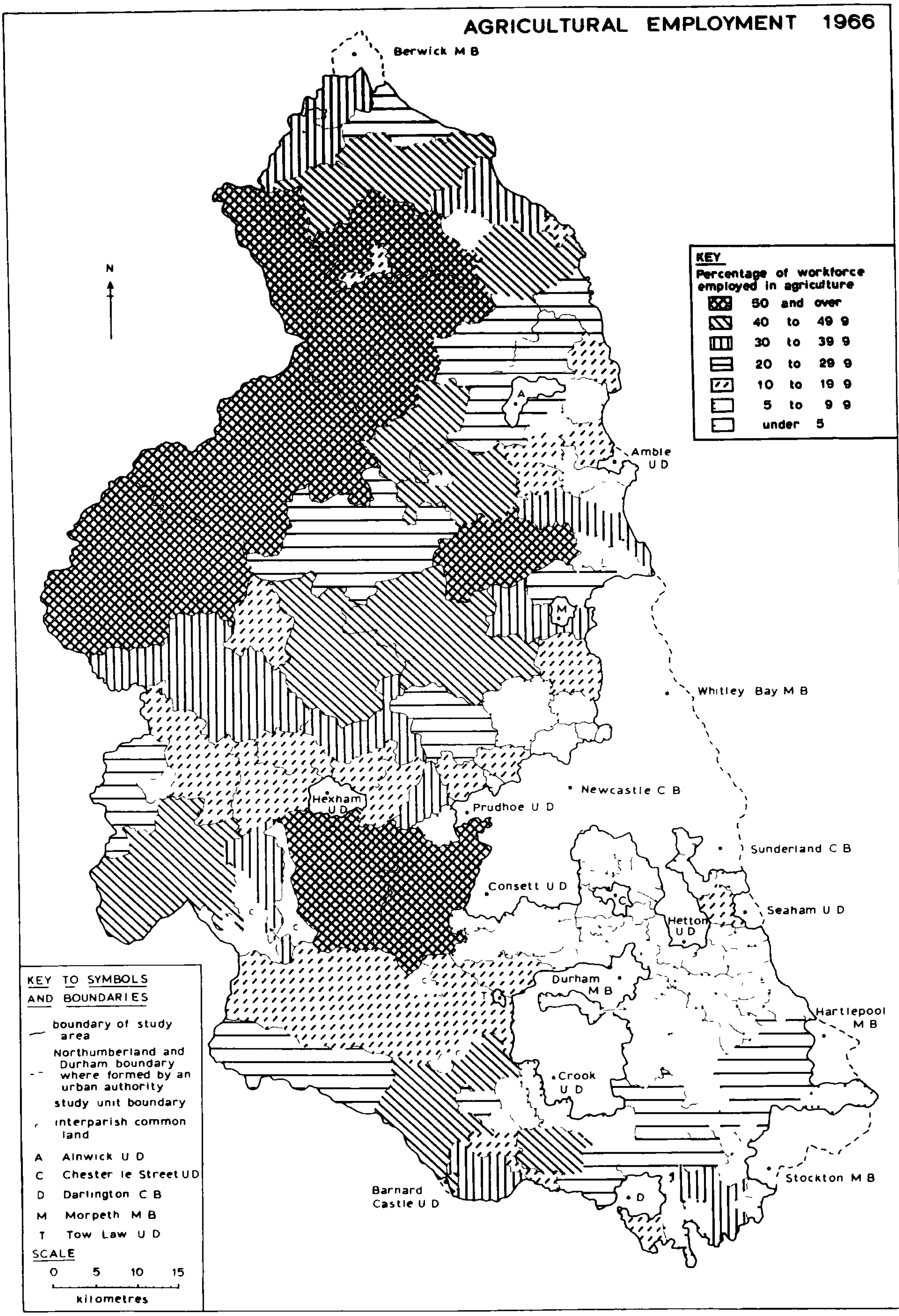

AGRICULTURAL EMPLOYMENT 1966
Berwick M B
N
KEY
Percentage of workforce employed in agriculture
50 and over
40 to 49 9
30 to 39 9
20 to 29 9
10 to 19 9
5 to 9 9
under 5
A
Amble U D
M
Whitley Bay M B
Newcastle C B
Hexham U D
Prudhoe U D
Sunderland C B
Consett U D
C
Seaham U D
Hetton U D
Durham M B
T
Hartlepool M B
Crook U D
Stockton M B
Barnard Castle U D
D
KEY TO SYMBOLS AND BOUNDARIES
boundary of study area
Northumberland and Durham boundary where formed by an urban authority
study unit boundary
interparish common land
A Alnwick U D
C Chester le Street U D
D Darlington C B
M Morpeth M B
T Tow Law U D
SCALE
0 5 10 15
kilometres

Figure 6.1

differences between this measure and that adopted in Figure 2.3, a very similar pattern may be noted, with maximum values largely restricted to north and west Northumberland and the most extensive tract of low values covering north, central and east Durham. Both Bogue (1969) in relation to the USA, and Robertson (1961) in relation to England and Wales, give figures of slightly over 60 percent as type values for agricultural-rural areas. In the present study, however, only eight units attained 50 percent or more of their workforce being employed in agriculture. These units were those containing the parishes of Blanchland (51.5 percent), Alnham (51.9 percent), Nunnykirk (60.5 percent), Alwinton (62.2 percent), Kielder (61.8 percent), Healey (63.0 percent), Branxton (64.3 percent) and Akeld (69.4 percent). Indeed, if one lowers the level to 40 percent, thus reaching a value which Robertson (1961) considered reasonably typical of a rural area, only 11 more units are included, nearly entirely from central, north and west Northumberland. A mere two examples are to be found from Durham - the Bolam unit (41.3 percent) and the Hamsterley unit (46.8 percent).

A further feature worthy of comment is the wide range of values found amongst the rural nodes in Figure 6.1. Whilst agriculture employs just under 40 percent of the Allendale labour force, values of between 17 and 26 percent are to be found in the Middleton-in-Teesdale, Stanhope, Bellingham and North Sunderland units. However, considerably lower values are to be found in Wolsingham, Wooler, Rothbury, Belford and Haltwhistle, the last mentioned a mere 2.3 percent. Whilst Guy's (1969) conclusion of an inverse relationship between size of settlement and dependence upon agricultural employment is undoubtedly true, the range here would appear surprisingly large.

At the other end of the scale many units are noted to possess under 5 percent of their labour force in agriculture. Of these, 21 have under one percent thus employed. The division between the two counties is once again particularly marked with only two such values (North Gosforth and Woolsington) to be found in Northumberland. The vast majority of occurrences is restricted to County Durham mining parishes such as Hylton (0.6 percent), Silksworth (0.7 percent), Pelton (0.4 percent) and Coxhoe (0.5 percent).

Three final factors apparent on Figure 6.1 deserve mention. First, the area of relatively low agricultural employment percentages around Alnwick stands out clearly, particularly along the coast, even though fishing is now included in the figures. Once again, the similarity with Figure 2.6 is striking and the relevant comments in section 2.3 appropriate. Second, the remarkable band of moderate values, compared to the flanking higher ones, is noteworthy between Heddon-on-the-Wall and Haltwhistle, once again demonstrating the existence of this Tyne valley commuter corridor. Finally, the moderate values of south Durham, even on a unit basis, stand out clearly amongst the surrounding lower ones. Indeed, over one-quarter of the Elwick Hall workforce was employed in agriculture according to the 1966 Census. This again corroborates what was discovered on a parish basis in section 2.3.

Change in Primary Employment

It is well known, however, that the agricultural labour force is experiencing severe contraction at the present time, and the effects of this have long been **felt** in the rural areas of Durham and Northumberland. Economic historians tend to place the start of the great decline in agricultural employment in the late eighteenth century, commonly about 1870 (Court 1964) though Hirsch (1951) has traced the history of the problem as far back as 1349 ! The causes of the modern movement are not difficult to find : ".. in the great prosperity, and the general rise of wages of the manufacturing and mining districts; in the fact that labourers were tempted by the higher wages in the towns, and on work on the railways....."(Eversley 1907 p.280). Thus the number of labourers fell from nearly one million in 1861 to only slightly over 600,000 by the turn of the century (Ernle 1961). Likewise, the great increase in the use of mechanical power on farms during the twentieth century has undoubtedly contributed to substantial labour saving since (Ashby 1935).

In the post-1945 period, much the same factors have been operative, and Wibberley (1950) is one of many to have noted that the time has passed when the farm worker would be satisfied with fewer rewards, amenities and opportunities than the urban industrial worker. The push factors of more efficient labour usage and mechanisation and the pull factor of the attraction of urban areas have continued to operate without hindrance. After the wartime increase in the numbers of farm workers therefore, decline soon set in and since 1949 the fall may be considered particularly rapid (Hirsch 1955). Thus Warriner (1960) in noting the 22 percent fall in the agricultural labour force between 1949 and 1958 felt that the post-war rate of decline in manpower was as severe as during the agricultural depression at the end of the nineteenth century. Striking declines are noted elsewhere, for example the fall in full-time male and female agricultural workers from 553,000 in 1951 to 3[illegible]3,000 in 1964 (RSA 1965). This was proportionately greater than the fall in the whole labour force and has led to the obvious conclusion that ".. the reduction in the number of regular whole-time workers and the increasing relative size of the part-time seasonal and temporary labour force suggests that farmers have been replacing men by machines, or replanning and simplifying their farming systems, so that they can manage with fewer workers. It also suggests that farmers, and in particular horticultural growers, are becoming increasingly dependent on casual workers to cope with the busy seasonal peak labour periods "(MAFF 1965 p.8). Developing technology and the great post-war increase in labour costs are considered by Saville (1957) as the prime determinants of the growing substitution of capital for labour costs on Britain's farms.

Recent developments give no indication of a change in the above forces. Black (1968) has noted the continuing lag of agricultural behind industrial wages whilst the large increase in labour productivity but considerably smaller one in agricultural output are "... reflected in the heavy outflow of labour from agriculture, with no benefit in relative earnings to the workers remaining "(p.62). This stands in stark contrast to earlier hopes and expectations of an agricultural industry paying wages equally as high as industry (Smith 1955). A continuing potential surplus of agricultural workers has even been postulated (Marsch 1960). On the regional scale this gains credence from the 1955-65 loss of 9,000 persons from the agricultural labour force in the Northern region and the forecast of slightly over 1,000 in the following few years (NEPC 1967).

From this, one may turn to look more closely at the study area in terms of the change in its agricultural labour force. Between 1956 and 1966 regular whole-time employees in agriculture fell from 5,789 in County Durham to 3,717 and from 7,446 in Northumberland to 5,152. These declines were of 35.8 percent and 30.8 percent respectively compared to the Northern Region figure of 31.4 percent and a national one of 35.2 percent (NEPC 1967).

Quite obviously all rural areas are affected. In an attempt, however, to distinguish any marked patterns in the nature of overall primary employment change over a short but in terms of this study, critical period, the 1967 primary (agriculture and forestry) employment total attributable to a parish unit was expressed as a percentage of the corresponding figure for 1963. Figure 6.2 shows the resultant distribution. The

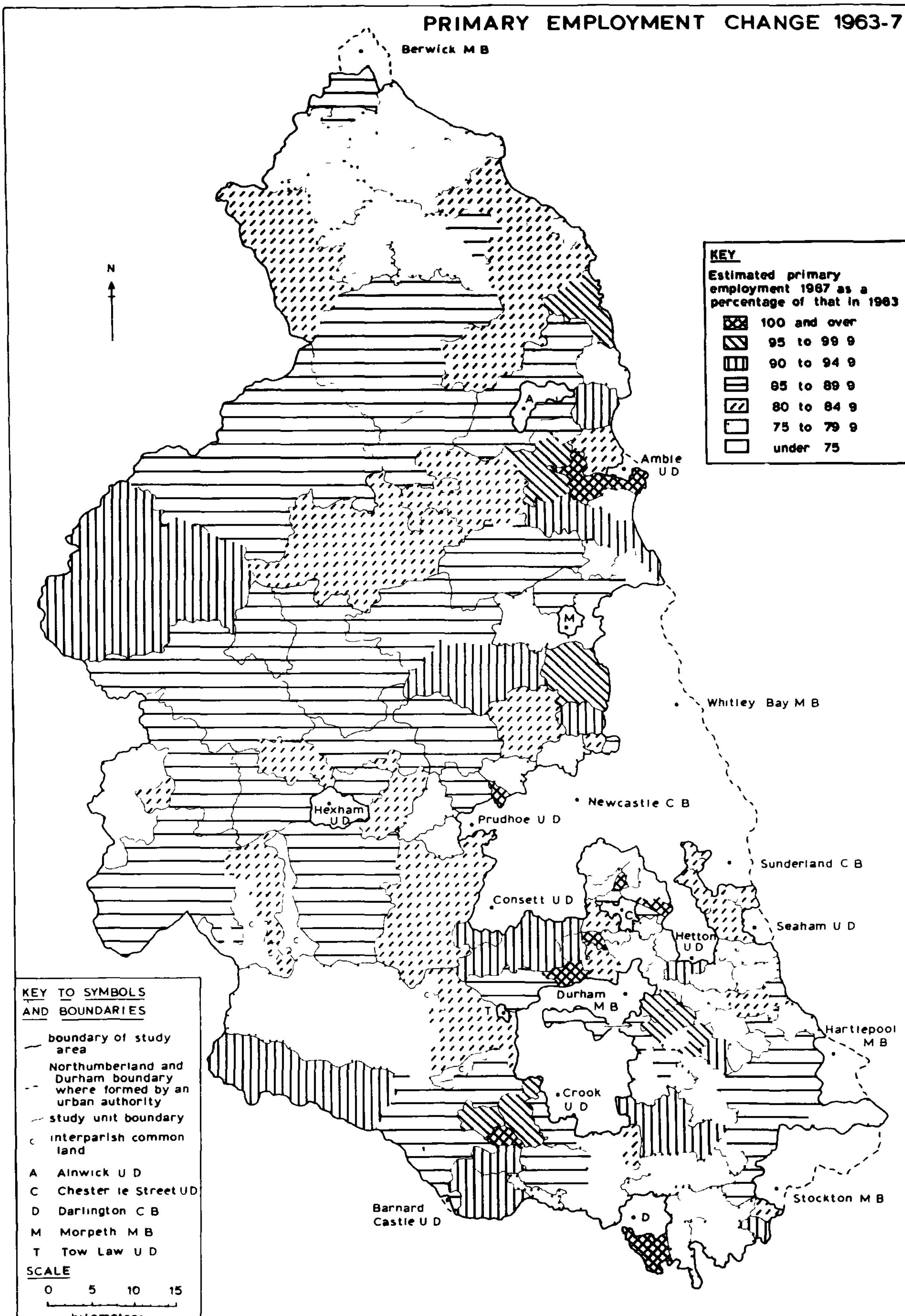

PRIMARY EMPLOYMENT CHANGE 1963-7
Berwick M B
N
KEY
Estimated primary employment 1967 as a percentage of that in 1963
100 and over
95 to 99 9
90 to 94 9
85 to 89 9
80 to 84 9
75 to 79 9
under 75
A
Amble U D
M
Whitley Bay M B
Newcastle C B
Hexham U D
Prudhoe U D
Sunderland C B
Consett U D
C
Seaham U D
Hetton U D
Durham M B
T
Hartlepool M B
Crook U D
D
Stockton M B
Barnard Castle U D
KEY TO SYMBOLS AND BOUNDARIES
boundary of study area
Northumberland and Durham boundary where formed by an urban authority
study unit boundary
interparish common land
A Alnwick U D
C Chester le Street U D
D Darlington C B
M Morpeth M B
T Tow Law U D
SCALE
0 5 10 15
kilometres

Figure 6.2

unweighted mean value for 1967 represents a decline in this primary labour force, of 16.5 percent. This is a significantly high figure when it is compared to the 19.9 percent decline in the purely agricultural labour force 1951-61 in the rural areas of the North-East which were considered by Edwards (1963). Much variation is, however, exhibited. Three main areas of markedly above average loss appear - north Northumberland, south Durham and the Durham coalfield. The first mentioned with its arable emphasis has been previously noted as an area of great decline in the agricultural labour force, particularly in the area of the Tweed valley (Edwards 1963, Ross 1967). This process, it seems, continues unabated, Perhaps more noteworthy is the extent of above average loss in the Durham coalfield, an area in which agricultural employment has little relative significance. Away from these three areas, marked declines are isolated, though several mining parishes in Northumberland form a small subsidiary zone.

Overall there is a clear predominance of mining units amongst those which saw the largest declines in agricultural and forestry employment. Of the 29 units with under three-quarters of their 1963 primary employment remaining in 1967, 20 are to be found in County Durham, and the overwhelming majority of these are typical mining parishes. The most severe declines were in Harraton/South Biddick (- 52.1 percent) and Fishburn (-38.6 percent). In Northumberland only one value is greater than that for Fishburn with the East Chevington agricultural employment falling by half. Elsewhere in Northumberland the most severe falls were in the order of 25 to 35 percent and were largely divided between mining units such as Ulgham, Ellington/Lynemouth and East Chevington, and parishes containing some of the larger rural settlements such as North Sunderland, Wooler and Ancroft.

Two main areas appear on Figure 6.2 where primary employment was retained at a level of 90 percent or over. Many units in north and central Northumberland fall into such a category, whilst parts of Barnard Castle R.D. have already been noted (see section 2.7) to be of this nature. In addition, some of the urban fringe units which have experienced recent rapid population growth, also saw little, if any, decline in primary (largely agricultural) employment between 1963 and 1967 in consequence of intensification. Of the mere seven units with greater primary employment at the latter date, four (Ouston, Bournmoor/Lambton, Hurworth/Blackwell and Wylam) may be considered in this category. The remaining three (the Cockfield, Esh and Acklington units) perhaps not insignificantly all possess mining employment, with land reclamation a possible cause.

The importance of the agricultural employment variables was found to be paramount in Factor 2 of both the Q and R-mode factor analyses.

Consequently, it is with some interest that a discussion of the relevant correlation matrix is approached with regard to the variables representing 1961 agricultural employment, 1963 primary employment and 1966 agricultural employment.

The first feature of note is the high degree of association between each of these three indices, all the three relevant correlations being over 0.9. This bears out the already noted close link between the primary employment variable (derived from the June Agricultural Census Returns and Employment Exchange forestry employment totals), and the two straightforward agricultural employment percentages (taken from the 1961 and 1966 Censuses of Population).

As a result, all three variables have a common pattern of correlation. A particularly full set of correlations is apparent from Table 6.1. The highest correlations, generally over 0.9, are the negative ones with the density variables for 1951, 1961 and 1967. The correlation between density 1961 and primary employment 1963, reaches the remarkable level of $r_s = -0.97$. Many other coefficients lie between $\pm$ 0.6 and 0.8. Thus, the distance variables, excluding that from the centre of population potential, generally reach 0.6, though the variation is between 0.53 (distance from nearest settlement of 70,000 persons or more, and 1963 primary employment) and 0.68 (distance from a centre of 7,000 or more persons and 1966 agricultural employment). Extremely clearly reflected, therefore, are the inverse relationships between primary employment on the one hand, and density and proximity to urban centres on the other. As might be expected, both population potential variables (for 1951 and 1967) correlate at high negative levels.

In terms of alternative employment, moderate to high negative associations are found with both mining and production variables, whilst moderate negative correlations with the proportion of the workforce aged between 15 and 44 for both 1961 and 1966 reflect the effects of age-selective migration upon one aspect of the workforce structure in rural areas. The moderate negative correlations with the two journey to work variables reflect the self-contained nature in employment terms of many rural parishes and units.

Turning to social and socio-economic aspects, the moderate to high positive associations with the top social and socio-economic groups and an above average minimum terminal education age are particularly interesting. The former set may well reflect the significant stratum of

Table 6.1

Spearman Rank Correlation Matrix of Chapter 6 Variables

Variable[1]	35	36	37	87	38	88	39	89	40	90
1	-.92		-.89	-.88	.64	.66	.59	.46		
2	-.97		-.93	-.91	.60	.62	.64	.52		
/5	-.96		-.93	-.91	.56	.59	.66	.55		
3								.48		
4								.40		
77									.41	
8					.55	.53				
9					-.55	-.53			.43	
10	.63		.68	.59	-.40	-.47	-.55			
11	.56		.64	.61			-.60	-.54		
12	.53		.62	.58			-.70	-.65		
13	.56		.58	.56	-.44	-.51	-.43			
14	-. 71		-.76	-.71	.52	.56	.64	.51		
79	-.71		-.76	-.71	.51	.55	.65	.52		
80										
17										
18										
19										
82										
21										.46
22										
25										
26	.46		.51	.45			-.49	-.40		
27	-.43		-.49	-.41			.44	.42		
84										
85										
35	*		.93	.93	-.65	-.67	-.60	-.49		
37	.93		*	.91	-.61	-.63	-.66	-.53		
87	.93		.91	*	-.64	-.65	-.59	-.51		
38	-.65		-.61	-.64	*	.93			-.44	-.41

(1) See Table 3.2 and Appendix C

Table 6.1 cont.

Variable	41	42	43	44	91	92	45	46	47	48
1				.47	.48		.57		.40	
2				.51	.52		.59		.42	
75				.54	.52		.61		.43	
3										
4										
77										
8										
9										
10							-.64		-.53	
11				-.43			-.74		-.60	
12				-.41			-.67		-.55	
13							-.57		-.46	
14				.49	.43		.72		.57	
79				.49	.44		.72		.57	
80				.49	.52					
17				.70	.41					
18				-.69						
19					-.40					
82					-.52	.46				
21										
22					.43					
25										
26				-.50	-.42		-.43			
27										
84					.40					
85							-.42			
35				-.52	-.52		-.55			
37				-.51	-.48		-.63		-.51	
87				-.48	-.47		-.56		-.45	
38										

Table 6.1 cont.

Variable	93	94	49	95	96	50	51	97	98	99
1	-.69		-.67	.60		.55			.60	
2	-.71		-.70	.60		.58	-.42	-.41	.62	
75	-.70		-.71	.60		.59	-.42		.64	
3										
4										
77										
8										
9										
10	.45		.44	-.63		-.61			-.67	
11	.49		.51	-.64		-.60			-.64	
12	.49		.55	-.72		-.67			-.75	
13	.40		.42							
14	-.54		-.56	.65		.60			.64	
79			-.56	.65		.61			.65	
80										
17										
18										
19										
82										
21										
22										
25										
26				-.44		-.46			-.45	
27						.42			.41	
84										
85										
35	.66		.64	-.48		-.47	.40	.40	-.49	
37	.62		.62	-.54		-.52			-.56	
87	.63		.62	-.48		-.48		.41	-.50	
38										

Table 6.1 cont.

Variable	100	52	53	101	102	54	55	103
1	.54	-.46	-.60	.45			.51	
2	.57	-.50	-.70	.46			.55	
75	.59	-.52	-.70	.46			.57	
3								
4								
77								
8								
9								
10	-.63	.55	.51				-.60	
11	-.59	.57	.54				-.54	
12	-.67	.65	.63		.42		-.56	
13								
14	.58	-.52	-.55				-.55	
79	.58	-.53	-.55				.56	
80								
17								
18								
19								
82								
21								
22								
25		.43						
26	-.42	.41						
27								
84								
85								
35	-.45	.42	.42				-.44	
37	-.50	.47	.61	-.42			-.50	
87	-.45	.43	.61	-.43			-.41	
38								

Table 6.1 cont.

Variable	35	36	37	87	38	88	39	89	40	90
88	-.67		-.63	-.65	.93				-.46	-.43
39	-.60		-.66	-.59			*	.80		
89	-.49		-.53	-.51						
40					-.44	-.46			*	.63
90					-.41	-.43			.63	*
44	-.52		-.51	-.48			.43			
91	-.52		-.48	-.47						
45	-.55		-.63	-.56		.40	.67	.56		
46										
47			-.51	-.45			.43			
48										
93	.66		.62	.63			-.58	-.53		
94										
49	.64		.62	.62			-.64	-.57		
95	-.48		-.54	-.48			.51	.49		
96										
50	-.47		-.52	-.48			.49	.45		
51	.40							-.44		
97	.40			.41						
98	-.49		-.56	-.50			.57	.56		
99										
100	-.45		-.50	-.45			.49	.51		
52	.42		.47	.43			-.43	-.41		
53	.62		.61	.61			-.59	-.59		
101			-.42	-.43						
102										
55	-.44		-.50	-.41			.40			
56										-.52
57	-.62		-.61	-.59	.68	.66			-.46	-.55
58					.52	.43				
59					.40	.43			-.51	-.42
105										
106	-.55		-.53	-.56	.53	.56	.45	.41		
61	-.70		-.65	-.63	.57	.56	.43			
107	-.70		-.65	-.63	.55	.56	.44			

Table 6.1 cont.

Variable	41	42	43	44	91	92	45	46	47	48
88							.40			
39				.43			.67		.43	
89							.56			
40										
90										
44				*	.57					
91				.57	*					
45							*		.56	-.61
46								*	.75	.73
47							.56	.75	*	
48							-.61	.73		*
93							-.47			
94										
49							-.48			
95							.62		.40	
96										
50							.58			
51										
97										
98							.63		.44	
99										
100							.57			
52							.51		-.42	
53							.49			
101										
102										
55							.53			
56					.49					
57				.48	.64		.43		.45	
58		.41								
59										
105										
106				.41						
61				.41	.41					
107		.42								

Table 6.1 cont.

Variable	93	94	49	95	96	50	51	97	98	99
88										
39	-.58		-.64	.51		.49			.57	
89	-.53		-.57	.49		.45	-.44		.56	
40										
90										
44										
91										
45	-.47		-.48	.62		.58			63	
46										
47				.40					. 44	
48										
93	*		.82	-.43			.69	.67	-.42	
94		*	.50							
49	.82	.50	*	-.47		-.43	.69	.68	-.49	
95	-.43		-.47	*		.94			.93	
96					*					. 66
50			-.43	.94		*			.90	
51	.69		.69				*	.92		
97	.67		.68				.92	*		
98	-.42		-.49	.93		.90			*	
99					[illegible]					*
100	-.40		-.42	.86		.92			.91	
52				-.73		-.74			-.69	
53	.75		.78	-.64		-.63	.80	.72	-.69	
101	-.42		-.45							
102	.61		.58				[illegible]	.72		
55			-.41	.76		.78			.78	
56										
57										
58										
59										
105										
106										
61										
107										

Table 6.1 cont.

Variable	100	52	53	101	102	54	55	103
88								
39	.49	-.43	-.59				.40	
89	.51	-.41	-.59					
40								
90								
44								
91								
45	.57	-.51	-.49				.53	
46								
47		-.42						
48								
93	-.40		.75	-.42	.61			
94								
49	-.42		.78	-.45	.59		-.42	
95	.86	-.75	-.64				.76	
96								
50	.92	-.74					.78	
51			.80		.86			
97			.72		.79			
98	.91	-.69	-.69				.78	
99								
100	*	-.67	-.68				.76	
52	-.67	*	.44				-.69	
53	-.68	.44	*	-.45	.74			
101			-.45	*				
102			.74		*			
55	.76	-.69					*	
56								
57								
58								
59								
105						-.43		
106								
61								
107								

Table 6.1 cont.

Variable	[illegible]	36	37	87	38	88	39	89	40	90
62					-.45	-.42				
65	.44		.40	.43	-.49	-.49			.48	.40
67	.51		.52	.50	-.57	-.57				
68	.71		.67	.66	-.71	-.69	-.42			
109	.68		.67	.65	-.73	-.71	-.41			
69	.50		.49	.47	-.68	-.66			.53	
70									.45	.53
71								.48	.41	.44
72	.50		.46	.48	-.68	-.65			.54	.54
110	.62		.60	.62	-.71	-.71			.44	.48
73					.49	.42	.40			
112	.60		.57	.57	-.71	-.69			.53	.54
113	-.67		-.69	-.64	.47	.46	.67	.56		
114								-.48	-.41	-.44

Variable	41	42	43	44	91	92	45	46	47	48
62										
65		-.40		-.48	-.51					
67										
68				-.41	-.54					
109					-.41					
69		-.42			-.45					
70										
71										
72		-.46			-.43					
110		-.48			-.51					
73										
112		-.43			-.43					
113				.41			.53			
114										

Table 6.1 cont.

Variable	93	94	49	95	96	50	51	97	98	99
62										
65										
67										
68	.41		.44							
109										
69										
70										
71										
72										
110	.43									
73										
112										
113	-.52		-.54							
114										

Variable	100	52	53	101	102	54	55	103
62								
65								
67								
68								
109								
69								
70								
71								
72								
110								
73								
112								
113			-.48					
114								

farm owners (who are employers of labour) and managers, and the latter the relatively more favoured nature of the truly rural areas when compared especially to coalfield units with their lack of high status persons possessing a strong formal education. The lack of skilled manual workers is however apparent from the relevant high negative correlation.

The positive association of agricultural employment and car ownership is worthy of note. Here, the highest correlation reaches 0.71 between the proportion of persons having household access to two or more cars and 1963 primary employment. Such associations reflect the economic necessity of a farmer possessing his own transport, but it is also likely that the remoteness of many rural areas (in which a large proportion of the workforce find their employment in agriculture) necessitates the possession of some form of personal transport for a far higher proportion of the population than would otherwise be expected.

With the progressive emphasis of the Local Authority housing upon larger settlements, it is perhaps not surprising to find that a strong negative correlation exists between primary/agricultural employment and the proportion of persons and households renting their accommodation from the Local Authority. Again, the low room densities apparent from the correlation matrix reflect the occurrence of many small households- often of elderly persons- in the remoter agricultural areas. This latter point is further exemplified by the two age at death variables which correlate at moderate levels.

Finally, a number of other agricultural variables exhibit significant correlations with the three at present under consideration. The extensive nature of agriculture in those units with a high level of agricultural employment, is reflected in the moderate positive correlation with the proportion of agricultural land under rough grazing and common, and the moderate negative correlations with the Standard Man Day, Standard Net Output and regular whole time agricultural workers (all on a unit area basis) variables. This obviously is a reflection of the remoteness and poor land quality in many of these areas, which also shows in the remaining correlations. Thus, a moderate negative correlation with the proportion of agricultural holdings possessing under 20.1 hectares of crop and permanent grassland is to be expected, leading to the moderate positive associations with the Standard Man Day and Standard Net Output variables when they are measured on a per holding basis. Likewise, a positive correlation of over 0.6 with average holding size (including rough grazing) is not unexpected. Nevertheless, the similarly high coefficients with the 1963 and 1967 ratios of theoretical labour requirements against estimated usage (in terms of Standard Man Days) suggest either or both of greater efficiency in labour usage and the significantly more widespread occurrence of full time holdings in such areas when compared to those situated near towns or on the coalfield.

In view of the large number of significant associations shown by the straightforward agricultural employment variables, it is disappointing to find that there are no correlations of ± 0.4 or over relating to the 1963-7 primary employment change variable discussed earlier in this sub-section.

(ii) Mining Employment

The discussion of mining employment in section 2.3 demonstrated that, whilst it might take place in a rural environment, it is not a characteristic of rurality. Indeed, at some level the predominance of mining activity becomes such that it dominates its surroundings which, if not urban, have certainly lost all affinity to rurality. Robertson (1961) considered that the typical rural population (at a Rural District level) had a mere 0.5 percent of its workforce employed in mining and quarrying, though reasonably representative values might vary from zero to six percent.

The abnormally high levels of mining employment in many of the units in the present study will already be apparent, stemming from the 5,000 million tons of economically worthwhile coal reserves estimated to lie within the broad shallow triangular basin of the gently eastward dipping Northumberland and Durham coalfield (House 1969). To recount the history of the exploitation of this coalfield would not be appropriate here except in so far as an appreciation of certain of the issues will serve to clarify other characteristics of the studied populations. It is therefore sufficient to mention the early (nineteenth century) exploitation of the western part of the coalfield. With the exhaustion of the thicker and better seams and post-World War I decline of the industry, it was many of these small colliery settlements in the west that suffered severe unemployment in the interwar period. The lack of facilities so bemoaned by Sharp (1946), and of a secure economic base, has long laid these settlements open to population decline. In east Durham the deeper better seams and later exploitation have led to the characteristically large colliery settlements often within an administrative Rural District and it is here that one now most usually finds the predominance of mining employment with frequent journey to work movements of redeployed miners from west Durham to the pits in the east.

Nevertheless, closure and decline run across the whole of the coal mining industry. Thus House (1969) notes that the period 1957 to 1965 saw 25,000 miners in North-East England released through pit closure and reorganisation, albeit mainly in central and west Durham and south- east Northumberland, although manpower reductions have been almost universal at all collieries. In one sense the economic problems of these areas are as bad, if not worse, than those found in the declining agricultural areas. Indeed, it has been stated that "... the problem in the coal mining areas is to some extent worse than in the purely agricultural areas. The latter economy can be the basis of growth policy, the former requires complete substitution " (House 1966 p.150).

The percentage of economically active persons employed in all forms of the mining industry in each of the 147 parish units in 1966 is shown in Figure 6.3. Only 32 of the units possessed no mining employment at all in 1966 compared to 24 in 1961. Three main areas of high values may be recognised on Figure 6.3. The most prominent of these is undoubtedly that in central and north Durham, with a marked core towards the eastern seaboard. There, mining often employs over 40 percent of the economically active population with the highest values exhibited by Thornley (45.9 percent), Monk Hesleden/Nesbitt (46.5 percent), East Murton (47.2 percent), Easington (47.5 percent), Horden/Castle Eden (48.1 percent) and Kelloe (48.5 percent). All these units together with those of Haswell, Little Lumley, Edmondsley/Waldridge, Bearpark, Shadforth, Wingate, Coxhoe and Fishburn had nevertheless experienced a decline from 1961 when at least 50 percent of the respective samples of economically active population were similarly employed. This reflects the overall decline in mining with the 1966 unweighted mean for mining employment over the 147 units being 13.8 percent compared to the corresponding figure of 19.9 percent in 1961. As one proceeds further west, the role of mining in the economy declines markedly and such values as the 24.3 percent of the Consay unit in the north-west or the 16.7 percent of Etherley in the south-west are the most notable figures.

A second area of high value, though nowhere in its midst do values approach those discussed above, is to be found west of Hexham. Moreover, these figures include quarrying for roadstone along the Whin Sill and some limestone quarrying north-west of Hexham. Nevertheless, though in decline, the working of the pockets of coal preserved on the northern downthrow side of the southern boundary fault in Haltwhistle R.D. was the main reason for the 1966 employment of between 16 and 19 percent of the economically active population in mining in the Thirlwall and Bardon Mill units.

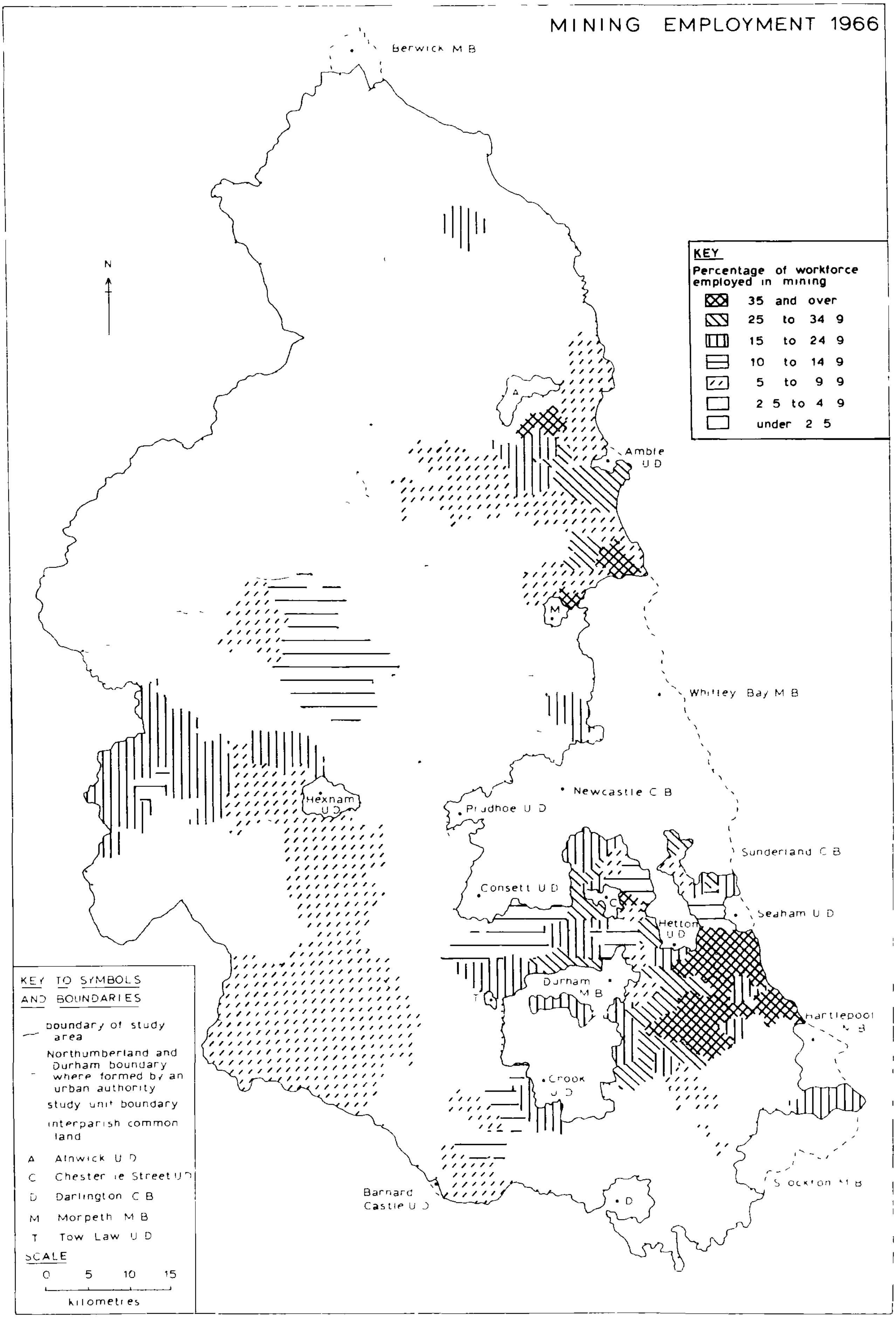

MINING EMPLOYMENT 1966
Berwick M B
N
KEY
Percentage of workforce employed in mining
35 and over
25 to 34 9
15 to 24 9
10 to 14 9
5 to 9 9
2 5 to 4 9
under 2 5
A
Amble U D
M
Whitley Bay M B
Newcastle C B
Hexham U D
Prudhoe U D
Sunderland C B
Consett U D
C
Seaham U D
Hetton U D
Durham M B
Hartlepool M B
Crook U D
T
Stockton M B
Barnard Castle U D
D
KEY TO SYMBOLS AND BOUNDARIES
boundary of study area
Northumberland and Durham boundary where formed by an urban authority
study unit boundary
interparish common land
A Alnwick U D
C Chester le Street U D
D Darlington C B
M Morpeth M B
T Tow Law U D
SCALE
0 5 10 15
kilometres

Figure 6.3

The main area of coalmining employment in Northumberland is, however, to be found between Alnwick and Morpeth with occasional outliers in the south-east of Castle Ward R.D.. Though this area is far more restricted and broken than its Durham counterpart, occasional extreme values are to be found. In the Shilbottle unit, 38.8 percent of the workforce were thus employed (69.2 percent in 1961), in the Pegswood unit 48 percent (59.4 percent in 1961) and in the Ellington/Lynemouth unit 60.2 percent (69.9 percent in 1961).

Outside these areas, low or moderate values reign supreme. Vast areas of Northumberland can be seen to possess under 2.5 percent of their working population employed in all forms of mining whilst the more moderate values of, for example, the Durham dales may be related to extractive industries other than coal. Indeed, only the Belford unit in north Northumberland (17.9 percent of its economically active population so employed) seems worthy of further mention with 7 out of 41 relevant persons employed in the entire mining industry.

The correlation structure demonstrated by the two mining variables is particularly interesting and revealing though not entirely surprising after the discussions of Tables 3.3 and 3.13. The correlations exhibited by both variables are similar in nature, their intercorrelation being at the extremely high level of 0.93. Mining as Table 6.1 shows, is positively correlated with the three population density variables (r_s=0.66 between mining employment in 1961 and population density in 1951) and the two population potential indices (r_s=0.56 between 1961 mining employment and 1951 population potential). Likewise, it shows moderate negative correlations with two distance variables - from the centre of population potential and from a settlement of at least 7,000 persons. Other correlations show the concentration of Local Authority housing in units with substantial mining employment and the generally unsatisfactory nature of the available accommodation - relatively high person per room values, much overcrowding, and a lack of households possessing basic amenities. The predominance of private household populations in these areas in 1961 is shown by the correlations of 0.43 and 0.40 between that variable and the 1961 and 1966 mining indices respectively.

Moreover, the unbalanced social structure of the units with significant mining employment stands clearly out. High negative correlations of up to -0.71 are exhibited between the two mining variables and those indices representing the top social class in 1966 and the most favoured category of socio-economic groups in both 1961 and 1966. Correspondingly, the predominance of mining employment can be seen to be associated with high proportions of the population being in the skilled and supervisory (manual) social and socio-economic groups. Moderate to high negative correlations reflect the lack of car ownership in such areas; r_s=-0.73 between the 1966 mining employment variable and persons with household access to one car or more. Finally, the disfavoured social and socio-economic structure is emphasised by the association between mining employment and the 1961 terminal education age variable (r_s=-0.66 and -0.68 for the 1961 and 1966 mining employment indices respectively).

The remaining correlations of note are predictable. Quite naturally, mining employment is found to correlate negatively with all three agricultural employment variables for 1961, 1963 and 1966, and(at a slightly lower level) with service employment in both 1961 and 1966. The positive association of mining communities with short distance residential mobility which was found in section 4.3 is again noted and the increasing tendency for persons employed in mining to have to travel longer distances to work as rationalisation and redeployment progress in the mining industry, is evident.

(iii) Employment in Production

Like mining, production [1], with certain exceptions as discussed below, is not considered a typical feature of employment in rural areas. Indeed, for most people, production/manufacturing and the rise of an urban dominated society are inextricably linked. As Saville (1957) states : " The map which Peterman produced for the Census of 1851 showed the widespread distribution of occupations and industries in the rural areas ; and similar maps for succeeding decades would illustrate their relatively slow decline under the impact of an industrialising economy " (p.26). Such has been the decline in rural industries, services as well as small manufacturing and craft employment, that as an obvious catalyst to depopulation it has been lamented at length, and such authors as Orwin (1949) have over-optimistically pleaded for the large scale decentralisation of industry to rural villages to offset an otherwise seemingly irreversable process.

Nevertheless, the appreciation of the continuous decline of rural industry since the early nineteenth century and its link with rural depopulation has led since 1945 to the establishment of various bodies

(1) Employment statistics presented in the unpublished 10 percent 1961 parish and 1966 Enumeration District tabulations refer to manufacturing plus construction, gas, electricity and water.

to assist the creation of small scale industry in rural areas. The Rural Industries Bureau and the various County Rural Community Councils have been perhaps the most important of these organisations (Williams 1958). From an early preoccupation with largely advisory services, the assistance offered to rural crafts has consistently increased in range and by 1968 it was noted that the Credit Services Division of the Council for Small Industries in Rural Areas (COSIRA: a body formed by the amalgamation of the Rural Industries Bureau and the Rural Industries Loan Fund) was making industrial loans of up to £25,000 available for building plant or for use as working capital. Loans of a similar magnitude were also available by this time for the improvement of tourist accommodation in rural areas (N R C C 1968/69). The success by the late 1960s of such government supported organisations is however debatable especially in the remoter rural areas of the North-East. This will become apparent in the discussion below.

Figure 6.4 portrays the distribution of employment in production in the twenty Rural Districts of Northumberland and Durham as this was revealed by the 1966 Census. With production, as with mining, a clear differentiation exists between the remoter rural units and the remainder. In the remoter rural areas very few parish units have over 24 percent of their labour force thus employed. Indeed, figures of under 10 percent are not uncommon, though every one of the 14 examples is restricted to Northumberland with a particularly notable expanse along the Anglo-Scottish borderlands.

Three features appear worthy of further note in relation to those units which possessed little production employment in 1966. The first is the close agreement between these 1966 employment statistics for the remoter rural areas and the conclusions of earlier workers. Little or no improvement is shown in the volume of manufacturing employment. Even along the South Tyne valley, despite the aberration at Haltwhistle and the relatively high values immediately north and west of Hexham, absolute values still only rarely reach 20 percent. Despite the seemingly optimistic views of McKay and Stagg (1961), there is little to cause one to dissent from House and Knight's (1966) comment as to the dearth of manufacturing in this area. Similarly, in the extreme north, in Norham and Islandshires and Glendale R.Ds., House (1956) and Ironside (1964) have commented on the lack of manufacturing employment which is also shown here. No unit which contains a parish from either two Rural Districts has even 20 percent of its economically active population employed in production, and even as one approaches the market town of Berwick-upon-Tweed, values only increase slightly. Pride of place may however be given to the Bellingham R.D. units. Ironside (1964) noted 1951 manufacturing employment to be a mere 2 percent of the total in this

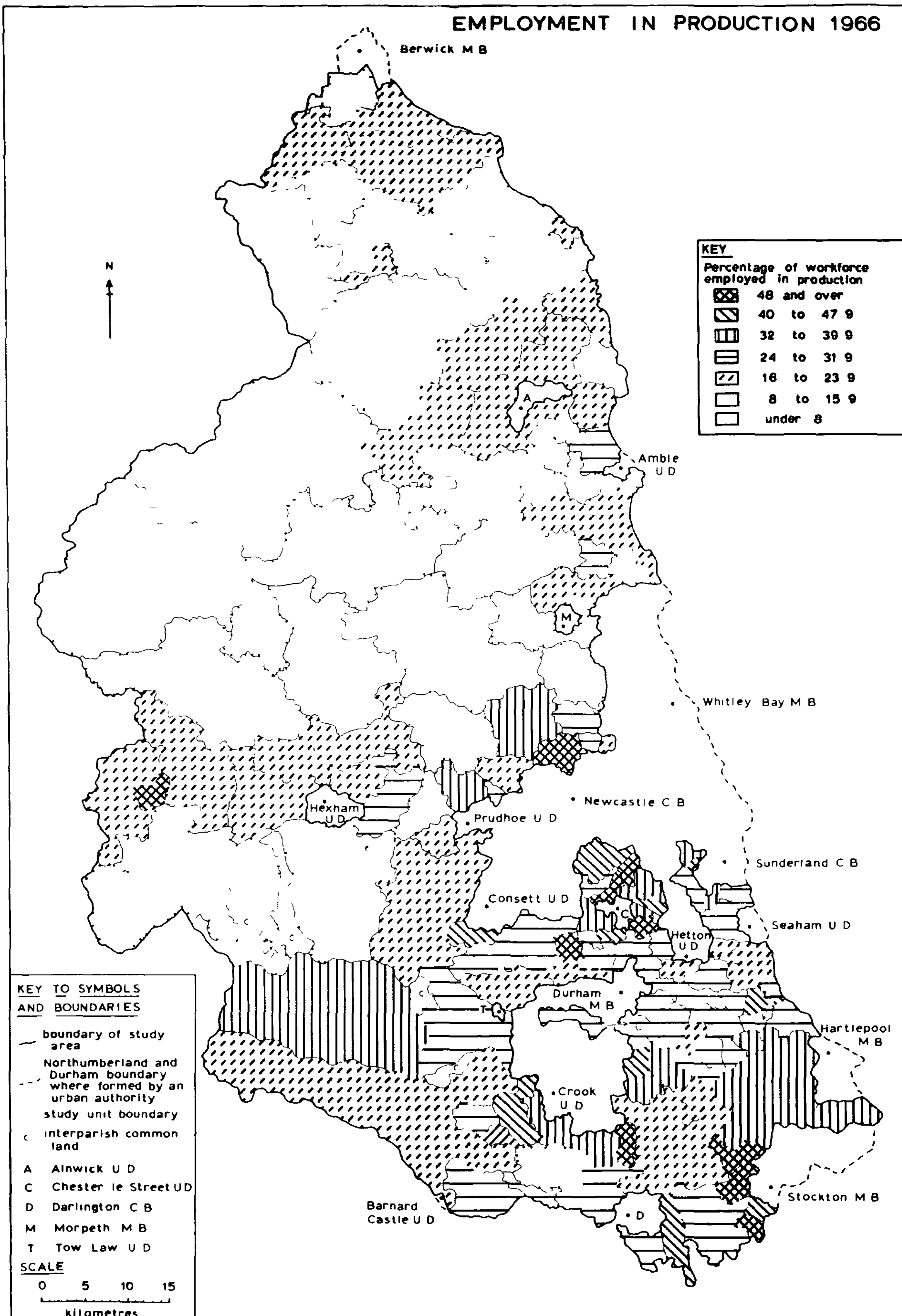

EMPLOYMENT IN PRODUCTION 1966
Berwick M B
N
KEY
Percentage of workforce employed in production
48 and over
40 to 47 9
32 to 39 9
24 to 31 9
16 to 23 9
8 to 15 9
under 8
A
Amble U D
M
Whitley Bay M B
Hexham U D
Newcastle C B
Prudhoe U D
Sunderland C B
Consett U D
C
Seaham U D
Hetton U D
Durham M B
T
Hartlepool M B
Crook U D
D
Stockton M B
Barnard Castle U D
KEY TO SYMBOLS AND BOUNDARIES
boundary of study area
Northumberland and Durham boundary where formed by an urban authority
study unit boundary
c interparish common land
A Alnwick U D
C Chester le Street U D
D Darlington C B
M Morpeth M B
T Tow Law U D
SCALE
0 5 10 15
kilometres

Figure 6.4

area. Despite the extreme nature of this figure, for the seven units containing Bellingham R.D. parishes (including 11 other parishes also) the 1966 Census derived figure for production was only slightly over 6 percent.

Secondly, one may look at any discernible effects upon Figure 6.4 of the larger rural centres and market towns in the remoter areas. Mitchell (1950) commented strongly upon the centralisation of manufacturing in rural areas in market towns, whilst Ironside (1964) noted that manufacturing employment in the market towns increased by 52 percent between 1931 and 1951 and that "....much of the increase in the Rural Districts surrounding the towns was due to the expansion of those industries in the towns, as journey to work from the rural areas has developed strongly since 1931" (p.135). However, it would be easy to overstress the role of the market towns in this regard. Certainly, such assertions relating to market town industry as: "The great need always is to avoid overdoing it" (Clark 1957 p.59), are not supported. It has already been pointed out above that any such influences wielded by Berwick are of small magnitude and Figure 6.4 also shows this to be the case with respect to Morpeth, Alnwick and Hexham. Similarly, though one may note with interest the continuing efforts of the Northumberland Rural Community Council to build up manufacturing in the rural nodes of Allendale, Belford, Bellingham, Rothbury, Otterburn, Seahouses and Wooler (N R C C 1968/69), in 1966 only Seahouses (23.2 percent) had more than 20 percent of its economically active population employed in production, with the comparable figures for Allendale and the Otterburn unit being below 10 percent.

Thirdly, in contrast to the above, one may note that in Durham, the lowest production values tend to be shared between units with an important mining concern and the more rural areas. Thus, of the ten County Durham units with the lowest percentages of employment in production (though none falls below 13 percent), four (East Murton 18.6 percent, Bearpark 16.6 percent, Cornsay 20 percent and Kelloe 21.2 percent) have a significant mining interest, whilst six can be considered largely rural (all were class 3a or 3c in the factor analysis classification of section 3.11). These rural examples comprised those units containing the parishes of Woodham (17.0 percent), Whessoe (21.7 percent), Bolam (13.0 percent), Hamsterley (16.9 percent), Forest and Frith (18.6 percent) and Staindrop (22.0 percent). Nevertheless, the extreme picture presented by House (1969 p.62) where, in a table based on 1966 Employment Exchange data, it appears at a subregional level that the south-east of the Durham coalfield vies with rural north Northumberland for bottom position in the possession of manufacturing employment, is not repeated at a parish unit level.

The highest values for employment in production are quite predictably usually to be found in those parts of Rural Districts which are nearest significant towns or within generally heavily populated areas. If one considers those units which on Figure 6.4 are shown as having 40 percent or more of their working population employed in production in 1966, four categories may be discerned.

First, there is a number of units adjoining major urban areas. It is likely that many workers will travel to work from the former to the latter. Such are Ford (60.3 percent, though this parish may be regarded as being a suburb of Sunderland C.B.), Preston-on-Tees (43.0 percent), Egglescliffe (51.9 percent), Healeyfield (45.5 percent), Woolsington (49.5 percent), Elton/Norton (49.6 percent) and the Low Dinsdale unit (40.0 percent). Second, although the first two cases overlap with the above, there is a number of units in which mining employment has experienced a rapid recent decline. Again, all these units are in close proximity to urban centres and it is likely that journey to work to these towns will have become increasingly important as the mining interests have declined. Typical units are Great Lumley (49.3 percent), Bournmoor (46.2 percent), Ouston (50.4 percent), Pelton (49.4 percent), Plawsworth (40.8 percent), Ferryhill (40.4 percent), Cockfield (54.2 percent), Evenwood and Barony (44.5 percent) and Langley (50.9 percent). In every one of these cases production employment in 1966 accounted for at least 10 percent more of the workforce than it did in 1961. Third, one has the peculiar aberration of a trading estate situated in a nominally rural area and having a marked concentration upon a vast range of manufacturing industries (Beaver 1968). Great Aycliffe, indeed, has the highest proportion of its resident workforce employed in production of all units (66.0 percent), with Lamesley (44.9 percent) and Peterlee (41.7 percent) rather further behind. Finally, there are rural parishes which through other exceptional circumstances have significant manufacturing employment. Haltwhistle (51.1 percent) is an obvious example, being one of very few rural nodes which have succeeded in attracting manufacturing employment. Carlton/Whitton (52.7 percent) and Birtley (54.9 percent) are the remaining, though rather different examples from County Durham. Both, particularly the heavily populated latter unit, also have affinities with certain of the earlier types.

The overall picture, therefore, is one of little production employment in the remoter rural areas and a relative abundance in the various types of non-mining, largely non-rural units outlined above. A number of obvious exceptions such as Haltwhistle or the Weardale units (Stanhope 33.6 percent, Wolsingham 29.5 percent) are to be found, but these are truly exceptional and, in the latter cases result from the peculiar industrial history of Weardale. Despite remedial efforts, this general dearth of production/manufacturing employment in the remoter rural areas is a continuing feature and one which will not easily be improved. Despite the Northumberland Rural Community Council's efforts to build up such employment in some of the larger villages in that county a more reasonable assessment of the situation would be that "... the basic strategy for the rural areas should be to select certain market towns for economic growth recognising that not all of them are suitable and that the selection of industries likely to settle and prosper there will be from a narrow spectrum of the practicable "(House 1969 p.239). Even this 'solution' has two pernicious problems to overcome. First, even with industry drawing upon a wide rural hinterland, it is likely that new industries moving to market towns will need to bring part of their labour force with them. Second, the lack of attraction to (indeed , even repulsion from) the remoter rural areas of the North-East is a factor of some significance militating against the inmovement of new industry (House et al 1968).

In view of what has been said, it is perhaps not surprising that the 1966 production variable showed up particularly strongly in the R-mode factor analysis, Factor 1. This equally has implications for the correlation matrix. The highest correlation of all in Table 6.1 in relation to the production employment variables for 1961 and 1966, is quite naturally that between themselves. Its level ($r_s = 0.80$) is, however, somewhat lower than the corresponding intercorrelations between the various agricultural or mining indices. Of some significance here is the increase in production/manufacturing found between 1961 and 1966 in certain of the declining mining parishes. This, too, may be cited as the reason for the increase in the unweighted mean of employment in production between the 1961 Census (Schedule D) figure of 22.0 percent and the 1966 figure of 25.7 percent. Nevertheless the correlation structure of the two variables are quite similar.

Many of the points made in the regional analysis above are further emphasised by the correlation matrix. Thus, production employment, particularly for 1966, is moderately or (more usually) highly correlated with the various density and population potential variables. Correspondingly notable negative correlations exist with the various distance variables reaching a maximum level of r_s=-0.70 between 1966 production employment and distance from a centre of at least 70,000 people. This emphasises the tendency of rural areas with many of their economically actve inhabitants employed in production, to be situated very close to major urban areas. The journey to work element exhibited in the correlation matrix follows from this.

As a corollory of these density and locational aspects a number of other correlations logically follow. First, the agricultural employment variables show moderate to high negative links. Moreover, various measures of agricultural intensity reflect the Von Thünen type influence of the near urban location of units with substantial employment in production. For example, the proportion of rough grazing and common land correlates at a moderate negative level (between -0.41 and -0.43), and the Standard Man Days per hectare variable at a moderate positive level (between 0.49 and 0.57). Similarly, the negative associations with the Standard Man Day ratio variables partly reflect the point made in section 3.9 that smaller holdings, insufficient to occupy the owner or tenant on a full-time basis may cause the calculated availability of labour to be somewhat overstated. Hence when divided by the theoretical labour requirements based upon crops and livestock the resultant quotient is particularly low.

A number of social status and socio-economic variables also exhibit significant correlations. In 1966 Local Authority housing shows its association with high production employment levels whilst a lack of car ownership is also a significant feature. It is apparent that production tends to be linked with the skilled and supervisory manual social and socio-economic groups, whilst a negative correlation is observed between employment in production and the semi-skilled and unskilled social classes IV and V.

Finally, the moderate correlations between 1961 employment in production and the change in density between 1961 and 1967 (0.40) reflect the increasing suburbanisation of rural areas close to the larger towns and the likelihood of many of the growing suburban populations being employed in manufacturing. This is the case at Woolsington and Elton/ Norton. In addition, the growth of New Towns at Peterlee and Newton Aycliffe with the youthful population of these and similar areas is instrumental in the 0.43 correlation between the 1966 variable and the percentage of the 1966 workforce aged under 45. The tendency of the more densely peopled areas, partly on account of their age structure, to have a low average age at death is also reflected.

(iv) Service Employment

Finally in this survey of industrial structure, one comes to service employment (including defence). The proportion of the population employed in service industries obviously reflects the presence or absence of other industries. It is held, however, that a wide representation of non-service employment does not automatically give rise to a low percentage employment in the service industries (Fullerton 1966).

Service employment forms a particularly interesting aspect of rural economic structure. As Brunn (1968) pointed out in the United States: "The outmigration of large segments of rural population to urban areas has undoubtedly contributed to the alteration of the number, variety and composition of services available in trade centres" (p.200). In his study of rural north-west Ohio, he went on to show that the rural trade centres in this area of severe depopulation experienced a decline in the number of services they offered between 1940 and 1964. At the same time, the threshold population values for the services which were retained, were lower in 1964 reflecting a powerful inertia effect.

These conclusions have been verified in Northern England itself and it has been noted that in areas of depopulation "....service industry establishments, especially where the capital investment is high in relation to the resources of the owner, as it is in both small shops and large hospitals, will tend to remain for some years in the hope of a reversal of population trends. Immigration is more likely to lead to increased employment in services than is the equivalent emigration to a decline " (Fullerton 1966 p.166). In contrast, Sheppard (1962) in her study of three East Riding (Yorkshire) parishes noted a decline in service employment "....proportionately greater than the decline in total population" (p.93).

With this in mind, therefore, one may turn to an analysis of Figure 6.5 which shows 1966 unit service employment. In the Northern Region as a whole, service employment has been traditionally low compared to the national average. Fullerton (1966) holds that even since 1952 the growth in this sector of the economy has not been sufficient to lessen the regional-national differential. Nevertheless, the composition of rural service employment may be expected to be complex, for as has been noted in a general study of service employment in Northern England "....Rural Districts vary considerably in area, population and location in relation to service centres and therefore have a greater variety in the pattern of their service distribution than towns. Differences are small in any individual service group, but large in the aggregate. All Rural Districts

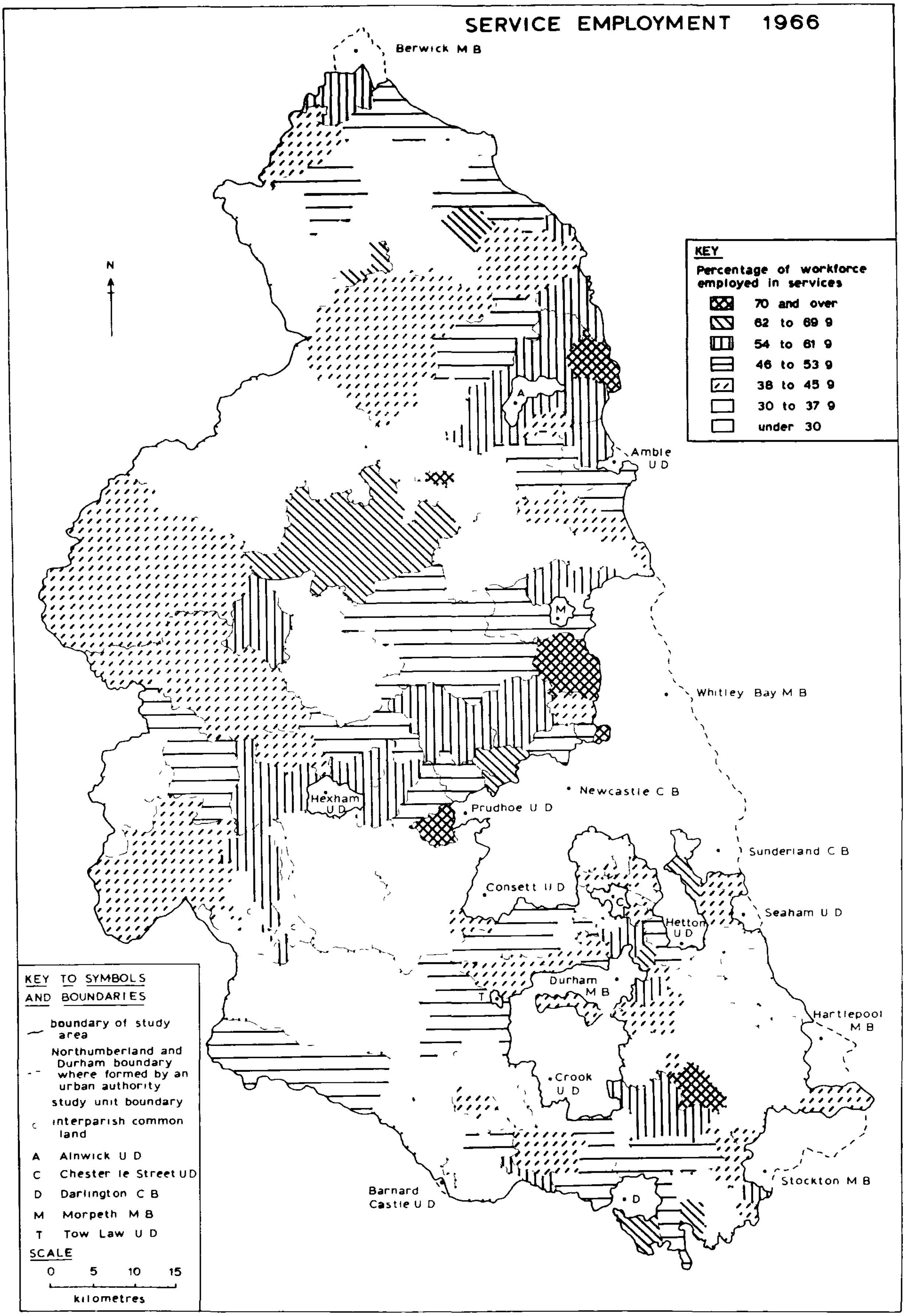

SERVICE EMPLOYMENT 1966
Berwick M B
KEY
Percentage of workforce employed in services
70 and over
62 to 69 9
54 to 61 9
46 to 53 9
38 to 45 9
30 to 37 9
under 30
N
Amble U D
A
M
Whitley Bay M B
Newcastle C B
Hexham U D
Prudhoe U D
Sunderland C B
Consett U D
Seaham U D
Hetton U D
Durham M B
T
Hartlepool M B
Crook U D
Stockton M B
Barnard Castle U D
D
KEY TO SYMBOLS AND BOUNDARIES
boundary of study area
Northumberland and Durham boundary where formed by an urban authority
study unit boundary
interparish common land
A Alnwick U D
C Chester le Street U D
D Darlington C B
M Morpeth M B
T Tow Law U D
SCALE
0 5 10 15
kilometres

Figure 6.5

contain traces of all the services although numbers are often very small" (Fullerton 1960 p.39).

Figure 6.5 has five features which are worthy of note. The first is the area of little service employment found in the main Durham coalfield. Indeed, a majority of the 13 units with a 1966 service sector employing under 30 percent of the workforce, are units with a significant mining interest - Hylton (26.3 percent), Easington (27.4 percent), Little Lumley (27.7 percent) Monk Hesleden/Nesbitt (23.6 percent), Horden/Castle Eden (25.8 percent), Thornley (20.3 percent), Kelloe (24.2 percent) and Langley (24.6 percent), are Durham examples, with Ellington/Lynemouth (27.3 percent) the sole Northumberland representative. All these units, with the exception of Easington (at a mere 30.6 percent) had a 1961 value similarly below 30 percent.[1]

Secondly, it is notable that over vast tracts of the remoter rural areas, the proportion of the working population employed in service industries is generally little, if at all, greater than in the coalfield. Thus, the remaining four examples of units with under 30 percent service employment in 1966 are all of this type - the Hedley (17.4 percent), Thirlwall (28.3 percent), Chatton (19.4 percent) and Branxton (28.6 percent) units. In such areas the dominance of agriculture is often extreme. It is most interesting that, as with production, so with services, the dearth of such employment recognised in specific areas of Haltwhistle R.D. (House and Knight 1966) and Norham and Islandshires R.D. and the north of Glendale R.D. (House 1956) is emphasised by the present analysis.

Thirdly, the importance of the larger villages in the remoter rural areas from the point of view of service employment stands clearly out, adding weight to Guy's (1969) contention that a progressive concentration of rural service employment on the larger villages and market towns is

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[1] Although the 1961 figure does not include defence employment, which is included in that for 1966, none of the units mentioned would be affected in any case. Those areas with important defence employment are readily apparent from the analysis of R-mode Factor 5 in section 3.8. Over 80 of the 147 parish units had no defence employment whatever in 1961 and, of the remainder only 14 had over 5 percent of their economically active population thus employed. These were the Middleton St. George (46.2 percent), Longhoughton (37.5 percent), Otterburn (25.6 percent), Stamfordham (23.8 percent), Streatlam and Stainton (21.6 percent), East Chevington (15.2 percent), Egglescliffe (14.0 percent), Rochester (12.5 percent) Great Burdon (8.2 percent), Preston-on-Tees (8.1 percent), Lesbury (6.8 percent), Hett (6.0 percent), Beadnell (6.0 percent) and Evenwood and Barony (5.6 percent) units. The almost identical nature of this list with the high scoring units on R-mode Factor 5 is quite clear.

occurring. Thus Bellingham (61.0 percent), Rothbury (75.7 percent), Belford (66.7 percent) and Wooler (67.7 percent) stand out as most noticeable peaks amidst considerable areas of lower value. The percentage figures for other rural nodes - Alnmouth/Lesbury, North Sunderland and Allendale in particular - are only slightly lower and in no case fall below 54 percent. It is, of course, true that exceptions to this do occur. Surrounding Alnwick, and most obvious along the coast, there is an area of high value including the Rennington, Warkworth, Longhoughton and Embleton units. Likewise, the Hepple unit in the south of Rothbury R.D. and the Horncliffe unit in the extreme north of Northumberland show uncharacteristically high values. By way of contrast, Haltwhistle, as an important rural node has an untypically low employment in the service industries. In all these cases, however, special features may be called into account, which stress the applicability of the general rule that service employment in remoter rural areas is disproportionately concentrated in the large villages and is extremely limited in the less populated parishes.

In the 'exceptions' mentioned above, the influence of Berwick is obviously paramount in the Horncliffe unit figure, whilst the Hepple unit includes the particularly important defence installation of Otterburn Camp. RAF Boulmer is largely the cause of the Longhoughton value of 70 percent although in much of the surrounding area, the growing influence of tourism is an important feature, together with a number of institutional establishments catering especially for old people. Moreover, the particularly low figure for Haltwhistle is perhaps not surprising in view of the previously noted importance of manufacturing there (with, additionally, significant mining employment).

Fourthly, a quite remarkable feature is the notable belt of service employment which stretches westward from Castle Ward R. D. down the Tyne valley through many of the parishes noted in Chapter 3 to have a disproportionately large number of persons in the more favoured social classes and socio-economic groups. No less than nine units between Haydon Bridge and North Gosforth have over 54 percent of their economically active populations employed in the service industries. Indeed, Broomley and Stocksfield (73.1 percent) and North Gosforth (75.9 percent) reach particularly extreme values. Another characteristic of this "commuter belt" is thus exposed. One might even further extend this belt to include Stannington with 82.8 percent of its workforce employed in the service industries. Here, however, as one may imagine, totally extreme influences are at work in the form of a regional concentration of hospital facilities.

Finally, and leading on from this fourth point, many of the remaining (often isolated) units of high value - all in County Durham - may be correlated with a residential function and, frequently, a predominance of people of high social status. This is certainly true in the Herrington (64.1 percent), Belmont (63.3 percent), Shincliffe (60.6 percent), Preston-on-Tees (54.7 percent) and Hurworth (63.9 percent) units. All of these units except Belmont (1b) were established as Class 2 in the factor analysis derived classification of section 3.11. Elsewhere, high values are largely a function of important institutional employment as at Woodham and Windlestone (unit service employment 57.4 percent), Sedgefield (70.4 percent) and Gainford (55.6 percent), whilst the 63.7 percent of Middleton St. George is directly consequent upon the importance of RAF Middleton.

Turning to the relevant part of the correlation structure in Table 6.1, it is particularly revealing how this tends to emphasise points four and five of the above analysis. Although the service employment figures for 1961 do not include the defence aspect (those for 1966 do) there is nevertheless a great deal of similarity exhibited by the correlation coefficients for the two service employment variables. This is despite the variables for 1961 and 1966 intercorrelating at the relatively low level of 0.63.

Significant correlations with other variables in no case reach above ± 0.55, but the association of service employment with high social status is clear. Thus, five indices mainly representing professional and managerial classes exhibit significant associations with both service employment variables. Similarly, the variable representing semi-skilled and unskilled social classes shows significant negative correlations. One may also view the negative correlations with 1961 production employment, 1966 mining employment, 1961 person per room densities, and 1961 person per household densities from the same social commentary angle. The positive correlation of the 1961 terminal education age variable with 1966 service employment (0.53), and the 1966 low person per room density variable with both service employment indices serve to strengthen this impression.

On the other hand, it is likely that the correlation of 1966 service employment with long distance residential movement for 1960-61 (0.41) and 1961-66 (0.43) relies heavily upon the inclusion of defence population. The corresponding coefficients for 1961 service employment, which does not include the defence elements, only reach 0.24 and 0.23

respectively. The final correlations of note are those of -0.42 (for 1961 service employment) and -0.51 (for 1966 service employment) with the proportion of the 1961 population enumerated in private households. This obviously reflects the importance of institutions such as hospitals in providing substantial employment in the service industries.

(v) Functional Structure

Stevens (1946) was one of the first geographers to investigate rural population in Great Britain from the point of view of its broader functional composition. He divided the population into primary (those involved in producing from the land) and secondary (in part ancillary to the exploitation of the land, and in part providing services for the primary sector) elements. This was later amplified by the better known tripartite division of Stamp (1949) who added the adventitious sector (those living in the country by choice) to the two above. The existence of such people living in the country but not functionally or directly connected with the land is known to have been recognised by Defoe (Pahl 1966). This threefold functional definition has been generally accepted in subsequent studies of rural population particularly in the contributions of Vince (1952) and Robertson (1961).

Numerous problems have stemmed from this approach to the analysis of the functional structure of rural population and, for example, Vince (1952) noted that some of the persons served by nominally secondary population will almost certainly not be primary rural population. Nevertheless, Stevens (1946) in calculating the ratio of primary to secondary population came to the conclusion that 2 was an average value for the truly rural areas. This assertion received support from Vince (1952), though in the Fenland, where a closed rural system is most closely approached, he calculated the ratio at 1.78, a figure used in Robertson's (1961) analysis of rural occupational structure. The possibility is noted by the last mentioned author that the high proportion of primary rural population in such areas may in fact reveal a paucity of secondary population rather than a balanced ratio. Moreover, Vince (1952) argues against the likelihood of any constant primary : secondary ratio appearing in those rural areas which are devoid of any adventitious population, giving the differential ability to command services (prosperity) of different primary populations and distance from market centres as his two main reasons. Support for the differential prosperity factor acting in this way has been raised more recently: "....the more economically backward the rural region is....the smaller the numbers in this secondary group " (Saville 1966 p.44).

It is, however, apparent that of the 147 parish units in the present study few have a primary : secondary ratio of 1.78 or over if one merely compares the 1961 and 1966 agricultural employment figures with the remainder of the labour force. This discounts the possibility of there being any adventitious population and ignores any persons who may have migrated from town to country in retirement. For the remoter rural areas these assumptions may be reasonable. It is found that in both 1961 and 1966 a mere six units had a ratio calculated by this method of 1.5 or more. For 1961, these were the Kielder unit (3.4), the Alnham unit (3.0), the Rennington unit (1.6), the Akeld unit (1.6), the Plenmeller unit (1.5) and the Carham unit (1.5). In 1966, the corresponding order was the Akeld unit (2.3), the Carham unit (1.8), the Hedley unit (1.7), the Alwinton unit (1.6), the Kielder unit (1.6) and the Tritlington unit (1.5). The almost exclusively upland Northumberland nature of these areas is not surprising.

If not even more important, it is interesting to speculate upon the nature of changes in the functional structure of rural populations and to see how these may correspond to other attributes such as location with respect to urban areas. Vince (1952) has given a number of functional change types. These are :

(a) rural dilution - where an increase occurs in the total occupied population, but a relative and absolute decrease in the primary element. This, of course, is at its extreme in those areas which are close to towns and are experiencing new and rapid suburbanisation. Such is Elton/Norton where the percentage of the workforce employed in agriculture fell from 27.0 to 4.7 between 1961 and1966 ;

(b) primary rural depopulation - where a decline is experienced in both the total occupied and the primary population. Several subtypes are apparent within this category, varying from a relative rise in the adventitious proportion, following a greater than average primary decline, to a relative rise in the primary population despite an absolute fall in numbers. From the available data in the present study, such a breakdown is impossible though one may appreciate the logic of arguing that a decline in the absolute numbers of the primary population but an increase in the corresponding relative proportion is most typical of the remoter upland areas (Wibberley 1950). Nevertheless, although the present study is restricted by not having any data on adventitious population available, it is somewhat surprising to note that of 22 units with over 40 percent of

UNEMPLOYMENT IN RURAL NORTH-EAST ENGLAND 1961 & 1966

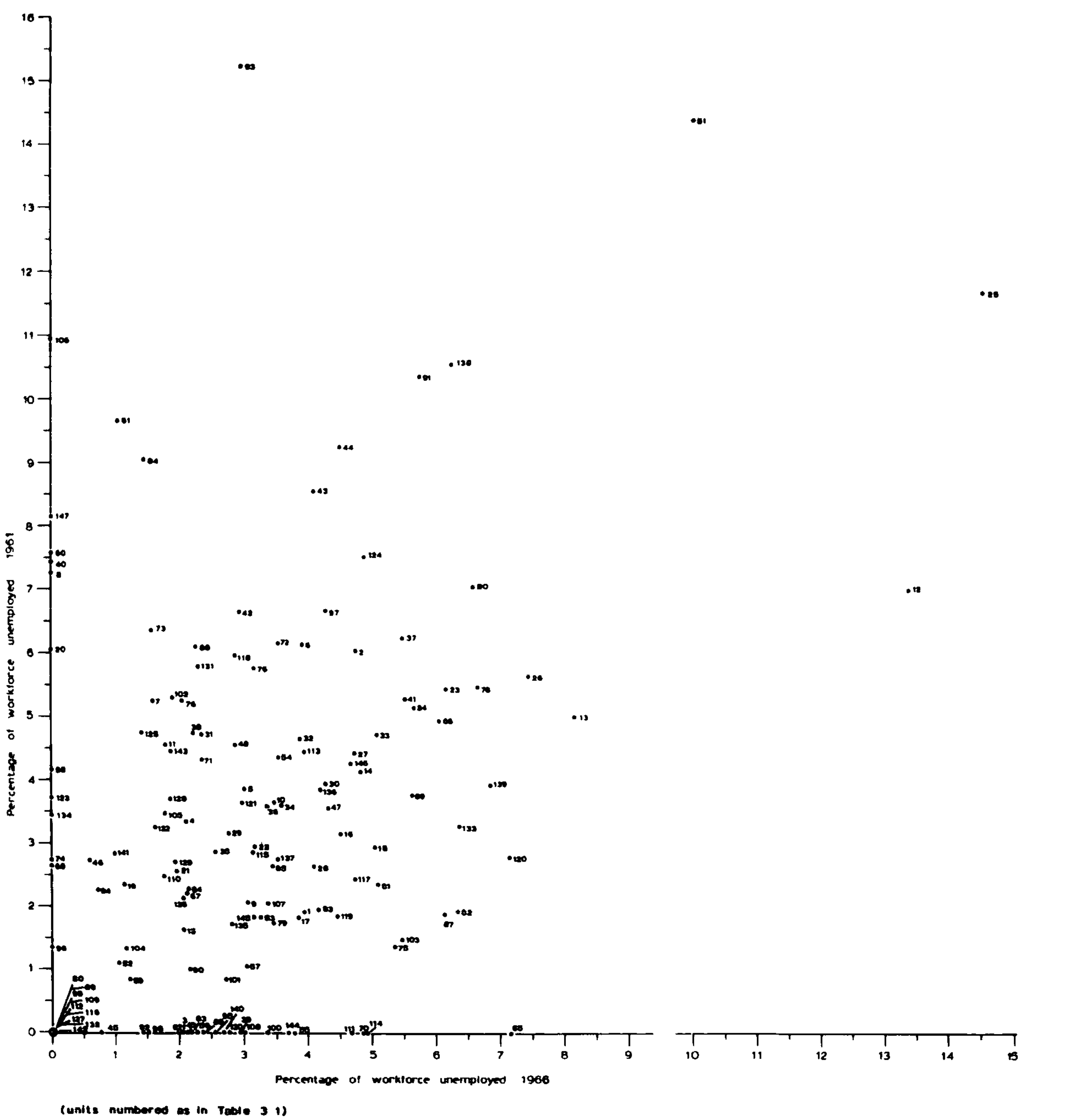


Figure 6.6

rural areas on the other hand, no increase in a negligible adventitious element can be foreseen. For such areas, the only policy which may be able to consolidate present population levels , remains that of concentrating resources upon selected key settlements. Second, it has been noted that areas which are attractive to the settlement of sizeable adventitious populations may be in danger of losing their rural character. Hence, Clark (1948) considered that up to 33 percent of a rural population might satisfactorily be adventitious in nature but that: "....this adventitious population must be fitted into the rural pattern and must never be allowed to swamp it" (p.56). Here again, one may clearly see the ubiquitous modern urban way of life and its associated technology.

(vi) Unemployment

Despite the great post-war fluctuations noted by Chetwynd (1963), the North-East is well known as an unemployment black-spot with a significant proportion of declining industries in its regional economic structure. Nevertheless, although Openshaw (1966) feels that many highland rural areas suffer from both high unemployment and low activity rates, it is the latter rather than the former which House (1966) regards as a characteristic feature of rural areas in the North-East.

Unemployment data are available both from the 1961 and 1966 10 percent Census material. Figure 6.6 portrays unemployment expressed as a percentage of the economically active population for both these years, plotted one against the other. A wide scatter of points may be noted, although there is little difference between the unweighted mean values: 3.5 percent in 1961 and 3.2 percent in 1966. Few features emerge clearly from the graph though there are two points which may justifiably be made despite obvious exceptions. First, the two units with over ten percent of their economically active population being recorded as unemployed in both 1961 and 1966, are Durham units both of which have some significant mining interest - Sedgefield and Plawsworth. Similarly, Pittington with 13.3 percent unemployed in 1966 has a major mining interest though here 1961 unemployment was slightly under 10 percent. Second, amongst those 16 units with under 2 percent unemployment in both years, a high proportion tend to be either the remoter upland rural units or commuter belt parishes. The Henshaw, Greystead, Hepple, Alwinton and Carham units fall into the former category, and the Broomley and Stocksfield, Heddon-on-the-Wall, North Gosforth, Middleton St. George and Wylam units have some cause to be included in the latter category.

The correlation matrix relating to these two variables is disappointing and, indeed, the 1966 unemployment index possesses no rank correlation which reaches a level of $\pm$ 0.40. Seven correlations of this magnitude are, however, found in association with the 1961 unemployment index. Two are positive and relate to the proportions of persons living at a density of over 1.5 persons per room in 1961, and the proportion of persons living in property rented from the Local Authority in 1966. Correspondingly, the five negative correlations refer to indices representing high social status - a 1961 above minimum terminal education age ; a 1966 person person per room density below 0.5 ; the proportion of the economically active and retired population in the professional and managerial socio-economic groups in 1961 and 1966, and in Social Classes I and II in 1966.

(vii) Age of the Labour Force

One characteristic of the rural labour force which has often been noted to give rise to concern in certain remoter rural areas, is that of its age structure. In looking at Northumbrian Tweedside, for example, House (1956) remarked on the increasingly unbalanced nature of the predominantly agricultural labour force which had been caused by age-selective migration to the towns. Consequently, one variable representing the proportion of the economically active population in 1966 which was aged 44 or under was included in the factor analyses described in Chapter 3 and a further such index for 1961 is included here.

In both years, the unweighted mean gives 60.7 percent of the economically active population as being aged under 44. However, an obvious division exists between those units with over 70 percent, and those with under 50 percent of their workforce in this category. Thus, in both 1961 and 1966 the vast majority of units with over 70 percent of their labour force in the younger age groups were one, or a combination of two types-coalmining or suburban fringe/residential. Units with establishments relating to the armed services form a majority of the few exceptions. Thus, in 1961, of the twelve units of this type, Peterlee (at 84.1 percent the maximum value), Great Aycliffe, Belmont and Great Lumley could all be placed in the suburban fringe/residential category though mining also intrudes in the first and last instances. The Hazlerigg, Dinnington and Widdrington units correspondingly had substantial mining employment. Of the remainder, the Streatlam and Stainton and Middleton St George units find themselves with such high values on account of their defence populations. This leaves the Bellingham, Carham and Woodham units as exceptions. It is not without significance that all of these units had a corresponding value of under 70 percent in 1966 and even in 1961 were the lowest three values in excess of this figure. In 1966 the same general pattern repeats itself with the residential urban fringe units of Ouston, Peterlee, Great Aycliffe, Belmont, Bournmoor, Great Lumley, Woolsington, Witton Gilbert and Egglescliffe, and the mining units of East Chevington, Pelton, Shadforth, Thornley and Hazlerigg. On this occasion the sole remaining unit (Longhoughton) has obvious defence interests.

By way of contrast, the vast majority of units with under 50 percent of their economically active population aged under 45 are from the remoter rural areas though in addition there is a significant presence of Tyne valley units. In 1961 the Cartington, Greystead, Bavington, Alnmouth, Rothbury, Allendale, Belsay and the Tyne valley units of Broomhaugh and Riding and Broomley and Stockfield possessed similar values. The only other unit with a comparably low value - the Whessoe one - has already (section 5.2) been noted to have an aged population. In 1966 the Meldon, Alnmouth, Rothley, Hebron, Greystead, North Sunderland, Bamburgh, Alwinton, Bavington and Milfield units in the obviously rural areas of Northumberland were in this unfortunate position together with the Tyne valley units of Haydon Bridge, Humshaugh, Corbridge and Broomhaugh and Riding. The only County Durham unit in 1966 with under half of its labour force in the more youthful age groups was that containing the parish of Piercebridge.

Although the above analysis reveals similar tendencies to those found in the straightforward demographic analysis of age structure in section 5.2, two points are nevertheless worthy of particular stress. These are : (a) the obviously youthful workforce structure still possessed by certain mining parishes ; (b) the relatively aged structure of a number of "commuter belt" parishes in the Tyne valley perhaps reflecting their propensity to attract rather older persons who wish socially and can afford economically to be removed from their workplace in the Tyneside conurbation and live in a more rural environment.

A large number of indices correlate significantly with the two variables at present under discussion. These further emphasise what has already been pointed out above. Despite an only moderate level (0.57) of intercorrelation between these two indices, many of the correlations which reach $\pm$ 0.40 are held in common. One of the most apparent relationships is a positive one reflecting the connection between a youthful labour force and an urban environment. Hence correlations of up to 0.54 are found between both the 1961 and 1966 age of workforce indices and the three density variables for 1951, 1961 and 1967, and the two population potential variables for 1951 and 1967. In addition, the 1966 variable correlates negatively with two of the indices representing distance from urban centres of various sizes. Correspondingly, negative correlations are shown with agricultural employment variables for 1961, 1963 and 1966, and a positive relationship in one instance with employment in production.

Amongst the remaining correlations of note, a large number reflect the link in the 147 parish units between a youthful labour force and a high proportion of persons in the manual and unskilled social and socio-economic categories. Similarly, leading on from this, one has the negative correlations with car ownership, low 1966 person per room densities and a high terminal education age. Significant positive correlations for both the 1961 and 1966 workforce structure variables exist with the percentage of households living in 1966 in Local Authority housing, 1961 persons per household and 1961 persons per room.

Finally, as one might expect, a number of demographic variables representing a youthful age structure, or its results, also correlate at a level of ±0.40 or above with the two variables currently under consideration. As is apparent from Table 6.1, these vary from a correlation of 0.70 between the proportion of the entire population which was aged 15 to 44 in 1966 and the proportion of the workforce similarly aged, to correlations of 0.40 between the 1961 workforce structure variable and the Crude Birth Rate/Crude Death Rate difference factor, and 0.43 between the 1961 workforce age structure variable and the Crude Birth Rate during 1964/65.

(viii) Activity Rates

An activity rate is generally taken to mean the proportion of the population that is economically active (Clarke 1972). Quite frequently it is expressed age specifically so as to exclude the influence of persons considered too young or too old for employment. In the present study, the relatively few persons involved in the unit sample population at both the 1961 and 1966 Censuses together with their variable sex structure (far less women in total being employed than men) makes anything other than a very crude indication of activity rates impossible. Hence a single index of the proportion of the total 1961 population who were economically active (employed and unemployed) has been calculated. This index was not considered sufficiently significant to be incorporated in the factor analyses described in Chapter 3.

Nevertheless, despite its obvious reflection of the age structure of a unit's population, several associated points of interest stand out particularly clearly from a consideration of those units with the highest and lowest values. The unweighted mean value gave 41.5 percent of a sample population being economically active. Against this, twelve units fell below 35 percent. These units were largely of three types. First, there were those parishes which had a large number of children in consequence of a high birth rate, itself caused by a large population of young adults. Peterlee (34.6 percent) and the Streatlam and Stainton unit (34.4 percent) are of this type. Second, by contrast, a number of units had a sufficiently large number of old persons in their private household populations to similarly depress the activity rate. Pittington (34.1 percent), the Shincliffe unit (27.2 percent), the Alwinton unit (34.8 percent) and the Eglingham unit (34.3 percent) are of this type. Finally, the overwhelming effect of institutions, particularly old persons homes or hospital accommodation is a factor causing many of the most extreme values. Such an institutional effect may be cited in the cases of those units containing the parishes of Hebron (25.9 percent), Stannington (25.2 percent), Gainford (33.9 percent), Heighington (30.6 percent) and Sedgefield (26.0 percent).

In contrast, values in excess of 47 percent are exhibited by 14 units of considerably varied type. Little Lumley (48.1 percent), Lamesley (48.5 percent) and Carlton/Whitton (57.9 percent) may be described as part industrialised parishes, whilst others such as the Alnham (50.9 percent) and Greystead (49.5 percent) units are entirely of a rural and remote nature. The Otterburn (47.8 percent) and Middleton St George (50.0 percent) units have significant defence populations, whilst Heddon-on-the-Wall (49.2 percent) is largely of a residential nature. Few of the units in this category had above average proportions of their population in the 15 to 59 age groups in 1966 and genuinly high activity rates appear to obtain.

In part, doubtless, the lack of homogeneity in these unit types will result from several factors including the sex ratio at the 1961 Census, the age composition of the population and the proportion of the population aged over 15 still in full time education. Likewise the lack ofcorrelation between the proportion of the 1966 population aged between 15 and 59, and the 1961 economically active ratio will at least partly be the statistical result of comparing two sensitive sample ratios based upon relatively small populations. Nevertheless, it is somewhat surprising that despite the multiplicity of factors acting upon the overall activity rate only one correlation reaches $\pm$ 0.40 or over. Perhaps not unexpectedly, this correlation of 0.46 is with the 1961 proportion of the population aged 15 or over.

Little more than this can be said on the subject of activity rates. It may well be that "....the differential between the rural and the urban or regional rates is partly a reflection of variations in the age structure and journeys to work out of the rural area, but nevertheless indicates the degree of under-employment in rural areas" (Ross 1967 p.21). The verification of this and its extent, as well as the part played by the various causal factors must, however, be the subject of other studies.

6.3 The Rural Journey to Work

It is undoubtedly true that journey to work patterns reflect many social and economic characteristics of the populations to which they relate. As such, journey to work forms an obvious and significant topic to be considered here.

With the exception of 1931, all Censuses since 1921 have included a question relating to the workplace of enumerated persons. The deficiencies of such data have been well criticised by Lawton (1963) who, in particular, notes that workplace and residence are recorded in terms of Local Authority area rather than any economic or social entity. Similarly, what is recorded is the crossing of an administrative boundary rather than the duration or length of the journey to work. The most obvious result of this is that particularly small administrative units tend to show large volumes of movement across their boundaries.

Nevertheless, as will be clear from the ensuing analysis, although the drawbacks resulting from a Local Authority base may reduce the value of the statistics, it by no means makes them worthless. Moreover, House and Fullerton (1960) point to a consideration outlined by the Registrar General on journey to work statistics "....the stressing of this limitation is not intended to imply that there is any severe loss in the value of the Statistics:on the contrary, they gain in importance from being related to Local Government boundaries in so far as they illustrate the extent to which those boundaries enclose populations whose economic activity is identified with the area...."(pp.362-4).

Since the Census began to include a question on workplace, a number of fundamental changes in journey to work patterns have been apparent. Perhaps the most noticeable change has been that of the progressive extension of commuter hinterlands around poles of attraction. Hence, "....up to ten years ago, most rural-urban zones could have been described as extensions of the town into the surrounding rural area: if still administered by a rural district council this was merely an artificial and temporary situation arising from a lag in Local Authority boundary adjustments. This statement would not now necessarily be true, for commuters travel in from much farther afield" (Bracey 1970 p.24). Similarly, Lawton (1963) has remarked on the great growth of daily movement to work between 1921 and 1951 with some of the most marked changes having taken place in Rural Districts as employment has declined relative to population. In many cases, a self-contained nature in 1921 had been replaced by a significant degree of dependence for employment on nearby towns in 1951.

The data in the present study were derived from the 1966 Sample Census. Unpublished lists possessed by Durham County Council give details of every single journey to work movement which had as its origin or destination any part of the geographical counties of Northumberland or Durham. Specifying, amongst other things, the industry of employment, mode of travel to work, the enumeration district of residence and workplace, a majority of the entries relating to Rural Districts dealt with individual movements. The work of extracting and preparing a summary of these movements was therefore a particularly lengthy task. However, finally a table was derived giving for each parish in the twenty Rural Districts:

(a) the number of workers resident in and working in the same parish;
(b) the number of workers resident in a parish but working elsewhere;
(c) the number of workers working in a parish in which they were non-resident.

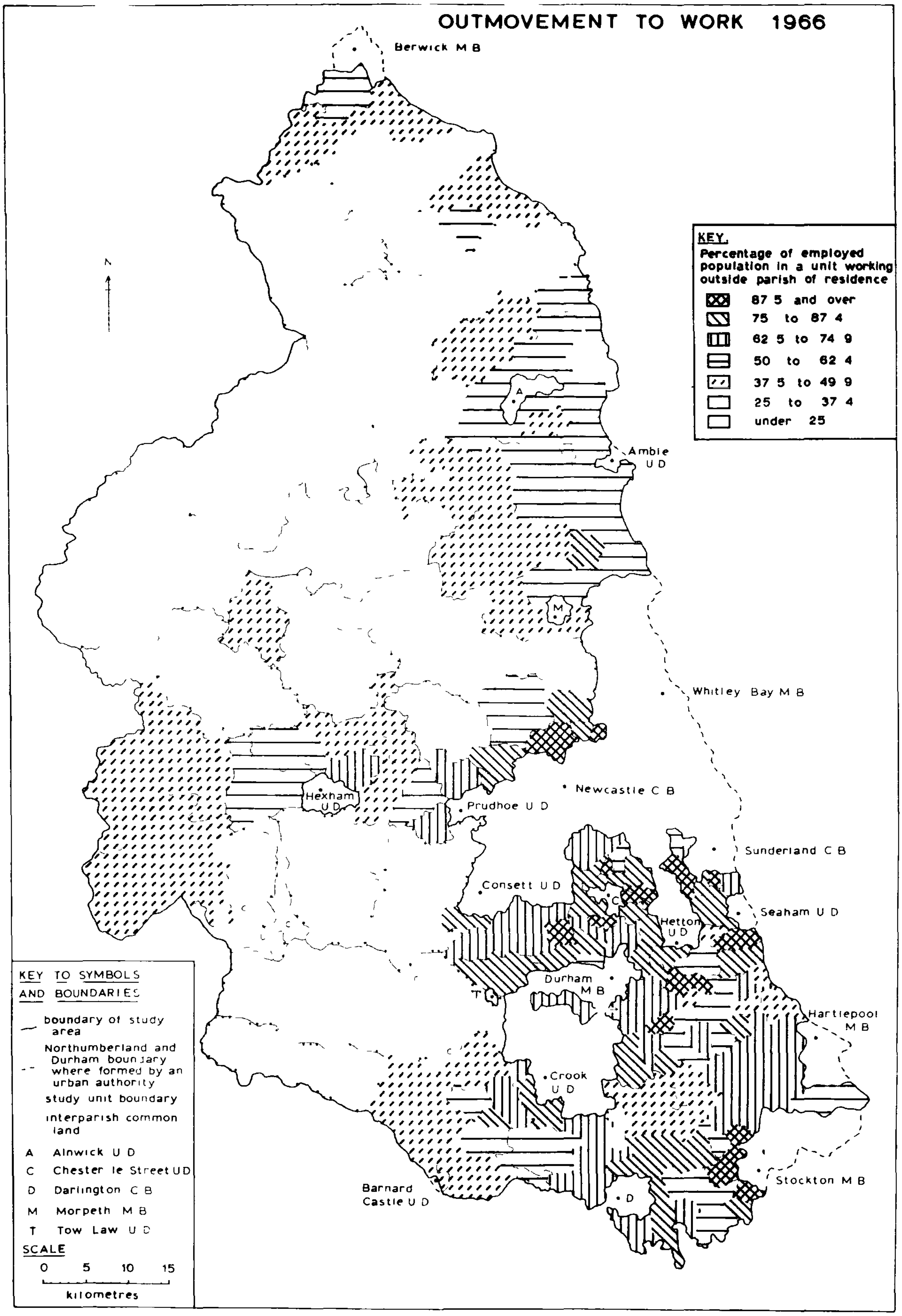
Consequently, account was taken of all persons in the twenty Rural Districts who worked in urban administrative areas or entirely outside Northumberland and Durham, and persons who did not live in any part of those Rural Districts but worked within them. Based on this Civil Parish level data, a number of measures of journey to work movement were subsequently developed.

(i) Outmovement to Work

In considering the proportion of the total resident population of individual Local Authority areas who work outside those areas, Lawton (1959) found two significant features. First, he noted that widespread outmovement to work was a much more apparent feature than inmovement. Second, he found that major industrial centres experienced very small volumes of such outmovement, but that surrounding these areas, a belt of suburban districts showed very intensive outward currents.

Similar calculations to those undertaken by Lawton have been made here with reference to the 1966 Census journey to work data described above. However, the calculations have been based on the individual units and the resident working population. Consequently, Figure 6.7 portrays the proportion of the unit resident working population who travel to work outside their parish of residence.

A number of features are quite apparent from Figure 6.7. The restrictions of the lowest values for outmovement to work to the remoter


OUTMOVEMENT TO WORK 1966
Berwick M B
KEY.
Percentage of employed population in a unit working outside parish of residence
87 5 and over
75 to 87 4
62 5 to 74 9
50 to 62 4
37 5 to 49 9
25 to 37 4
under 25
N
A
Amble U D
M
Whitley Bay M B
Newcastle C B
Hexham U D
Prudhoe U D
Sunderland C B
Consett U D
C
Seaham U D
Hetton U D
Durham M B
T
Hartlepool M B
Crook U D
Barnard Castle U D
D
Stockton M B
KEY TO SYMBOLS AND BOUNDARIES
boundary of study area
Northumberland and Durham boundary where formed by an urban authority
study unit boundary
interparish common land
A Alnwick U D
C Chester le Street U D
D Darlington C B
M Morpeth M B
T Tow Law U D
SCALE
0 5 10 15
kilometres
Figure 6.7

rural areas is particularly clear. Although this in part, may be explained by the frequently larger parishes in such units, causing movements of a length which elsewhere would cross a parish boundary to still be of an internal nature, this is not always so (for example Wooler and Rothbury). Likewise, such is the restricted nature of the location of such low value units that factors other than size of parish may be looked for in the correlation analysis (see below). Nine parish units have under 25 percent of their resident working population employed outside the parish of residence. With the possible exceptions of Longhoughton (21.1 percent) with its defence interests and Wooler (23.5 percent) with its function as a subsidiary rural node, all may justly be described as remote rural units - the Stanhope (12.9 percent), Kielder (10.4 percent), Elsdon (17.4 percent), Kirkwhelpington (19.2 percent), Alwinton (8.6 percent), Bowsden (15.9 percent) and Branxton (21.6 percent) units. Thus, Edwards' (1963) conclusions on their being an inverse relationship between the importance of agriculture and the importance of journey to work movements would certainly appear to be supported by the present study.

The distribution of extremely high values for outmovement gives an equally clear pattern. Of the 14 units shown on Figure 6.7 as having 87.5 percent or over of their working population employed outside the parish of residence, one-half are quite clearly suburban residential centres. The North Gosforth unit, for example, recorded 97.4 percent of its resident workforce moving outside that parish to work, most obviously to the Tyneside conurbation. Other high values are exhibited by Herrington/Offerton (91.2 percent), Bournmoor/Lambton (95.0 percent), Ouston (95.1 percent), Elton/Norton (91.5 percent), Woolsington (94.6 percent) and Preston-on-Tees (89.5 percent). The other seven units with comparable values for outmovement to work are all situated in County Durham - Tunstall (91.2 percent), Plawsworth (93.8 percent), Coxhoe (90.6 percent), Langley (93.1 percent), Hawthorn/Cold Hesledon (87.5 percent), Little Lumley (89.5 percent) and Shadforth (89.2 percent). Of these units, only Plawsworth had under 20 percent of its 1966 enumerated workforce employed in mining (19.7 percent) and a majority had over one-third thus employed. The effect of rationalisation in the mining industry and the concentration on a relatively small number of pits may be seen reflected here, in the resultant increased journey to work of many redeployed miners. Other workers have commented upon this phenomenon (House and Knight 1967, House 1969), with one noting most pertinently that: "At present, more than a thousand miners are travelling daily from West Durham to work in the developing coastal collieries, and their numbers may well increase" (Bowden 1965 p.21). It is interesting to note that a number of the mining units mentioned above as having particularly strong outward journey to work movements are located in close proximity to mining units which have extremely strong inmovements to work (see below). Such are Tunstall (adjacent to Silksworth), Coxhoe (adjacent to Kelloe) and Shadforth (adjacent to Thornley).

A number of less extreme features are also apparent from Figure 6.7 and are worthy of comment. First, it is apparent that nearly all the County Durham units away from the extreme west have moderate to high outflows in contrast to the majority of Northumberland units with their more self-contained nature in this context. One may perhaps relate this high rate of movement in Durham to the proximity of urban areas with their more varied employment opportunities, particularly in the light of Thorpe's (1970) comment on the great increase of journey to work distances between 1951 and 1966. Second, amongst the low values generally found in Northumberland, a belt of more moderate outflow exists in the east from Morpeth to slightly north of Alnwick. Several factors may combine to cause this - the relative proximity of Tyneside and the urban areas of south-east Northumberland, the occurrence of significant but localised mining activity in parts of this area of rural Northumberland, and the exceptional nature of part of the coastal belt already noted on several occasions in earlier sections. Third, it is very noticeable that surrounding Hexham and Alnwick, and south of Berwick, there is an increase in the proportional importance of outmovement to work as these market towns are approached. This is obviously a reflection of the importance of such market towns in the employment structure of rural areas. Although the importance of the market towns in this context has previously been stressed by Ironside (1964), the present analysis does indicate a fairly strong distance decay function in relation to their role of employment centres.

A large number of significant correlations of $\pm$ 0.40 or above occur in Table 6.1 in relation to this journey to work index. These serve to amplify the above analysis and, quite naturally, many are to be expected from the important position held by the outmovement to work index in Factor 1 of the R-mode factor analysis and Factors 1 and 3 of the Q-mode analysis. Thus, the less rural and more heavily populated units are more likely to have a large proportion of their working population employed outside their parish of residence as exemplified by the moderate to high correlations between the present index and all three density variables. Correspondingly, the association between units experiencing a marked outmovement to work and mining employment and particularly production (r_s = 0.67 between the outmovement to work and the 1966 production variables) is also apparent. Not unexpectedly, a moderate to high negative relationship exists between the outmovement to work and the various agricultural employment variables.

Two other forms of positive relationship with outmovement to work are no more than logical extensions of the above arguments. First, as will be shown in section 6.4, the more densely peopled units, partly in consequence of land values and partly in consequence of Von Thünen effects, possess a more intensive land use pattern as measured by output values and labour requirements per unit area. Hence such correlations as those of 0.58 between the present index and the 1967 Standard Net Output per hectare, and 0.53 between the former and the percentage of regular agricultural workers who were whole time employees. Second, the proximity of areas with substantial outmovement to work to major urban centres is particularly striking, emphasising Bracey's (1959) contention that the distance which commuters are willing to travel varies proportionately with the size of centre to which they journey. Nevertheless, the strength of the relationships with both population potential variables (r_s = 0.72) and all four distance indices (reaching r_s = -0.74 between outmovement to work and the distance from the nearest centre of 24,000 or more persons) is particularly marked.

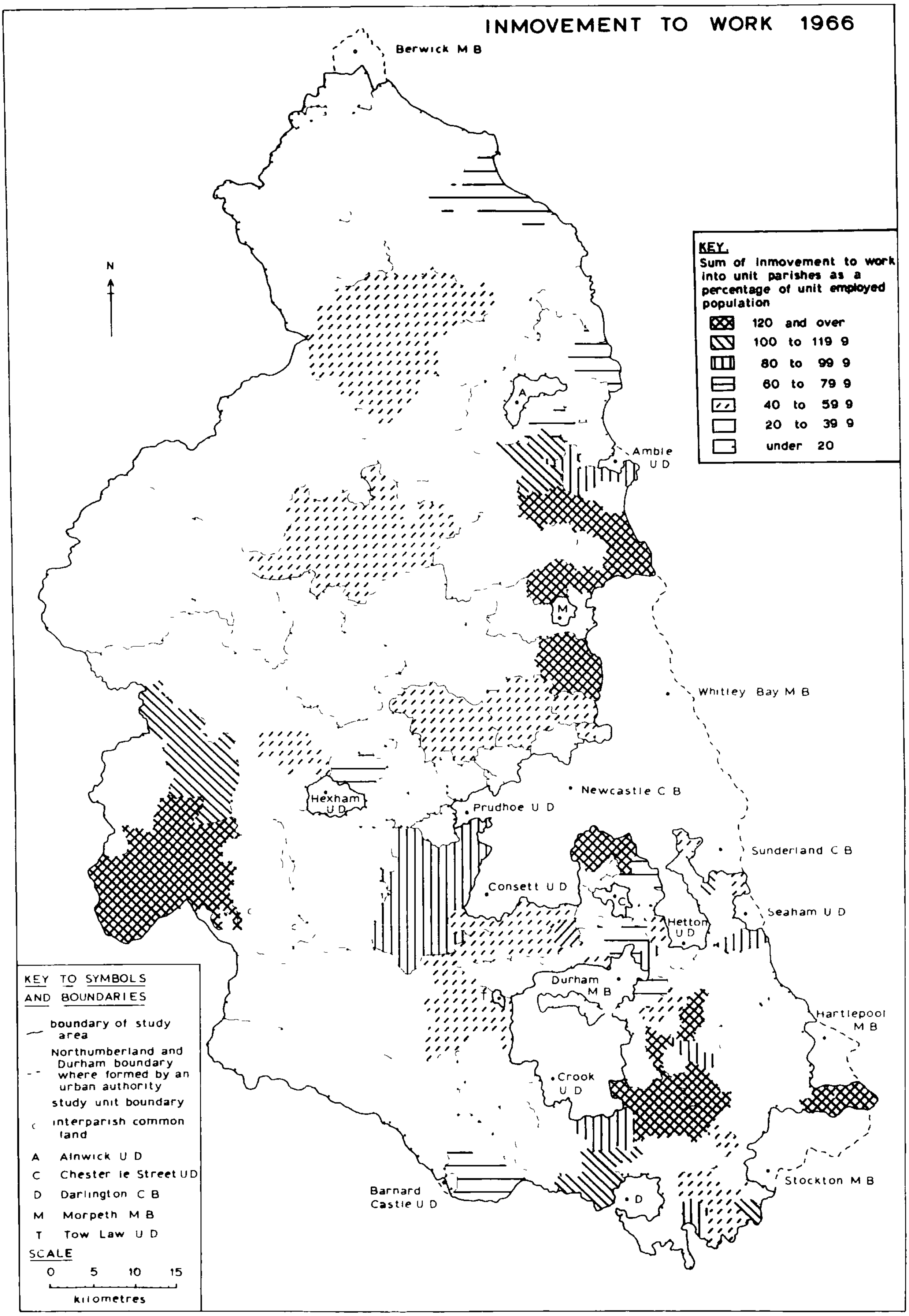
The remaining correlations of significance are of a varied nature. Negative associations of slightly under -0.50 exist in relation to the two indices representing the ratio of theoretical Standard Man Day requirements to estimated actual usage, though once more this probably does no more than exemplify the fact that many of the more densely populated near-urban units have a substantial number of part time farmers (see section 6.4(i)). The two correlations with other journey to work indices require no further comment, whilst that of 0.53 with the proportion of 1961 economically active and retired males in Social Class III shows the importance of journey to work movement for skilled persons living in nominally rural areas and presumably working largely in manufacturing industry. The remaining three correlations (0.43 with persons per room in 1961, -0.42 with the proportion of 1961 households possessing no family unit, and -0.43 with the average age at death variable) all reflect in part the age differential between near urban and remoter rural areas.

(ii) Inmovement to Work

Lawton (1959) has also noted the main features of inmovement to work at a Local Authority level, where this is calculated as the number of workers moving into an area expressed as a proportion of the total resident population of that area. It was found that, perhaps not surprisingly, urban areas were generally far more obvious examples of high percentage inmovements to work as compared to Rural Districts. He concluded: "The surrounding rural areas with little to offer by way of manufacturing or service industry tend to draw their labour mainly from within their own boundaries. Many of the more remote districts have less than 5 percent daily inmovement and there is a strong coincidence between such areas and the rural districts associated with long and continuous loss of population by migration" (Lawton 1959 pp.245-7).

With this in mind, one may turn to the pattern of inmovement as it is defined by the 1966 Census data at the unit level of this study. Two preliminary points should, however, again be borne in mind. First, because of the nature of the data (especially the variation in activity rates), all journey to work movements have been related to the resident working population of the parish of origin as derived from the special unpublished tabulations. Hence, one may expect higher proportional figures for movements than would be obtained had the total resident population been used. Second, as volume of movement is in part a function of the size of area considered, where several parishes comprise a unit, each parish has been considered as a separate entity before the summed total has been made of the proportion of persons moving into work. Hence, for a two parish (A and B) unit, all inmovements from B to A and vice-versa are included as actual inmovements to work in so far as that unit is concerned (see Figure 6.8). This has two advantages: (a) it reduces the effect of areal discrepancies especially, as is generally the case, the larger a parish, the smaller its population and the more such parishes required to form a unit; (b) it considerably reduces the amount of work required on the raw data to convert it into a usable form, a particularly important consideration when dealing with individual movements!

Figure 6.8 shows a distinct pattern even at the micro-level where one would expect a maximum of movement to occur. Few parish units are noticeable poles of attraction with a majority of units having a proportion equal to under 40 percent of their resident workforce coming into work. This is particularly so in two types of area. First, remoter rural areas



INMOVEMENT TO WORK 1966
Berwick M B
N
KEY.
Sum of inmovement to work into unit parishes as a percentage of unit employed population
120 and over
100 to 119 9
80 to 99 9
60 to 79 9
40 to 59 9
20 to 39 9
under 20
A
Amble U D
M
Whitley Bay M B
Newcastle C B
Hexham U D
Prudhoe U D
Sunderland C B
Consett U D
C
Seaham U D
Hetton U D
Durham M B
Hartlepool M B
Crook U D
Barnard Castle U D
D
Stockton M B
KEY TO SYMBOLS AND BOUNDARIES
boundary of study area
Northumberland and Durham boundary where formed by an urban authority
study unit boundary
interparish common land
A Alnwick U D
C Chester le Street U D
D Darlington C B
M Morpeth M B
T Tow Law U D
SCALE
0 5 10 15
kilometres

Figure 6.6

such as Stanhope (12.9 percent), the Kielder unit (10.4 percent), the Alwinton unit (8.6 percent) and the Bowsden unit (15.9 percent) have little attraction as workplaces to persons other than residents. Such low values are particularly apparent throughout the west of the region and in north and central Northumberland. Second, units such as those in the Tyne valley already noted as being largely commuter residences, equally experience low inmovements. Such values as the 11.7 percent of Elton/Norton, the 11.6 percent of Preston-on-Tees, the 14.9 percent of Heddon-on-the-Wall and the 11.7 percent of North Gosforth are most obvious.

Only 18 units on the other hand, have an inflow of workers to their constituent parishes which exceeds their total resident employed population. Despite the scattered nature of these units on Figure 6.8, they fall neatly into three types. First, a number of units have sufficient manufacturing employment to cause them to fall into this category. Greatham/Seaton is the most exceptional with over eight times as many workers crossing a parish boundary to work within the unit as actually live there. Lamesley and Birtley with ratios of slightly over 130:100 are less extreme examples. It is interesting to note that, despite the large absolute numbers entering to work, neither Peterlee nor Newton Aycliffe fall into this category. Second, the increasing concentration of mining on a number of pits has its influence. In Durham, Kelloe and Thornley are notable attractions here, whilst in Northumberland the area around Morpeth provides similar examples. Finally, a number of rural service centres draw in significant numbers of workers. The regional hospital centres of Sedgefield and Stannington are most notable here but one may also note the Woodham unit which contains Aycliffe Approved School and another County Council run residential school.

It is apparent from Table 6.1 that few significant correlations are exhibited by this variable, despite its importance as the major component of Factor 4 in the R-mode factor analysis. Indeed, only two correlations of ± 0.40 or over are found, both with other journey to work indices: -0.75 with the total movement index and 0.73 with the job ratio index. Nevertheless, this is not an entirely surprising state of affairs. It will be obvious that the three classes of unit discussed above and experiencing significant inmovement are not typical in any sense of all mining, manufacturing or service industry dominated working populations. Likewise, whilst the remoter rural areas tend to have a low value for the inmovement index, variations amongst these units themselves would seem likely to be explained by factors not considered in depth here such as size and population of parishes.

(iii) Total Movement to Work

A simple summation of the two movements already discussed, albeit overwhelmed in a few cases by large inmovement volumes, serves to indicate gross journey to work volumes in a parallel way to that used by Lawton (1959). In his study, that author found particularly low movement percentages (again based upon entire Local Authority areas and total resident populations) a characteristic of the remoter rural areas, with the more accessible rural areas having markedly higher figures.

In the current study, the unweighted unit mean total movement came out at 111.4 percent of the resident working population. This, however, obscures wide variations. The units with the highest values on this count quite naturally tend to be those noted above in section 6.3(ii) as having high values. Thus, the eight units with values over 200 percent vary from the astronomical 863 percent of Greatham/Seaton, across the substantially lower values of Kelloe (416 percent), Hebron/Longhirst (367 percent), Ellington/Lynemouth (344 percent), the Cresswell unit (267 percent), Thornley (254 percent), Langley (224 percent) and Lamesley (208 percent).

On the other hand, it is most noticeable how, except for the few aberrations noted above, most County Durham units apart from some in the more rural west, tend to have values which cluster within ±20 percent of 100. The same is true of the majority of Northumberland units in close proximity to Tyneside. However, as one moves away from the urban areas and into the remoter countryside, a progressive drop in total journey to work movement is at once apparent. In all 17 units have a total movement of under 50 percent (Table 6.2). The unifying characteristic of all these parish units, to a greater or lesser extent is their relative isolation from urban populations. It is particularly interesting that a number of the more populous of the remoter rural units also find their way into the above list. Certainly, none of North Sunderland, Stanhope, Wooler, Allendale, Rothbury, Middleton-in-Teesdale or Bellingham would appear to have much relevance either as dormitory settlements for the surrounding parishes or as employment nodes. The self-containment in employment terms of many rural units when these are compared to those which are nearer urban areas is quite striking.

Table 6.2

Total Journey to Work Movements

Unit number on Figure 3.1	Parishes in Unit	Percentage
127	Alwinton, Biddlestone, Harbottle, Rochester	22.9
110	Kielder, Falstone, Tarset	25.0
144	Bowsden, Lowick, Kyloe, Holy Isle	27.3
113	Hartburn, Kirkwhelpington, Rothley, Wallington Demesne	27.7
137	North Sunderland	31.1
76	Stanhope	32.5
126	Callaly, Netherton, Snitter, Thropton, Whittingham	36.4
107	Belsay, Capheaton, Whalton	38.5
141	Wooler	39.5
85	Allendale	41.5
125	Rothbury	42.3
136	Adderstone, Beadnell, Ellingham	44.2
140	Akeld, Chatton, Ewart, Doddington	45.5
124	Brinkburn, Hesleyhurst, Tosson Cartington, Longframlington	45.9
75	Forest and Frith, Newbiggin Middleton-in-Teesdale	46.1
111	Bellingham	46.2
109	Greystead, Simonburn, Wark	46.7

The nature of the correlation structure exhibited by this variable is not surprising in view of the above analysis but is especially noteworthy for its clarity. In the first place, high journey to work volumes show moderate positive associations with all three density variables and (at a slightly higher level) with the two population potential indices. This emphasises the tendency for County Durham and Northumberland units which are situated relatively near urban areas to experience significant journey to work movement across parish boundaries. The occurrence of other moderate positive correlations with the 1963 Standard Man Day per hectare and Standard Net Output per hectare variables and the 1966 production employment index may similarly be related to this locational effect.

Conversely, it is most noticeable how all four distance variables correlate negatively with total journey to work movement, reaching -0.60 in relation to the distance from a centre of 24,000 or more persons. One may ascribe the remaining three negative correlations with agricultural variables to a similar cause.

Of the final three variables correlating at a level of ± 0.40 or more with the present index, little need be said. Two relate quite reasonably to other journey to work measures; it is noticeable that the higher of the two relates to inmovement ($r_s = 0.75$) rather than outmovement ($r_s = 0.56$). The last association of note (0.45 with persons per household in 1961) obviously reflects a triangular effect - units nearer urban areas generally have a more youthful population and hence more persons per household, as well as higher journey to work mobility.

(iv) Job Ratio

In addition to the above, a final composite index based on the 1966 journey to work data was calculated. This, the job ratio, expresses the number of persons working within an area as a percentage of the occupied resident population of that area. An index exceeding 100 indicates more jobs than resident workers and vice-versa. The index was calculated on a parish basis but as internal movements between parishes in a unit cancel each other out, it consequently refers to the 147 units as a whole.

The pattern which one might expect at the District level has been well documented by Lawton (1959 and 1963). His most pertinent conclusion was: "The majority of rural districts are in this category /"under 100/ but since many fall in group 90-100, the outward movement of workers implied is not a large one. Nevertheless, job deficiency in such areas is serious after over a century of rural depopulation has drained surplus manpower" (Lawton 1959 p.253). Figure 6.9 shows the results of the present inquiry at the micro-level.

A most revealing pattern is presented by the job ratio distributions. Seventeen units have a ratio exceeding 100. Most of these (for example Stannington, Greatham/Seaton, the Plenmeller unit and the Longhoughton unit) have already been noted as having a particularly strong inmovement to work for one reason or another (section 6.3(ii)). Nevertheless, two points are worthy of stress. First, the trading estate influence is apparent in the values shown by Birtley, Lamesley and Great Aycliffe. On the other hand, all these ratios are little in excess of 150, compared to the 840.7 of Greatham/Seaton, whilst Peterlee falls well below unity.

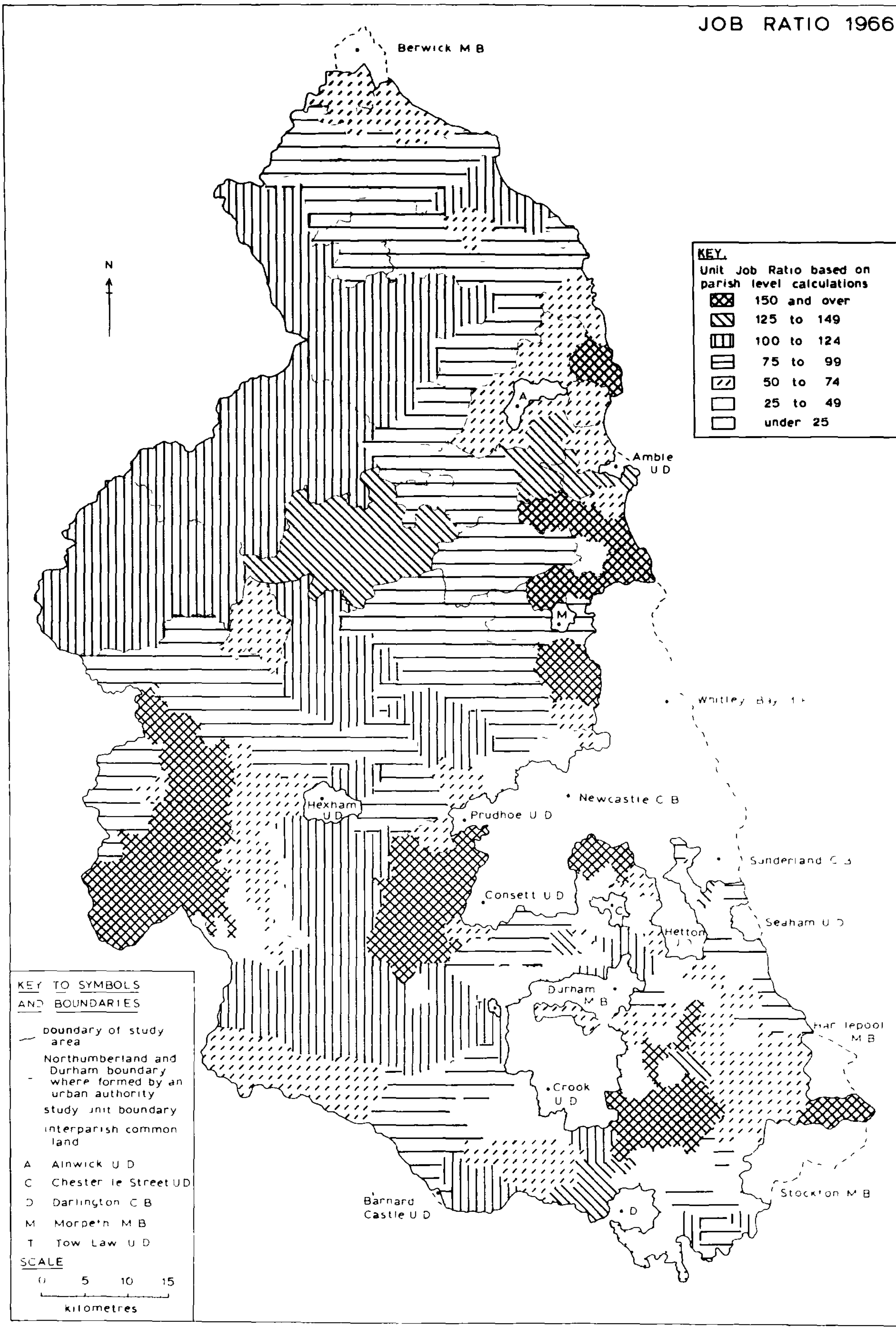

JOB RATIO 1966
Berwick M B
N
KEY.
Unit Job Ratio based on parish level calculations
150 and over
125 to 149
100 to 124
75 to 99
50 to 74
25 to 49
under 25
A
Amble U D
M
Whitley Bay
Newcastle C B
Hexham U D
Prudhoe U D
Sunderland C B
Consett U D
C
Seaham U D
Hetton
Durham M B
Hartlepool M B
Crook U D
T
Barnard Castle U D
D
Stockton M B
KEY TO SYMBOLS AND BOUNDARIES
boundary of study area
Northumberland and Durham boundary where formed by an urban authority
study unit boundary
interparish common land
A Alnwick U D
C Chester le Street U D
D Darlington C B
M Morpeth M B
T Tow Law U D
SCALE
0 5 10 15
kilometres

Figure 6.9

Second, the influence of isolated mining centres is clear whether in its continuing role in Morpeth R.D. (Lawton 1959) or in such parishes as Kelloe or Thornley in County Durham.

Whilst a substantial tract of the obviously rural units in Northumberland reveals ratios of between 75 and 100 (lower near the market towns of Alnwick and Berwick), values tend to rise in the Anglo-Scottish borders. Undoubtedly, here, isolation from urban centres leads to very little outmovement to work, whilst forestry attracts small but significant numbers of workers from elsewhere in the rural areas. Similarly, in County Durham, Weardale, with values slightly over 100 may appear a somewhat anomalous zone. Nevertheless, as noted by Ironside (1964) this may be accounted for by the presence of small manufacturing works, especially iron and steel plants at Stanhope and Wolsingham, whilst the recently built Eastgate Cement Works (Stanhope), has drawn many people in from outside the dale.

At the other end of the scale, fully 37 units have a job ratio below 50. Surprisingly, but conveniently, two types of unit form the overwhelming majority of these examples. First, many of the units already noted and defined as being residential/commuter types have extremely low job ratios. Offerton/Herrington (19.2), Great Lumley (31.7), Bournmoor/Lambton (43.6), Ouston (27.2), Elton/Norton (20.3), Preston-on-Tees(22.1), Hurworth/Blackwell (43.0), Wylam (44.1), Heddon-on-the-Wall (38.8), Woolsington (24.1) and North Gosforth (14.3) have all some claim to be so described. The urban fringe nature of these parishes is clear and, indeed, the influence of large centres is nowhere more obvious than at Darlington where the Whessoe, Great Burdon and Hurworth units all fall below 50. Second, many units in mining areas have equally low values, particularly where a pit in one unit may have been closed and redeployment to a neighbouring mine have occurred. Nearly all such units are naturally in County Durham with Tunstall (19.7), Edmondsley/Waldridge (23.9), Pittington (27.0), Shadforth (18.1), Sherburn (23.9), Hutton Henry (26.8) being the most extreme; Ulgham (30.9) is the sole Northumberland example.

In the factor analyses undertaken in Chapter 3, the job ratio variable was one of the main components of the R-mode Factor 4. However, this factor was solely related to journey to work indices, and in terms of Table 6.1, the only two correlations reaching ± 0.40 or over are with the inmovement (0.73) and outmovement (-0.61) to work indices. Consequently, despite the obvious categories into which extreme high and low job ratios fall, there is a general lack of correlative identity with any of the other indices used in the present study.

(v) Conclusion of the Journey to Work Study

The predominant impression left by Figure 6.7, Figure 6.8 and Figure 6.9, along with the associated analysis, is that mobility to work is mainly an urban related phenomenon with mining an accentuating influence. The remoter rural areas on the other hand, are far more self-contained entities in employment terms despite the increased journey to work distances in rural areas noted especially by Burton (1966). However, some evidence has been adduced suggesting a limited attraction exercised by such market centres as Alnwick and Berwick. The influence of such market centres is seen by many authors as important in employment and population terms for the surrounding rural area. It has been commented that: "If developments were concentrated at the commuting focus, by the introduction of additional employment opportunities and improved community facilities, the increase in population would occur not only at the centre but also in the hinterland villages" (Lewis 1967 p.303). Taken to its extreme, this approach has led to such statements as that by Bracey (1959) that the addition of commuters to rural areas will minimise the debilitating effects on rural social life consequent on the decline of rural population. Even so, any significant trend towards this state of affairs has been restricted to urban flanking units where it tends to be overwhelming in its influence. Conversely, in the remoter rural areas, little such effect is apparent.

6.4 The Nature of Agriculture I

As was pointed out in Chapter 2, one of the clearest features by which a truly rural area may be recognised is in the importance of agriculture, in terms of land use, employment and, by logical extension, a reduced population density on account of the land carrying capacity. It is appropriate therefore, in view of the chosen subject of research - rural (albeit administratively) population - a rather more detailed consideration should now be given to various aspects of agriculture. In consequence, a number of production efficiency, production intensity and agricultural labour force indices have been calculated in an attempt to assess any marked patterns of distribution that they may possess.

(i) Standard Man Day Ratio

As a simple measure of efficiency one may calculate the theoretical labour requirements of the crops and livestock in a parish by the application of standard labour requirements (Standard Man Days - SMDs) to the Ministry of Agriculture June Census Returns. This may be then compared with the actual agricultural labour usage in that parish.

One such variable was included in the factor analyses of Chapter 3. Acreages and livestock numbers were taken from the 1967 Ministry of Agriculture June Returns for every parish in Northumberland and Durham. These were then transferred to cards and, based upon given SMD equivalents (M A F F 1970), a computer programme was written to give total theoretical SMD requirements per parish unit. Similarly, the employment figures given in the same Census were used to arrive at an estimate of total actual labour usage. As it was not possible in the time available to analyse the data to provide a theoretical breakdown of the labour usage[1] (stockmen against fieldworkers etc.), the general figure of 275 SMDs per labour unit was used in the calculation of actual labour usage. No figures were available for the number of farmers or family helpers and therefore the practice was adopted following Johnston (1966), of estimating one farmer per farm in the labour calculation.

At the same time, it is obvious that regular part-time workers and temporary seasonal employees can not realistically be taken as being equivalent to the standard man year of the full-time worker. Discussion at both the County Durham Local Office and the North Regional Office

[1] The collection of data for 1963 and 1967, its transfer to punched cards and the final computer operations took approximately three months. The transcription of the records involved something over 500,000 digits.

of the Ministry of Agriculture suggested that an approximate figure of 0.5 of a full-time equivalent might be used in relation to these part-time and other groups. A figure of 0.47 was finally taken as being, in wage terms, the relationship between regular part-time and seasonal and temporary workers, and full-time regular employees in the post-war era (M A F F 1965).

The resultant comparison of theoretical to 'actual' labour usage is obviously a crude index. It is quite apparent that the labour requirement of a hectare of wheat will depend largely upon the intensity of the farming system. Similarly, the relationship between farmers and farms, or full-time and other employees may hold true overall but have wide local deviations. Consequently, on Figure 6.10, which shows the results of the above calculations, one must look for general patterns and themes rather than individual extremes. The general themes appear clearly.

It is obvious from Figure 6.10 that values in excess of 1.0 are largely restricted to central, north and west Northumberland where they cover much of the area. Most of these values occur in the least densely populated areas with extremes in the Alnham (1.31), Bowsden (1.27), Rothley (1.24) and Alwinton (1.23) units. Correspondingly, except for a restricted area immediately west of Darlington C.B., values in excess of 1.0 are extremely rare in County Durham.

At the other end of the scale, low values of below 0.6 are a feature of County Durham, especially in the coalfield area. It is quite obvious that such values are a feature associated with the more densely populated areas. Of the 19 parish units concerned, only 4 are to be found in Northumberland, whilst every one except Blackwell/Hurworth and Harraton/South Biddick[1] is a single parish unit. The majority of examples are Durham coalfield units and include Silksworth, Pelton, Coxhoe, Ryhope, Harraton/South Biddick, Hylton and Ford. All these seven units have a value of between 0.4 and 0.6. Only the lowest value of 0.11 (Sacriston) falls substantially below 0.4, and may be attributed to the obviously part-time nature of all four holdings (total area under 10 hectares) in the parish. Two of the holdings, indeed, possessed under 2 hectares of crops and permanent grassland.

[1] In both these cases, one parish (Harraton and Hurworth respectively) had a population of over 1,000 in 1961 with the amalgamation for study purposes being caused by peculiarities of the June Census Returns (see section 3.1).

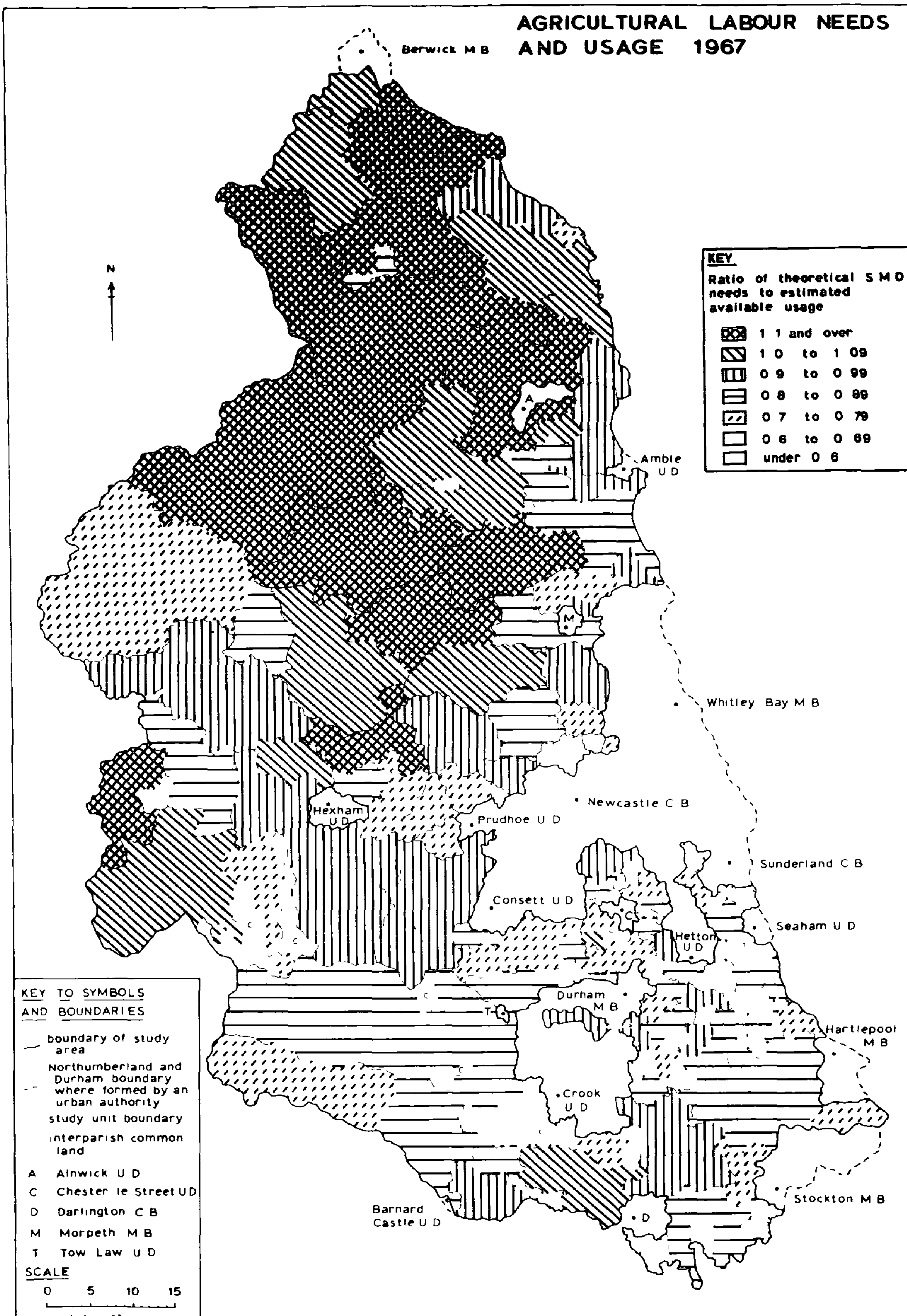

AGRICULTURAL LABOUR NEEDS AND USAGE 1967
Berwick M B
N
KEY
Ratio of theoretical S M D needs to estimated available usage
1 1 and over
1 0 to 1 09
0 9 to 0 99
0 8 to 0 89
0 7 to 0 79
0 6 to 0 69
under 0 6
A
Amble U D
M
Whitley Bay M B
Newcastle C B
Hexham U D
Prudhoe U D
Sunderland C B
Consett U D
C
Seaham U D
Hetton U D
Durham M B
T
Hartlepool M B
Crook U D
Stockton M B
Barnard Castle U D
D
KEY TO SYMBOLS AND BOUNDARIES
boundary of study area
Northumberland and Durham boundary where formed by an urban authority
study unit boundary
interparish common land
A Alnwick U D
C Chester le Street U D
D Darlington C B
M Morpeth M B
T Tow Law U D
SCALE
0 5 10 15
kilometres

Figure 6.10

Although certain low extremes may arise consequent upon deficiencies in the Census data, the clarity of the pattern presented by Figure 6.10 can not thus be explained entirely. There is no doubt that many of the farms included in the June Returns are insufficient for the full-time employment of the farmer himself. Indeed, of approximately 390,000 agricultural holdings covered by the Ministry of Agriculture's annual census, about 170,000 are considered to be unable to offer their occupier full-time employment (M A F F 1966 b). Similarly, both Wibberley (1961) and Gasson (1968) have commented on the positive relationship which exists between part-time farms, often of a particularly small size, and the proximity of urban areas. On the other hand, a more positive influence is also at work, and research by the latter named author has discovered that a larger proportion of full-time farmers are efficient in that they are able to manage with less labour than their farms theoretically require. Thus, "....it appears that full-time farmers tend to strive towards economic efficiency while part-time farmers are more often concerned with technical efficiency" (Gasson 1968 p.53).

Further corroboration of this analysis comes from Table 6.1 in so far as it relates to this SMD ratio index. Several themes emerge from the correlation structure which emphasise this variable's significant contribution to the Q-mode Factor 2 . As was noted in section 3.9 this factor largely refers to the remoter rural areas.

It can clearly be seen from Table 6.1 that a high ratio of theoretical labour requirements against estimated actual usage has locational implications. Such areas tend to be removed from significant population centres and positive associations are shown of up to 0.55 with all four distance indices. Correspondingly, strong negative correlations exist in relation to the three density variables ($r_s = -0.71$ in 1967) and the two population potential indices. Following from this, it is no surprise that a high ratio is similarly found to be strongly and positively associated with agricultural employment but negatively linked with employment in production. A number of significant correlations with other agricultural variables is also shown reflecting two factors, though both may, in turn, be related back to locational influences. First, moderate negative correlations are shown between the variable currently under discussion and those agricultural indices representing farming intensity in terms of output and labour usage per unit area. Second, the influence of holding sizes is also marked. Thus, a negative correlation of 0.45 is exhibited between the SMD ratio for 1967 and the proportion of holdings in 1967 which possessed less than 2.1 hectares of crop and permanent grassland. Likewise, a positive relationship of 0.58 is exhibited between the SMD ratio and the proportion of holdings possessing over 121.4 hectares of crop and permanent grassland. This relationship is further emphasised by the high correlations of 0.68, 0.69 and 0.78 with 1967 Standard Net Output per holding, 1967 theoretical SMDs per holding and 1967 average holding size respectively.

The remaining correlations of note are few. That of -0.54 with the proportion of economically active and retired males in Social Class 3 in 1966 may be attributed to the parallel negative association with employment in production; that of -0.48 with the outmovement to work variable may be attributed to the close negative link of this index and 'rural' commuter belts close to urban areas on the one hand and with densely peopled mining units on the other; that of 0.44 with the proportion of persons in 1966 having household access to two cars may be attributed to the locational necessity of multiple car ownership in many of the remoter areas of Northumberland and west Durham.

In addition to this SMD ratio being calculated for 1967, it was also worked out on a unit basis for 1963. Little more need be said of this in so far as both variables show extremely similar distributions (they intercorrelate at $r_s = 0.82$). Rather more interesting are the values shown by the percentage change of the ratio between 1963 and 1967. Despite the fact that no correlations, other than those with the actual ratios themselves, reach a level of ± 0.40, a distinct pattern does exist in the extreme values of the 1963-67 change variable itself. Thus, the twelve units, generally of a non-rural nature, whose ratios improved (i.e. increased) by over 40 percent between 1963 and 1967, have an obvious tendency to be situated close to urban areas. This is so for the Easington, West Rainton, Lamesley, Shadforth, Wingate, Sedgefield, Great Burdon, North Gosforth and Pegswood units. Of the three remaining examples, one (Wooler) falls into the anomalous class of small remoter rural units with relatively large populations, whilst the Bolam and Humshaugh units complete the list of exceptions. By contrast, no clear pattern is reflected in those 17 units which experienced a decrease in the ratio between 1963 and 1967. Very few experienced more than a small fall. The vast majority (96) of all units had a 1967 ratio between 0 and 25 percent above that in 1963.

(ii) Standard Man Days per Hectare

A standardised measure of agricultural production intensity may also be undertaken by SMD analysis. Thus, the theoretical SMD requirements of the various forms of crops and livestock calculated above in section 6.4(i) may be taken and divided by the total area of agricultural land to give the intensity of the theoretical labour need in agriculture per unit area. In the present case this is expressed as SMDs per hectare. Included in the total area of agricultural land is common land. Although small areas of common may not be in agricultural usage such tracts will usually be entirely insignificant in the total agricultural land of a unit. On the other hand, the agricultural importance of the large areas of common to the parishes in which they are situated, is obvious. In three cases, the area of common land was omitted: Allendale Common which is common to the parishes of Allendale and West Allen; Wolsingham Park Moor which is common to parts of Stanhope and Wolsingham C.P.s and Tow Law U.D., and Hamsterley Common which is common to the parishes of Lynesack and Softley, Hamsterley and South Bedburn. In each case only the total area of the common was known although the grazing is divided between parishes situated in different units. It was considered preferable to omit consideration of these areas and bear this in mind as the likely explanation of any anomalous values affecting the units concerned, rather than making any arbitrary and possibly grossly inaccurate divisions of the grazing area between the various parishes.

The results of the SMD per hectare calculation for 1967 are shown in Figure 6.11. No doubt exists as to the basic pattern. The predominant area of low values encompasses the western part of the region, extending over much of the central zone of Northumberland also. At the other end of the scale, it is apparent that the main tract of high value is to be found in County Durham away from the extreme west. This zone of intensive agriculture extends into south-east Northumberland.

The above contrast is well brought out by a comparison of those values over 15 SMDs per hectare and those under 5 (Table 6.3). The influence of mining and urban populations is particularly marked amongst the highest values. Once again one has a quantified idea of the influence of the Von Thünen effect of urban populations upon the intensity of agriculture, elaborating the descriptive remarks made by Pawson (1961),

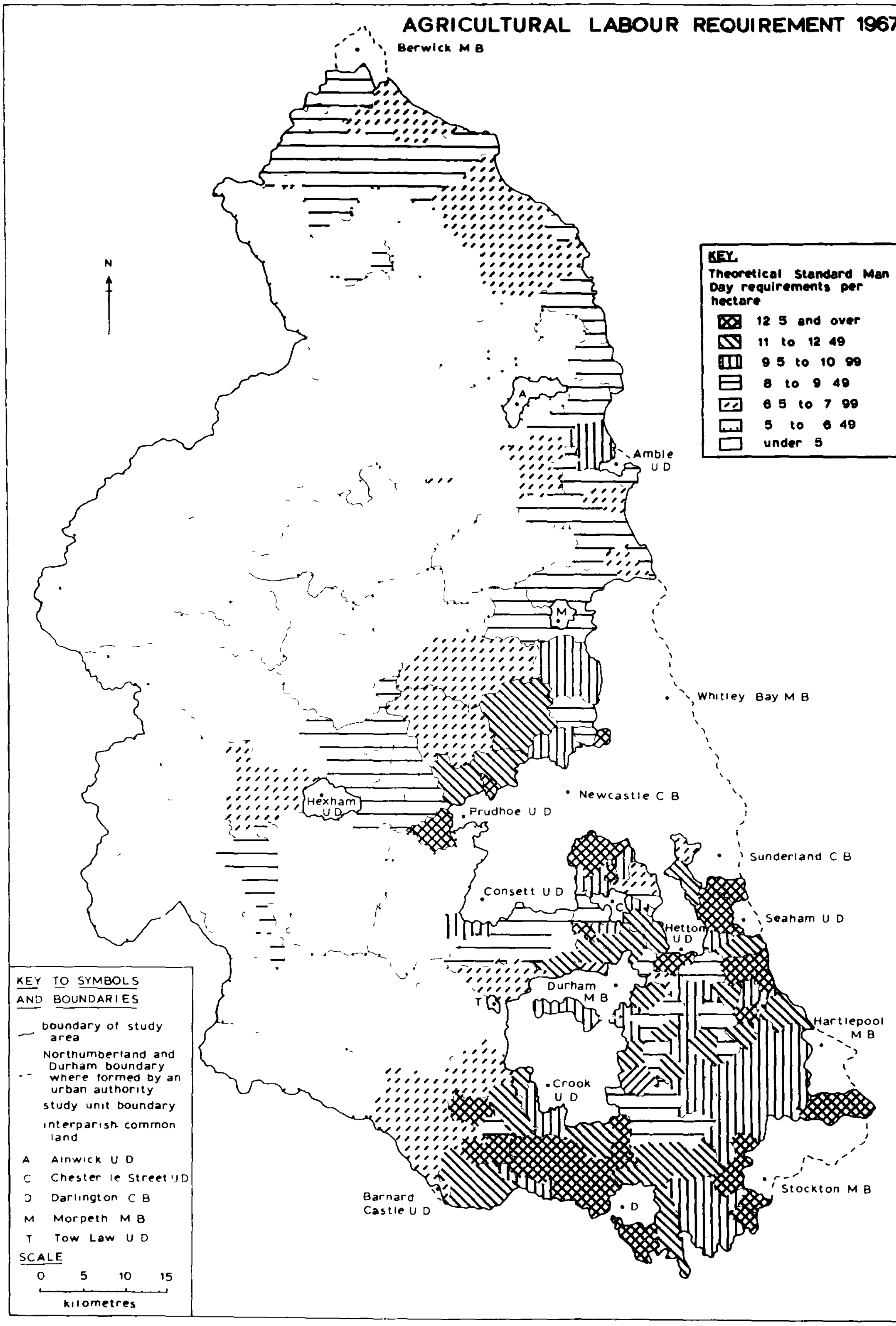

AGRICULTURAL LABOUR REQUIREMENT 1967
Berwick M B
KEY.
Theoretical Standard Man Day requirements per hectare
12 5 and over
11 to 12 49
9 5 to 10 99
8 to 9 49
6 5 to 7 99
5 to 6 49
under 5
N
A
Amble U D
M
Whitley Bay M B
Newcastle C B
Hexham U D
Prudhoe U D
Sunderland C B
Consett U D
C
Seaham U D
Hetton U D
Durham M B
T
Hartlepool M B
Crook U D
Barnard Castle U D
D
Stockton M B
KEY TO SYMBOLS AND BOUNDARIES
boundary of study area
Northumberland and Durham boundary where formed by an urban authority
study unit boundary
interparish common land
A Alnwick U D
C Chester le Street U D
D Darlington C B
M Morpeth M B
T Tow Law U D
SCALE
0 5 10 15
kilometres

Figure 6.11

Table 6.3

Extreme SMD per Hectare Values 1967

Unit number on Figure 3.1	Parishes in Unit	SMDs per hectare
21	Ouston	30.2
5	Tunstall	29.5
98	Wylam	19.2
104	North Gosforth	18.6
57	Egglescliffe	17.2
35	Horden, Castle Eden	17.0
6	Ryhope	16.9
24	Sacriston	16.5
62	Piercebridge, Archdeacon Newton, High Coniscliffe, Low Coniscliffe, Coatham Mundeville, Walworth	15.8
55	Elton, Norton	15.8
110	Kielder, Falstone, Tarset	1.5
127	Alwinton, Biddlestone, Harbottle, Rochester	1.9
112	Hepple, Hollinghill, Elsdon, Otterburn	2.4
76	Stanhope	2.9
86	Plenmeller with Whitfield, Coanwood, Slaggyford, West Allen	3.0
111	Bellingham	3.3
75	Forest and Frith, Newbiggin, Middleton-in-Teesdale	3.4
87	Thirlwall, Greenhead, Featherstone, Hartleyburn	3.9
109	Greystead, Simonburn, Wark	4.1
128	Alnham, Ingram, Roddam, Ilderton, Earle, Lilburn, Bewick, Chillingham	4.1
89	Henshaw, Melkridge, Bardon Mill	4.4
108	Corsenside, Birtley, Bavington, Chollerton	4.5
84	Hexhamshire Low Quarter, Slaley, Hexhamshire, Blanchland, Hunstanworth	4.7
126	Whittingham, Callaly, Snitter, Netherton, Thropton	4.7
124	Cartington, Longframlington, Brinkburn, Hesleyhurst, Tosson	5.0

NAAS (1965) and House and Fullerton (1960) on the agricultural effects of Tyneside, the Durham mining area, and Teesside/Darlington respectively. Conversely, the influence of relief, climate and location is marked amongst those units exhibiting the lowest values. All could justifiably be described as being of the remoter rural type.

In addition to the above comments, several rather more specific features revealed by Figure 6.11 are noteworthy. First, the effect of the interparish common land not having been taken into account in calculation of SMDs per hectare of agricultural and common land has an obvious effect in the cases of Allendale and Lynesack and Softley, increasing the apparent intensity of their agriculture. The effect is, however, strangely absent in the other four parish units thus affected (the Stanhope, Wolsingham, Hamsterley and West Allen units). Second, it is noticeable how a finger of higher values than the surrounds extends along the Tyne valley as far west as Haydon Bridge. Undoubtedly the fertility of this tract has an effect here (see Pawson 1961 p.77) but, in addition, the speed of access to Tyneside proper as well as the location of substantial commuter populations in the Tyne valley would also appear to show their influences.

A third feature of note is the tract of moderate to high values which extends up the east Northumberland coast to just north of Alnwick. As has been seen in earlier sections, this coastal area stands out in contrast to the contiguous units as a distinct zone. In the present instance of agricultural intensity, the reasons for the higher values may be the combination of a number of possibilities - the influence of mining in parts of Morpeth and Castle Ward R.Ds., the relative fertility of the coastal plain, good communications with the south-east Northumberland industrial area, and the influence of tourism on the agriculture of the immediate area.

Fourth, there is a noticeable increase in the intensity of agriculture from the low levels of central Northumberland towards Berwick and Tweedside. This may in part reflect the influence of Berwick but is most certainly in the main the result of the suitability of Tweedside for arable farming. Finally, it is worth noting that some of the more populous units in the remoter rural areas have slightly but significantly higher values than those of surrounding units. Haltwhistle, Rothbury, Wooler and North Sunderland are obvious examples in Figure 6.11.

The correlation structure shown in Table 6.1 which refers to this variable is most interesting. Quite obviously, the highest levels of association are shown with other measures of agricultural intensity, reaching 0.92 with Standard Net Output per hectare in 1967. A number of these are further commented upon below. Apart from these, the majority of significant correlations refer to population density and location indices. Thus the three density variables have coefficients of correlation of between 0.54 (density 1951) and 0.59 (density 1967), and both population potential variables a coefficient of 0.58. Similarly, the three location variables representing distance from population centres of a given size correlate at levels of between -0.63 (centre of 7,000 or more) and -0.67 (centre of 70,000 or more).

The remaining correlations of significance fall into two categories. First, there are those which are quite revealing - moderate negative correlations with the three agricultural employment variables (ie the greater the relative importance of agricultural employment, the less intense the agriculture), and moderate positive correlations with the two production employment indices. In both cases one is seeing reflected the influence (negative or positive) of industrial populations on the intensity of agriculture. In addition, the moderate negative correlations with the SMD ratio variables for 1963 and 1967 which were discussed above (section 6.3(i)) reflect both the greater efficiency of labour usage in the remoter rural areas with their emphasis on extensive rather than intensive agriculture, and the importance of part-time agricultural holdings in the near-urban areas of greater agricultural intensity. Second, there are those correlations which are relatively meaningless having no obvious relationship with the SMDs per hectare variable other than is revealed through another association. Thus the correlations of -0.42 with the average age at death variable and of 0.57 with the outmovement to work index merely reflect the associations between (a) a high age at death and the remoter rural areas, and extensive agriculture and the remoter rural areas in the former instance, and (b) little outmovement to work in the remoter rural areas, and extensive agriculture and the remoter rural areas in the latter case.

In addition to the above, similar SMD per hectare values were calculated with reference to the 1963 Ministry of Agriculture June Returns in order to establish whether any distinct pattern of change took place between the two dates. Perhaps the most apparent feature, however, is the close association between the values for the two dates (r_s= 0.91). On the other hand it is most interesting to note that the unweighted mean value in 1967 was 9.72 SMDs per hectare whereas in 1963 it had been 9.96. Though this at first might appear surprising it nevertheless reflects Wibberley's (1961) contention that the modern emphasis in farming is upon efficiency which, it is held, will have as a corollary an extensification of land use. In respect of the former, it is not insignificant that efficiency (in so far as it is measured here by the SMD ratio variable) did indeed show an increase between 1963 and 1967 from 0.70 to 0.82.

Despite this, most units showed a relatively small change in theoretical SMD requirements per hectare between 1963 and 1967. A mere 14 showed a decrease in excess of 15 percent and 10 an increase of a comparable magnitude. A majority of units at both extremes, particularly the former, tend to be of the more densely populated type (see Table 6.4). There is, however, no clear differentiation between the types of unit at the two respective extremes.

It would seem likely that the predominant occurrence of these more densely populated units in Table 6.4 is a reflection of the pressure upon land and the resultant tendency for agricultural land to change its use. This could be expected to have a severe effect upon measures of agricultural intensity where small areas of market garden type crops are concerned. Indeed, many horticultural crops, particularly small fruit and flowers, demand in excess of 100 SMDs per hectare. This is obviously the cause of the most extreme cases in Table 6.4 of Sacriston and Silksworth. In the former case, the disappearance of over 30 hectares (the vast majority of the total farmland) of permanent grassland between 1963 and 1967 resulted in a far greater measured intensity of agriculture for the latter year because of the greater relative importance of the extent of horticultural crops in the remaining area. Moreover, the area of intensive crops under glass increased threefold from 0.2 to 0.6 hectares. In Silksworth, on the other hand, a decline of over one-third in the area under intensive horticultural crops caused the severe fall noted above.

(iii) Standard Man Days per Holding

As a final index of the intensity of agriculture by SMD analysis, a figure was calculated for each unit to give the number of theoretical SMDs required by all crops and livestock on a per holding basis. An overall unweighted average of 556 SMDs per holding resulted, though considerable variation occurred in individual values. Again, a marked difference was discernible between the general trend in County Durham

Table 6.4

Extreme Percentage Changes in SMD per Hectare Needs 1963-67

Unit number on Figure 3.1	Parishes in Unit	Change over ± 15 percent
24	Sacriston	255.6
104	North Gosforth	54.2
141	Wooler	44.0
5	Tunstall	32.6
109	Greystead, Simonburn, Wark	23.0
92	Humshaugh, Wall, Whittington	22.8
67	Bolam, Morton Tinmouth, Hilton, Wackerfield, Ingleton, Headlam, Langton, Killerby, Summerhouse, Denton, Houghton-le-Side	20.9
64	Great Aycliffe	19.0
115	Pegswood	15.7
82	Healeyfield	15.0
4	Silksworth	-51.2
57	Egglescliffe	-46.3
6	Ryhope	-34.2
1	Hylton	-28.1
2	Ford	-28.1
56	Preston-on-Tees	-27.9
101	Ponteland	-23.8
17	Harraton, South Biddick	-20.3
18	Birtley	-20.0
30	Sherburn	-19.8
125	Rothbury	-18.7
16	Bournmoor, Lambton	-18.1
46	Cornforth, Mainsforth	-17.5
20	Urpeth	-15.9

where many values were in the 400s or 500s and County Northumberland where the lower values tended to be between 500 and 800 but with many others over 1000.

A consideration of those units with under 250 SMDs per holding and those in excess of 1000, exposes a number of interesting features. First, it is apparent that amongst the 11 units in the former category the overwhelming causal factor is the small average size of the holdings. Thus, compared to the average (unweighted) holding size in all 147 units of 73.8 hectares, none of the above 11 exceed this figure, whilst 9 (Birtley, Pelton, Sacriston, Belmont, Coxhoe, Great Aycliffe, Cockfield, Evenwood and Barony and Lynesack and Softley) had average holding sizes of below 22 hectares (including an allowance for common land). Of the remaining two units, Haltwhistle's average holding size was barely half the 73.8 hectares average, whilst only the 69 hectares figure for the Middleton-in-Teesdale unit approached the overall average. Only two units had under 160 SMDs per holding and not surprisingly, both of these - Birtley and Sacriston - have the smallest average holding sizes.

On the other hand, in the 16 units with over 1000 SMDs per holding, the combination to a varying extent of the two factors of intensive agriculture and large holding sizes was responsible for such high values. In some cases such as Ouston, the intensive nature of agriculture clearly dominated, whilst in others such as the Alnham unit, it is clearly the average holding size which is to the fore. Perhaps not surprisingly, the largest concentration of units with such high values is to be found in the fertile coastal area of north Northumberland and along Northumbrian Tweedside where farms are particularly large. Hence the Adderstone, Bamburgh, Chatton, Branxton, Ford, Bowsden, Norham and Ancroft units form one-half of all units in this category. The remaining units with over 1000 SMDs per holding are scattered and occur where the two factors mentioned earlier combine in sufficient force; they are the Offerton, Plawsworth, Newbrough, Dinnington, Stannington and Rennington units.

A mere nine indices correlate at a level of ± 0.40 or over with that presently under discussion. The highest correlation (0.92) is with Standard Net Output per holding for 1967 (this variable is discussed in section 6.4(v)). The two next highest correlations are with the large agricultural holding index (0.79) and the average size of holding index (0.72), reflecting the predominant influence which holding size has upon the theoretical labour requirement per holding. The strong associations (r_s = 0.67 and 0.68 respectively) with SMD ratios for 1963 and 1967 reflect the tendency of holdings which are sufficiently large to employ labour to be more efficient in terms of actual labour usage than the often part-time holdings found nearer urban areas. The fact that the larger holdings with higher SMD per holding values tend to be found in the remoter rural areas is reflected in the remaining four correlations, three of which (with agricultural employment in 1961 and 1963 and the 1966 outmovement to work index) are positive, and one (with density 1961) negative.

(iv) Standard Net Output per Hectare

As an alternative measure of the intensity of agriculture, Standard Net Output (SNO) levels were calculated for each unit. SNO may be defined as being the estimated monetary output of crops and livestock as calculated from appropriate price and yield data. The output figures are net in the sense that the gross output values per hectare of crops or heads of livestock are scaled down to account for the assumed cost of purchased feed, livestock keep, seed, bulbs, cuttings and plants for growing-on (M A F F 1970). It may therefore be said that SNO as here used is designed to measure the cash value, at fixed prices, of average agricultural output in a unit, which is directly attributable to the land if standard management and fertiliser practices are assumed.

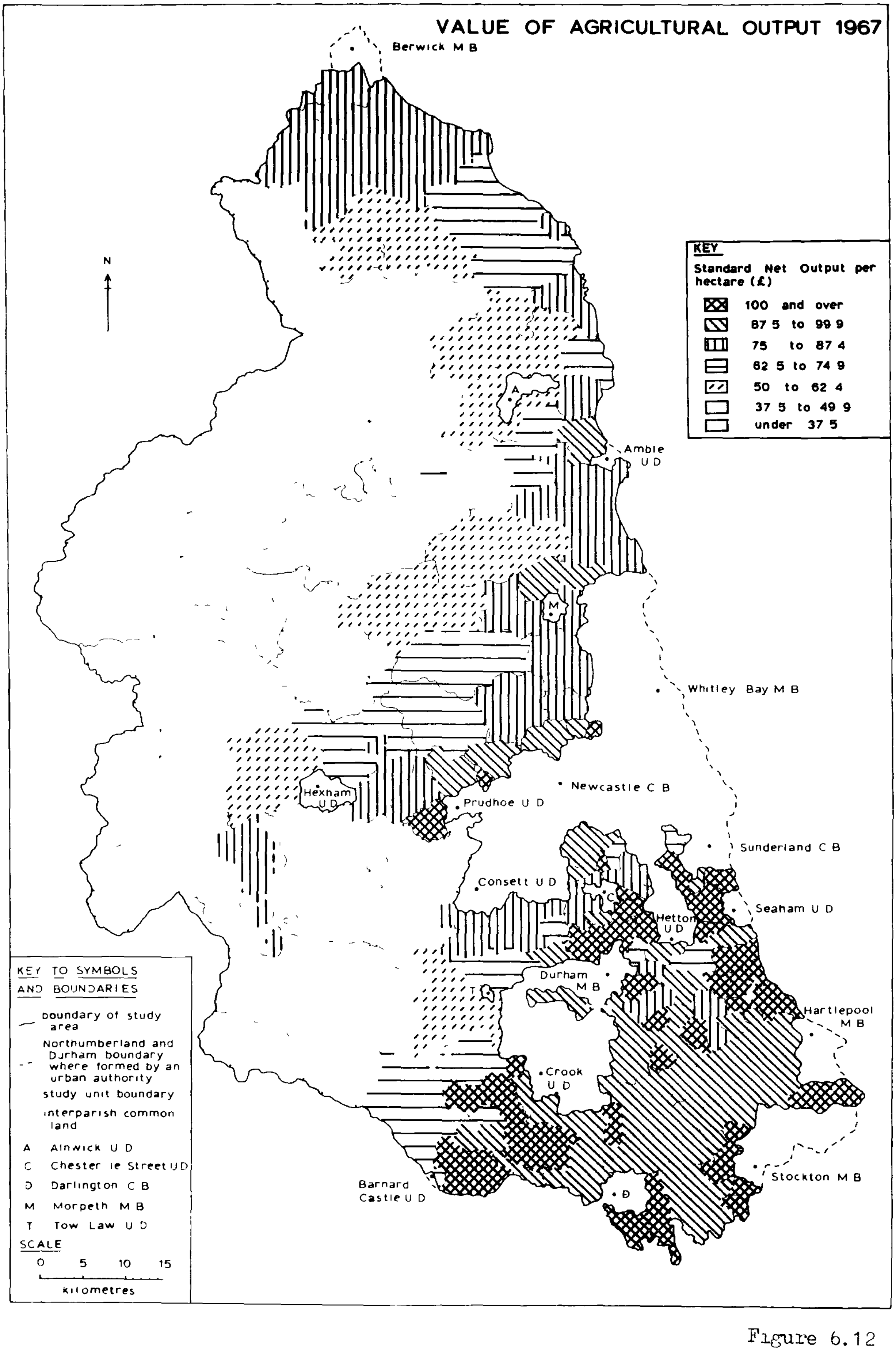
The raw data used were again the parish returns of the June Censuses of the Ministry of Agriculture for 1963 and 1967. The SNO factors used in the calculation of the total SNO figures were those given by a technical report of the Ministry of Agriculture (M A F F 1966 a). This report also notes the obvious drawbacks of using such a system to measure agricultural intensity. First, there is the subjective nature of the assessments arising from the arbitrary nature of judgements on yield and price, which are involved in estimating SNO factors for individual crop or livestock types. Second, it may be admitted that the June Returns do not always provide a true picture of the likely annual output from a holding. Third, wide variations occur in the mean standard outputs of areas even with apparently similar physical characteristics, perhaps reflecting the difference in types of farming and management rather than differences in land quality. Fourth, no SNO factors are available for a number of crops included in the June Returns. This particularly relates to glasshouse crops, flowers and bulbs. However, the number of enterprises thus affected is extremely small and must be considered unlikely to effect any significant modifications in the final measure of intensity. Indeed, "....despite these disadvantages....tests confirmed that....the system was capable of providing a broad indication of....productivity" (M A F F 1966 a p.5).

Resultant SNO totals for a unit divided by the area of agricultural land and common land within the unit gave the figures portrayed upon Figure 6.12. A close correspondence with Figure 6.11 may be observed. Indeed, the general and specific comments made with respect to the latter are equally applicable in the present case. Nevertheless, Figure 6.12 illustrates rather more effectively the influence of barley farming on Tweedside and the two 'fingers' of intensity stretching along Tyneside and north along the Northumberland coast.

Likewise, there is great similarity between the respective values of individual units portrayed on Figure 6.11 and Figure 6.12 although the SNO values are less given to upper extremes. This is probably a result of the exclusion of some of the most intensive horticultural crops from consideration here. Thus, of the ten units with the highest SMD per hectare values shown in Table 6.3, all except the Piercebridge and Sacriston units have a SNO per hectare value of between £100 and £148. Of the two exceptions both are affected by the exclusion of horticultural crops in the latter calculations though the Piercebridge unit value of £99 is still high. Moreover, the small area upon which the Sacriston figure of £89 has been calculated is noted above. One may also observe that the ten units with the highest SNO per hectare values (Horden/Castle Eden, Tunstall, Ryhope, Ouston, Great Lumley, Preston-on-Tees, Offerton/Herrington, Easington, East Murton, Broomley and Stocksfield - varying from a value of £148 per hectare for the first named to £112 for the last), all possessed a comparable SMD per hectare value in excess of 12.

At the opposite end of the scale, SNO values fall to as low as £12 in the Kielder unit. Unaffected by the non-inclusion in the SNO analysis of 'factory' farm crops, it is instructive to compare the lowest values in the present case with the corresponding values in Table 6.3. A mirror image is apparent with the ten lowest SNO per hectare values being: the Kielder unit £11.6; the Alwinton unit £14.2; the Hepple unit £19.3; Stanhope £26; the Slaggyford unit £27.5; Bellingham £27.9; the Middleton-in-Teesdale unit £30.6; the Thirlwall unit £33.6; the Greystead unit £34.5, and the Alnham unit £35.

The correlation structure of the 1967 SNO per hectare variable is shown in Table 6.1. The great similarity between the structure



VALUE OF AGRICULTURAL OUTPUT 1967
KEY
Standard Net Output per hectare (£)
100 and over
87 5 to 99 9
75 to 87 4
62 5 to 74 9
50 to 62 4
37 5 to 49 9
under 37 5
N
Berwick M B
Amble U D
Whitley Bay M B
Newcastle C B
Prudhoe U D
Hexham U D
Sunderland C B
Consett U D
Seaham U D
Hetton U D
Durham M B
Hartlepool M B
Crook U D
Barnard Castle U D
Stockton M B
KEY TO SYMBOLS AND BOUNDARIES
boundary of study area
Northumberland and Durham boundary where formed by an urban authority
study unit boundary
interparish common land
A Alnwick U D
C Chester le Street U D
D Darlington C B
M Morpeth M B
T Tow Law U D
SCALE
0 5 10 15
kilometres

Figure 6.12

revealed and that for the 1967 SMD per hectare variable renders further discussion superfluous.

For comparative purposes, an identical SNO per hectare calculation was made from the 1963 June returns. A high degree of correlation (r_s = 0.94) was shown between the two years with, for example, fully five of the ten 1967 highest values and nine of the ten lowest values being similarly placed. In terms of the change in values between the two years, it is noticeable that, whereas intensity as measured by theoretical labour requirements (SMDs per hectare) showed a slight (2.5 percent) decrease, intensity measured by SNO per hectare increased by a similar proportion. Some similarity is obvious between Tables 6.4 and 6.5 and the general point made above (section 6.4(iii)) is again emphasised - the most extreme changes in agricultural intensity are to be found in the most densely peopled areas where the pressures upon land are greatest and changing land use most likely. The occurrence of four of the lightly populated remoter rural units in Table 6.5 is therefore somewhat exceptional and requires closer attention to the June Returns of the Ministry of Agriculture to discern the causal factors. Thus, the Greystead unit lost (almost certainly to the Forestry Commission) over 2000 hectares of rough grazings from the parish of Greystead itself between 1963 and 1967. The consequence of this loss of a large area of the least intensively farmed land is obviously to raise the still low SNO per hectare figure from £27 in 1963 to £34 in 1967. Similar losses of rough grazing land from the parishes of Henshaw and Thirlwall in two of the other units will have caused a parallel effect. In the Rothley unit a rather different cause is apparent. Only in the parish of Rothley itself does there appear to have been any noticeable loss of rough grazing from the recorded agricultural area between 1963 and 1967 and even here it was only a matter of 200 hectares. However, all four parishes in the unit experienced an increase in the acreage of arable land which in Hartburn jumped from 300 hectares in 1963 to over 700 in 1967.

The sole correlation of note in Table 6.1 relating to the change in SNO per hectare 1963-67 is that of 0.66 with the comparable variable for SMD intensity change. This serves to illustrate the close similarity of measures derived from SMD and SNO sources.

Table 6.5

Percentage Changes in SNO per Hectare 1963-67

Unit number in Figure 3.1	Parishes in Unit	Percentage Change
24	Sacriston	70.7
21	Ouston	29.8
141	Wooler	26.5
109	Greystead, Simonburn, Wark	26.2
33	Peterlee	17.4
57	Egglescliffe	16.1
89	Henshaw, Melkridge, Bardon Mill	15.2
27	Bearpark	14.2
42	Kelloe	14.0
60	Great Burdon, Neasham, Morton Palms, Sockburn, Low Dinsdale	13.9
25	Plawsworth	13.1
26	Witton Gilbert	11.8
113	Rothley, Hartburn, Kirkwhelpington, Wallington Demesne	11.4
117	Ellington, Lynemouth	11.3
31	Shadforth	11.3
87	Thirlwall, Hartleyburn, Greenhead, Featherstone	11.1
55	Elton, Norton	10.9
14	Great Lumley	10.1
64	Great Aycliffe	10.0
4	Silksworth	-18.3
6	Ryhope	-15.4
98	Wylam	-14.9
1	Hylton	-13.9
2	Ford	-13.9
18	Birtley	-12.2
88	Haltwhistle	-12.1
29	Belmont	-10.8
30	Sherburn	-10.1

(v) Standard Net Output per Holding

An SNO per holding value for 1967 was also calculated and, it will be remembered, was included in the factor analyses of Chapter 3 (see especially section 3.5). Not unexpectedly, there is a very close similarity (r_s = 0.92) between this variable and the SMD per holding index. The most extreme values for SNO per holding in 1967 are given in Table 6.6. The units mentioned in Table 6.6 were all noted in the analysis which was undertaken in section 6.4 (iii), with the exception of Wylam, North Gosforth and Rothbury. However, when one observes that the average sizes of agricultural holdings in these parishes were 17.0, 18.7, and 15.0 hectares respectively, the full import of the analysis in section 6.4 (iii) is apparent in so far as the present section is concerned.

Table 6.6

Extreme Values of SNO per Holding 1967

Unit number on Figure 3.1	Parishes in Unit	SNO per holding
142	Branxton, Carham, Kilham, Kirknewton	13341
128	Alnham, Ingram, Roddam, Ilderton, Earle, Lilburn, Bewick, Chillingham	12867
138	Middleton, Easington, Bamburgh	12600
3	Offerton, Herrington	12136
25	Plawsworth	11814
140	Chatton, Akeld, Ewart, Doddington	11693
145	Norham, Duddo, Cornhill-on-Tweed	11498
144	Bowsden, Lowick, Kyloe, Holy Isle	11472
105	Bruswick, Dinnington	11038
146	Ancroft	10921
143	Ford, Milfield	10906
106	Stannington	10595
24	Sacriston	206
18	Birtley	674
125	Rothbury	1090
71	Cockfield	1282
29	Belmont	1548
22	Pelton	1571
73	Lynesack and Softley	1578

Table 6.6 cont.

Unit number on Figure 3.1	Parishes in Unit	SNO per holding
64	Great Aycliffe	1599
98	Wylam	1697
88	Haltwhistle	1700
104	North Gosforth	1864

(vi) Conclusions

Three comparisons may be drawn between the SMD and SNO indices, (a) from the above analysis; (b) from Table 6.1; (c) from the factor analyses of Chapter 3. From each, one arrives at the same general conclusions. It is apparent that the urban areas of North-East England exert a profound influence upon agriculture in the surrounding Rural Districts. In the more heavily populated and near urban areas, holdings are small, often of a part-time nature and the emphasis is upon intensive output per unit area. In the remoter areas, holdings are larger and the emphasis is upon the economic efficiency of agriculture.

Similarly, it is those units situated close to urban areas which appear to have experienced the most marked fluctuations in agricultural intensity during the period under review. The causal factor here is almost certainly the severe pressures on land found in many such areas.

6.5 The Nature of Agriculture II

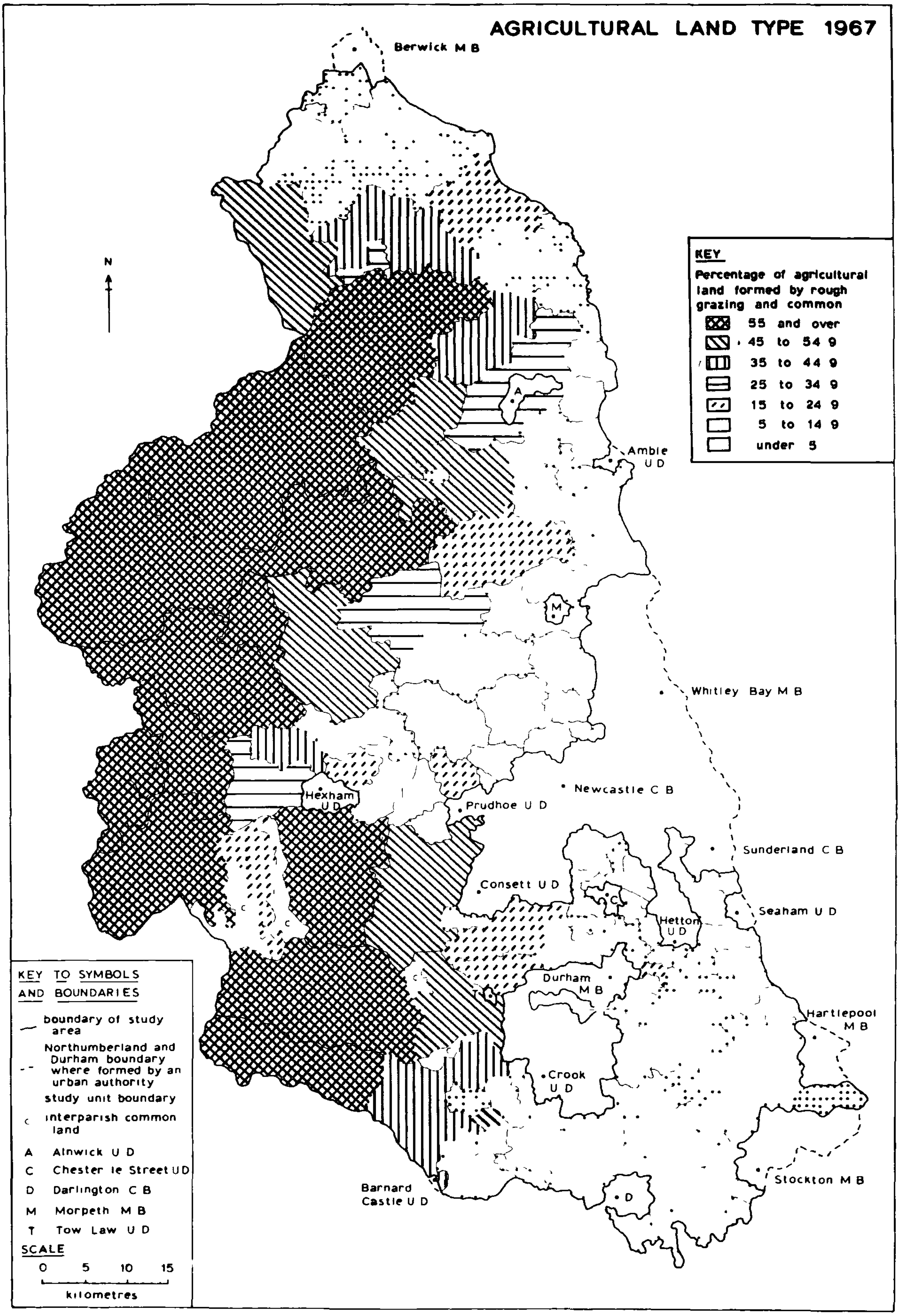
Leading from section 6.4, a number of further largely descriptive agricultural parameters were derived from the data contained in the Ministry of Agriculture June Censuses. These are briefly discussed below.

(i) Rough Grazing and Common Land

It will be obvious that the least productive agricultural land is that classified as rough grazing or common. Consequently, the area of land contained within the parishes of a unit which was classified in the 1967 June Returns as being rough grazing or which was found in section 2.4 to be common land has been taken and expressed as a percentage of the total area of all agricultural and common land within the unit.

Figure 6.13 gives a quantified expression to the well known general pattern of a predominance of rough grazing land in west Durham and throughout much of Northumberland. Indeed, in the latter county as a whole, "....the main outline of the farming picture in round figures is that of a total area of just over 1,000,000 acres, of which well over 400,000 acres are classified as rough grazings" (Pawson 1961 p.4). Again on Figure 6.13 one has the familiar regional breakdown - very low values on Tweedside, the coastal plain, the Tyne valley, south-east Northumberland and throughout County Durham away from the west. On the other hand, in the western uplands, where House (1969) notes that the climate is sufficiently rigorous to even preclude the growth of oats at above 1200 feet, large tracts of land are at least half covered by rough grazing. In all 14 units have over half of their agricultural land under rough grazing and common - the Corsenside (53.1 percent), Haltwhistle (57.0 percent), Hunstanworth (57.8 percent), Alnham (63.8 percent), Bardon Mill (62.5 percent), Greystead (64.5 percent), Thirlwall (66.5 percent), Bellingham (71.0 percent), Slaggyford (71.1 percent), Middleton-in-Teesdale (71.2 percent), Stanhope (76.1 percent), Hepple (82.0 percent), Alwinton (90.7 percent) and Kielder (91.3 percent) units. Overall there is little to interrupt the pattern of a consistent westward increase in the percentage of agricultural land in these categories. Only Allendale and Cockfield in any way stand apart from this progression - Allendale with its large area of improved grassland and Cockfield with its large proportion of common land.

Turning to the correlation structure presented by this variable (see Table 6.1), a familiar pattern results for an index which portrays



AGRICULTURAL LAND TYPE 1967
Berwick M B
KEY
Percentage of agricultural land formed by rough grazing and common
55 and over
45 to 54 9
35 to 44 9
25 to 34 9
15 to 24 9
5 to 14 9
under 5
N
A
Amble U D
M
Whitley Bay M B
Newcastle C B
Hexham U D
Prudhoe U D
Sunderland C B
Consett U D
C
Seaham U D
Hetton U D
Durham M B
Hartlepool M B
Crook U D
Barnard Castle U D
D
Stockton M B
T
KEY TO SYMBOLS AND BOUNDARIES
boundary of study area
Northumberland and Durham boundary where formed by an urban authority
study unit boundary
interparish common land
A Alnwick U D
C Chester le Street U D
D Darlington C B
M Morpeth M B
T Tow Law U D
SCALE
0 5 10 15
kilometres

Figure 6.13

a negative aspect of agricultural intensity. Thus, moderate negative correlations occur with population density, employment in production and population potential; moderate to strong positive correlations with distance factors; moderate positive correlations with agricultural employment indices, and strong negative correlations with the SMD and SNO intensity per unit area variables. It is in this light that one may view the important role of this agricultural variable in the Factor 2s of both the R and Q-mode analyses.

(ii) The Average Size of Agricultural Holdings

The size of agricultural holdings is a significant aspect in United Kingdom agriculture. It has been pointed out, for example, that any comparative economic analysis of the use of uplands for agriculture or forestry is greatly affected by the average holding size attributable to the former (James 1965). Indeed, it has been noted that, "In the uplands, where rural depopulation has been long-continued, and the range of alternative farming enterprises is small, the government is encouraging the enlargement of holdings to make viable units" (Coppock 1968 p.124). Similarly, Gasson (1968) has noted that "....while the average minimum size of a full time farm in the early 1960s was about 30 acres and in 1967 a little under 40 acres, by the mid -1970s this 'threshold size' will have risen to about 50 acres" (p.318). Correspondingly, recent years have seen a decline in the number of agricultural holdings in all size categories of under 120 hectares (300 acres)[1]. Between 1947 and 1964 the number of agricultural holdings in England and Wales fell from 361,000 to 300,000 with a maximum decline of 20 percent in the 6 to 20 hectare group.

In the current analysis the 1967 unweighted mean size of unit agricultural holdings (including rough grazings and intra-parish common land) was calculated to be 73.8 hectares. Wide divergences were however found from this average figure and are well illustrated by Figure 6.14. The general message of Figure 6.14 is clear - the large holdings are to be found in Northumberland and the small in County Durham. Indeed, it has been remarked that 80 percent of Northumberland's agricultural holdings are of 60 hectares or more[2] compared to a little over 20 percent in County Durham (NAAS 1965). As Figure 6.14 shows, whereas 11 Northumberland units have an average holding size in excess of 150 hectares and reach

[1] It should be noted that these figures (MAFF 1968) do not include areas of rough grazing or common land.

[2] Again exclusive of commons and rough grazings.

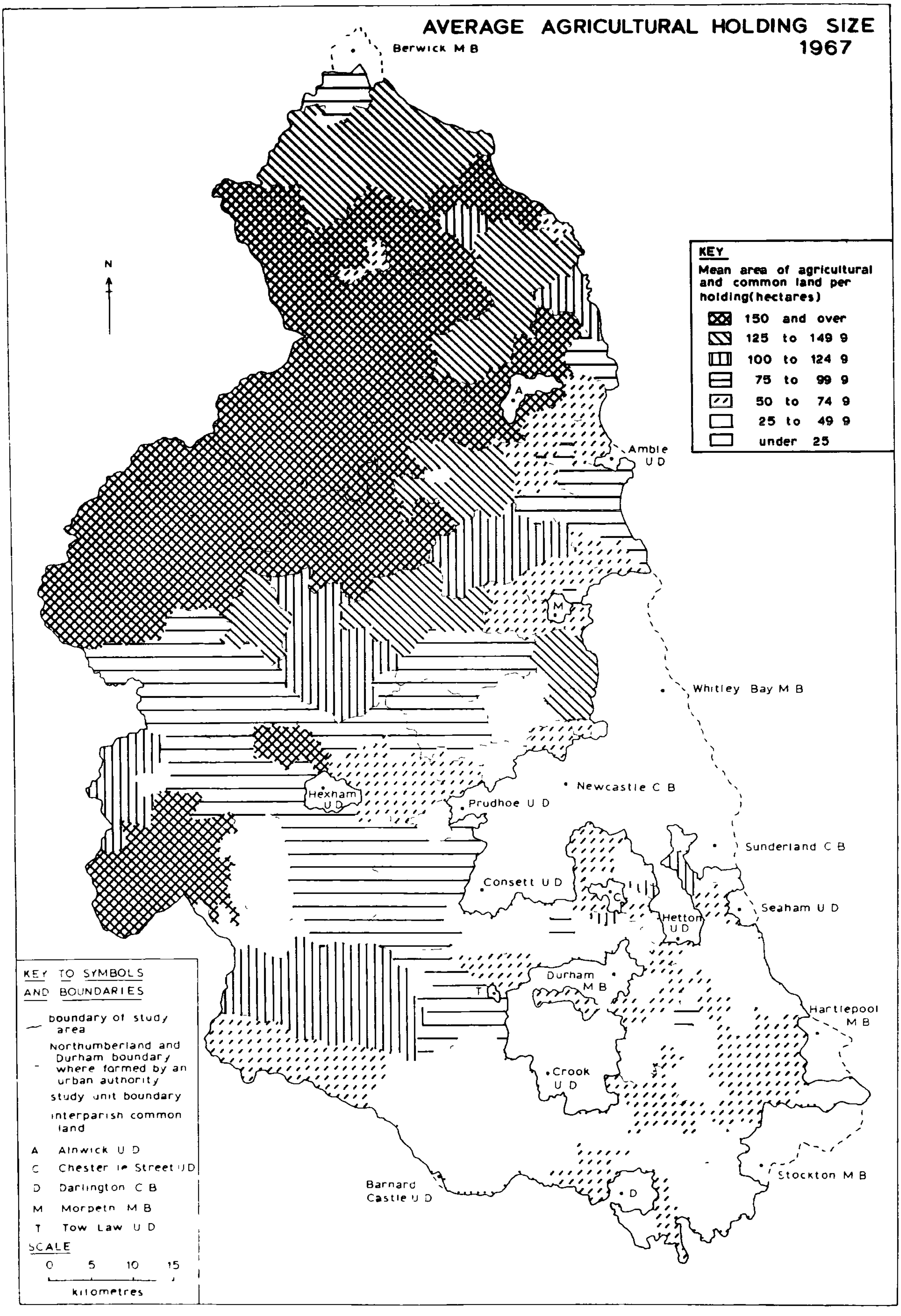

AVERAGE AGRICULTURAL HOLDING SIZE 1967
Berwick M B
KEY
Mean area of agricultural and common land per holding(hectares)
150 and over
125 to 149 9
100 to 124 9
75 to 99 9
50 to 74 9
25 to 49 9
under 25
N
A
Amble U D
M
Whitley Bay M B
Hexham U D
Prudhoe U D
Newcastle C B
Sunderland C B
Consett U D
C
Seaham U D
Hetton U D
Durham M B
T
Hartlepool M B
Crook U D
Barnard Castle U D
D
Stockton M B
KEY TO SYMBOLS AND BOUNDARIES
boundary of study area
Northumberland and Durham boundary where formed by an urban authority
study unit boundary
interparish common land
A Alnwick U D
C Chester le Street U D
D Darlington C B
M Morpeth M B
T Tow Law U D
SCALE
0 5 10 15
kilometres

Figure 6.14

399.5 hectares in the Alnwick unit, only four units in County Durham exceed 100 hectares - Offerton/Herrington (105.4), Bournmoor/Lambton (118.8), Plawsworth (120.8) and Stanhope (120.8). Alternatively, of the 19 units in both counties with an average holding size below 25 hectares, only three - Wylam (17.0), North Gosforth (18.7) and Rothbury (15.0) - are to be found in Northumberland. It is not without significance that none of the units with an average holding size of over 150 hectares had a 1967 population density in excess of one-third of a person per hectare, whilst, in contrast, only Lynesack and Softley (at 0.9) of those units with an average holding size below 25 hectares had a density of below 1 person per hectare.

Figure 6.14 does however possess a number of features of more specific interest. First, whilst it is apparent that the highest values of all are largely concentrated along the Anglo-Scottish borderlands it is noticeable that these are encircled in the south, east and north by a belt of slightly lower but still high values. This is especially the case on Tweedside where the large arable farm is the norm. Second, there is a marked tendency for some of the more densely peopled of the remoter rural units to have much smaller holdings than the surrounding units. This is the case with North Sunderland, Wooler, Rothbury and Haltwhistle and may be attributed to a combination of locally more favoured agricultural environments and demand factors, leading to smaller holding sizes. Third, the average holding sizes in Allendale and the Middleton-in-Teesdale unit are considerably lower than one might expect from their physical environment and location. In both cases the influence of lead mining may be cited as having created many smallholdings in a dual mining-agricultural economy, the effects of which are still apparent in present day holding sizes. In Allendale there is also the added complication of the large interparish Allendale Common. On the other hand, no such effect is visible in Weardale. Fourth, the commuter belt of the Tyne valley once more stands out with values which are at least one order lower than those of surrounding units. Finally, it is noticeable that average holding sizes along the Northumberland coastal plain to slightly north of Alnwick are less than in the contiguous units to the west. In both these last two cases the twin effects of a better physical agricultural environment and demand for more sophisticated foods from a more numerous population will cause the minimum economically viable holding size to be smaller than would otherwise be the case.

The correlation structure revealed by Table 6.1 shows a large number of variables which correlate significantly with the average holding size index. Again, it is apparent that a large average holding size is not compatible with a near urban location or dense population. Hence, the relevant correlation coefficients with distance from a centre of at least 70,000 persons and the 1967 density of population are 0.63 and-0.70 respectively. From this it follows that the areas with large holdings tend to be those with the highest proportions of their workforce employed in agriculture. High negative correlations are shown with SNO and SMD intensity measures per unit area, whilst high positive ones (reaching 0.80 for SNO per holding in 1967) exist for the same measures on a per holding basis. It is perhaps not surprising that the average holding size variable has a significant correlation with rough grazing as discussed in the previous section, but the level, $r_s = 0.44$, is low. This is especially so as both these variables had an almost identical showing in the factor analyses of Chapter 3. Strong correlations are shown with the SMD ratio variables indicating the greater economic efficiency of farming in areas of large holding sizes.

To consider a different aspect of holding sizes, the total number of holdings in 1967 was taken for each unit, and from other data available from the Ministry of Agriculture's June Census Returns for that year, the proportions of these which possessed: (a) less than 2.1 hectares of crop and improved grassland, and (b) 121.4 or more hectares of crop and improved grassland, were calculated for each parish unit.

The unweighted mean value for the former was 15.7 percent. There is, however, no clear differentiation between the types of unit at each extreme. Thus, amongst the 19 units with under 5 percent of their agricultural holdings having less than 2.1 hectares of crop and improved grassland, one finds residential parishes (Ouston, North Gosforth), mining parishes (Shadforth, Thornley, Shilbottle, Coxhoe, Hazlerigg, Pegswood) and various more obviously rural units (for example, those containing the parishes of Cleatlam, Allendale, Greystead, Nunnykirk and Ancroft). No one type predominates. Likewise, amongst the 14 units with at least one-third of their agricultural holdings in this category, one finds mining and industrial parishes (Silksworth, Tunstall, Ryhope, Little Lumley, Birtley, Sacriston, Sherburn, Monk Hesledon), residential parishes (Egglescliffe, Belmont) and some more rural units (Lesbury/ Alnmouth, Wooler). Although no lightly populated units in the remoter rural areas occur here, it may be appreciated that the heterogeneity within the two extremes is more marked than any difference in unit type between them.

Nevertheless, some rationalisation of this variable does come from Table 6.1. From the eight significant correlations, it appears that overall, a high percentage of such small holdings is to be related to units with a high population density, little agricultural employment (in relative terms), a low SMD ratio, and, more obviously, a low average holding size.

For the proportion of all holdings with 121.4 hectares or more under crop and improved grassland, the unweighted mean value was 13.2 percent. Here, fully 32 units had no agricultural holding which fell into such a category. As might be expected, the vast majority (28) of these is to be found in County Durham. Of these 32 units only the Kielder and Allendale ones can be said to be truly rural, the former with its harsh physical environment precluding much other than rough grazing, the latter belying its lead mining history. The remaining 30 units are divided between mining types such as Tunstall, Ryhope, Pelton, Bearpark and Fishburn; industrial types such as Birtley, Peterlee, Great Aycliffe and Carlton/Whitton, and residential types such as Elton/Norton, Wylam and North Gosforth.

At the other extreme, 21 units have at least one-third of their agricultural holdings in this favoured category. Four examples come from Durham - Offerton/Herrington, Ouston, Plawsworth and Kelloe. These high values, however, largely stem from the small total number of holdings, there being a mere 3 in Ouston and 6 in Plawsworth at the 1967 Agricultural Census. In Northumberland there is a substantial number of units with over one-third of their agricultural holdings possessing at least 121.4 hectares of crop and improved grassland. The highest values are to be found in parts of Alnwick and Belford R.D.s (the Longhoughton, Embleton, Beadnell and Bamburgh units) and on Northumbrian Tweedside and the area of Glendale R.D. immediately to the south. Indeed, it is an interesting commentary that of the units numbered 128 to 147 on Figure 3.1 only two have under 20 percent of their agricultural holdings in this favoured category. Wooler at 5.6 percent is an obvious exception in view of the parish's small size whilst the mining parish of Shilbottle at 17.7 percent is little short of the 20 percent level.

A mere six significant correlations relating to this variable are to be found in Table 6.1; three of them are high and one very high.

The occurrence of this type of holding is shown to have some affinity with distance from a centre of 70,000 or more people ($r_s = 0.42$), high agricultural labour usage efficiency (r_s with SMD ratios for 1963 and 1967 of 0.61 and 0.58 respectively), overall average holding size ($r_s = 0.74$), SMD requirements per holding ($r_s = 0.79$) and SNO per holding ($r_s = 0.86$).

(iii) Characteristics of the Labour Force

Three measures of agricultural labour force characteristics were derived from the 1967 Ministry of Agriculture June Returns to see whether any discernible pattern of variation existed within the Rural Districts of Northumberland and Durham.

(a) Regular Whole-Time Workers

First, the proportion of all agricultural employees who were defined in the June Returns as being regular whole-time workers was calculated for each unit. The results are shown in Figure 6.15. A general contrast may be observed between consistently moderate to high values throughout much of the truly rural area, particularly north and central Northumberland, and the more densely populated areas where values are considerably more varied, though on the whole lower. This confirms the impression already generated in section 6.4(i) of this chapter, that there tends to be more part-time and casual agricultural employment in the more densely populated and near urban areas. In addition, the more variable County Durham values may in part result from the smaller total number of agricultural employees. Thus, in Sacriston - the extreme example - none of the three enumerated agricultural workers could be described as full-time regular employees. Usually, however, the statistical basis can not be cited in explanation; in Cockfield 6 out of 30, and in Hawthorn/Cold Hesledon 11 out of 40 workers were whole-time regular employees in 1967.

In view of the points made above, the showing of this variable in the factor analyses of Chapter 3 is not unexpected. In both the R and Q-mode studies an appreciable part of this index was incorporated into each of the three principal factors though with an obvious predominance in the respective agricultural Factor 2s. In the Q-mode analysis particularly, the association of a high proportion of regular whole-time workers with the agricultural areas was shown by the ninth position of the variable in Table 3.15 with a score of 1.44. This is rather more illuminating than the solitary correlation of note shown in Table 6.1. Even this, 0.42 with

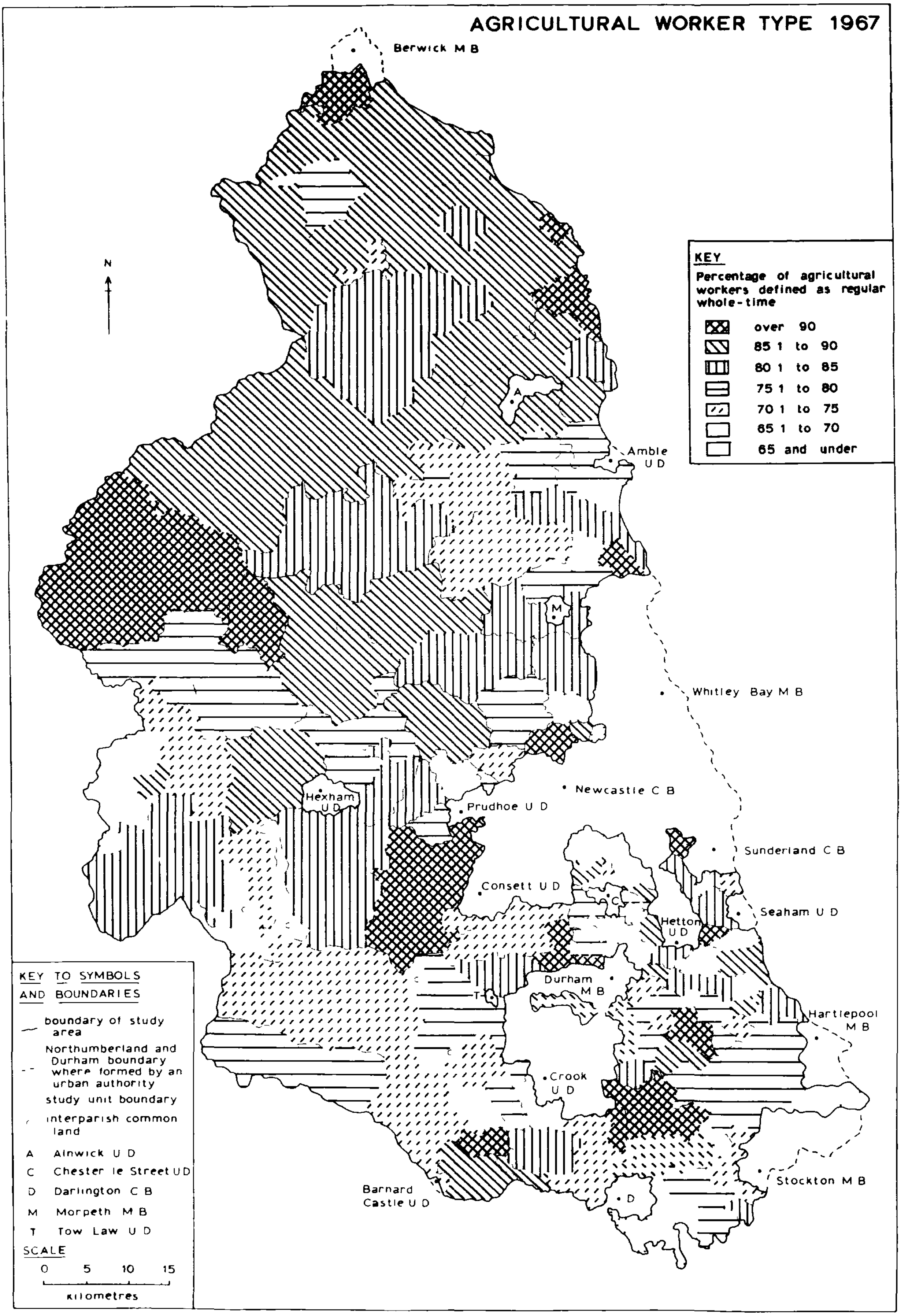

AGRICULTURAL WORKER TYPE 1967
Berwick M B
KEY
Percentage of agricultural workers defined as regular whole-time
over 90
85 1 to 90
80 1 to 85
75 1 to 80
70 1 to 75
65 1 to 70
65 and under
N
A
Amble U D
M
Whitley Bay M B
Newcastle C B
Hexham U D
Prudhoe U D
Sunderland C B
Consett U D
C
Seaham U D
Hetton U D
Durham M B
T
Hartlepool M B
Crook U D
Stockton M B
Barnard Castle U D
D
KEY TO SYMBOLS AND BOUNDARIES
boundary of study area
Northumberland and Durham boundary where formed by an urban authority
study unit boundary
interparish common land
A Alnwick U D
C Chester le Street U D
D Darlington C B
M Morpeth M B
T Tow Law U D
SCALE
0 5 10 15
kilometres

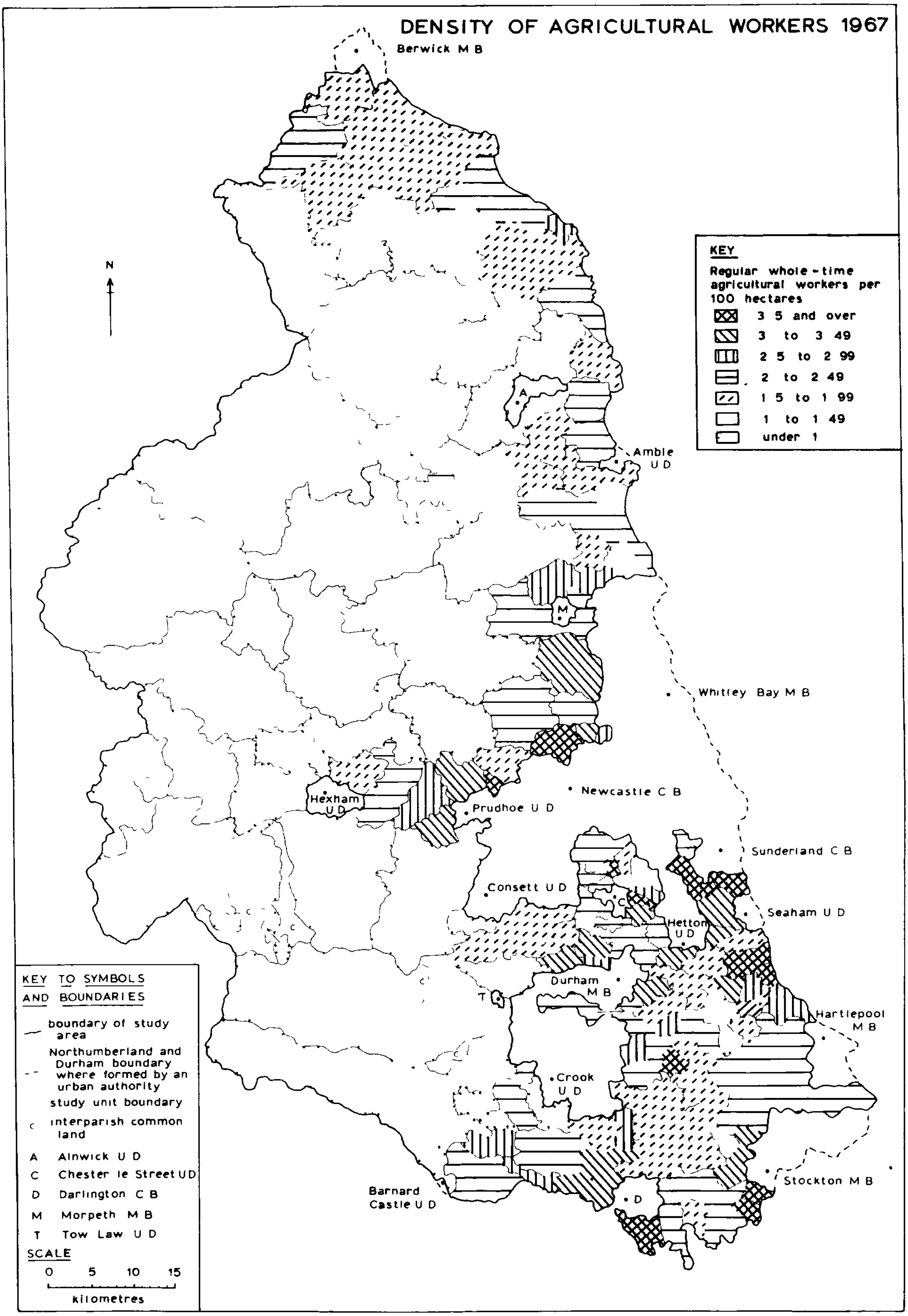
Figure 6.15

persons per room in owner occupied property in 1966, is unclear, except in so far as the agricultural areas in general tend to possess lower person per room densities.

(b) Density of Whole-Time Workers

As a further measure of agricultural intensity, the number of whole-time regular workers recorded in the June 1967 Census was taken and expressed in terms of the density per 100 hectares of agricultural and common land on a unit basis. Figure 6.16 shows the resultant distribution of values. A number of points clearly emerge. First, it may be appreciated that the lowest values (below 1.0) are nearly exclusively a feature of the extreme west of Durham and upland Northumberland. Indeed, in the west densities are remarkably low with, for example, the Middleton-in-Teesdale unit having only 0.18 regular whole-time agricultural workers per 100 hectares, the Stanhope unit 0.29, the Thirlwall unit 0.21, the Kielder unit 0.25, and the Alwinton unit 0.28. Only three units which can be described as having no affinity with the remoter rural areas have a density below 1.0. In each of these three, exceptional circumstances obtained. The anomaly of Sacriston has already been commented upon in (a) above; the parish had no regular whole-time agricultural workers in 1967. On the other hand, the larger unit of Harraton/South Biddick (0.36) possessed nine agricultural holdings but still only had one regular whole-time worker in 1967. Similarly, Ellington/Lynemouth in south-east Northumberland possessed a mere five such workers though it had twice as many holdings. Furthermore, in both Harraton/South Biddick and Ellington/Lynemouth, substantially more regular whole-time workers (10) had been recorded in 1963 before a sharp decline set in by 1967.

Four areas of moderate to high densities are shown on Figure 6.16. First, once again the north Northumberland coast stands out as a favoured area although no unit reaches a density of 3 workers per 100 hectares. Values in the extreme north are slightly lower but still, as might be expected, substantially higher than in the units further south in Glendale and Rothbury R.D.s. Second, the south-east corner of Northumberland with its benign economic and physical environment, exhibits such densities as the 3.10 of Stannington, the 3.32 of Hazlerigg and the 3.81 of Woolsington. Third, for similar reasons, high values stretch down the Tyne valley though, in this case, they do not pass Hexham. The outstanding density is that of Wylam (9.07), over 5 workers per 100 hectares in excess of any other Northumberland value. The influence of intensive market gardening type enterprises in this parish is thus exhibited.



DENSITY OF AGRICULTURAL WORKERS 1967
Berwick M B
N
KEY
Regular whole-time agricultural workers per 100 hectares
3 5 and over
3 to 3 49
2 5 to 2 99
2 to 2 49
1 5 to 1 99
1 to 1 49
under 1
A
Amble U D
M
Whitley Bay M B
Newcastle C B
Hexham U D
Prudhoe U D
Sunderland C B
Consett U D
C
Seaham U D
Hetton U D
Durham M B
T
Hartlepool M B
Crook U D
Barnard Castle U D
D
Stockton M B
KEY TO SYMBOLS AND BOUNDARIES
boundary of study area
Northumberland and Durham boundary where formed by an urban authority
study unit boundary
interparish common land
A Alnwick U D
C Chester le Street U D
D Darlington C B
M Morpeth M B
T Tow Law U D
SCALE
0 5 10 15
kilometres

Figure 6.16

Finally, it may be appreciated that the vast majority of Durham units away from the extreme west, has quite high values. On the coalfield, where it has been stated that the density of agricultural workers reaches levels which "are only generally surpassed in the richest areas of South East England" (Thorpe 1970 p.396), a density of between 3 and 4 is normal even in many densely populated mining units. East Murton (3.32), Easington (3.39), Pittington (3.34) and Shotton (3.29) are typical. On the other hand, particularly near a large town, densities may rise to such levels as the 6.17 of Silksworth or the 9.12 of Tunstall. In addition, residential units, especially those which are near to the conurbations, have high densities of agricultural workers. This is particularly noticeable around Teesside where Egglescliffe reaches 6.32 - a reflection of the fertility of the Tees lowland and the demand for horticultural crops in the conurbation.

Nineteen correlations of note ($\pm$0.40 or above) are exhibited by this variable in Table 6.1, but the relevant structure is quite similar to that already discussed in relation to other measures of agricultural intensity. The highest correlations are with such variables as SNO per hectare in 1963 and 1967 (r_s = 0.78 and 0.76 respectively). Moderate positive correlations exist with population density measures and moderate to high negative ones with distance and ordinary agricultural employment indices. This reflects the fact that the regular whole-time workers per hectare variable was shown to be quite closely associated with the urban/mining and residential Factors 1 and 3 of the factor analyses which were undertaken in Chapter 3, as well as with the population density Factor 7 of the R-mode analysis.

(c) Proportion of 1967 Whole-Time Regular Agricultural Workers Aged between 20 and 44 years

The age structure of the agricultural labour force is a matter which has received unfavourable comment from many researchers. It has been pointed out that "....the very young and the very old form an appreciably larger part of the male labour force in agriculture than in industry" (Hirsch 1955 p.11). Moreover, it would appear that the situation has not improved in more recent years. Indeed, whereas in 1950, 47 percent of regular whole-time male agricultural workers were aged under 35 and 68 percent under 45, the corresponding figures for 1965 were 44 and 61 percent respectively. Similarly, over the same period, the proportion of females in the regular whole-time agricultural labour force who were aged under 40 years fell from 72 percent to 48 percent (M A F F 1965). The great loss of agricultural workers is stated to be of those aged between 20 and 40 years (R S A 1965).

In an attempt to assess the position in 1967 in the Rural Districts of the North-East, the data available from the labour force statistics included in the June Returns of the Ministry of Agriculture were taken and the proportion of the male regular whole-time labour force aged between 20 and 44 years was calculated. The unweighted average for all units was 49.8 percent.

Although there is a great heterogeneity of unit types with values considerably above or below this average, one point stands out clearly. Of the 24 units with below 40 percent of their regular whole-time male agricultural labour force in this critical age group, 19 are in County Durham. Similarly, of the 31 units with over 60 percent of the labour force thus aged, 22 are in County Durham. Although in a number of cases such as Harraton, Ryhope or Great Aycliffe, low values may be attributed to statistical 'freaks' in consequence of the small numbers in the relevant categories of the entire agricultural labour force, most of these units do have a substantial absolute number of whole-time workers. It follows that the major effect in this instance is likely to be the relatively fluid and unstable position of agriculture in the more densely peopled areas. Indeed, it is particularly noticeable that the vast majority of units in Northumberland away from the south-east have near average values. If one excludes the influence of the densely populated mining units around Morpeth and south of Alnwick where values slightly in excess of 60 percent are achieved by the Shilbottle, Pegswood and East Chevington units and a value just below 40 percent by Ulgham, the only units north of an east to west line drawn through Morpeth with such extreme values are the Kielder (32.5 percent), Wooler (28.4 percent), Rothbury (66.7 percent) and Lesbury (62.8 percent) units.

To emphasise the heterogeneity of units in these extreme categories it is worth noting that no correlations of significance are found in Table 6.1 in relation to this variable. No evidence may be adduced from this present discussion to support Edwards' (1963) comment that over 50 percent of the Allendale labour force is aged over 44 years (here 52.0 percent of the regular whole-time male agricultural labour force in 1967 was found to be between 20 and 44 years of age), whilst other alleged problem areas such as Northumbrian Tweedside (Ironside 1964) are here found to have at least an average proportion of their labour force in this age group.

6.6 Conclusion to Chapter 6

The present chapter has served four main purposes. First, it has presented a number of clear distributional patterns relating to the economic variables under discussion. Second, it has further elucidated, and indeed emphasised, conclusions already reached in the study. Third, it has developed points made by earlier workers. Fourth, new themes have emerged.

The patterns of distribution vary. Some are straightforward, such as the pattern of agricultural employment in 1966, or that of mining employment in the same year. Other distributions are more complex. For example, the heaviest losses of primary (agricultural and forestry) workers between 1963 and 1967 is shown in section 6.1 to be shared amongst the contrasting areas of Tweedside, the Durham coalfield and south Durham.

Overall, however, much of the discussion on economic variables has served to stress the categorisation of units made in section 3.11, and to emphasise the relationships between indices treated earlier and those of the present chapter. Accordingly, the analysis of total journey to work movements clearly shows the self-contained nature of the truly rural units. Similarly there is corroboration of the extremely close negative association between population density and agricultural employment, the unfavourable age structure of rural-type units and the already established social and economic characteristics of mining units. Furthermore, the patterns of distribution of several agricultural parameters such as holding size or the proportion of agricultural land formed by rough grazing and common emphasize the difference between the agricultural/remoter rural units and the remainder. At the same time, areas previously noted to have a distinctive character when compared to their surrounds, stand well out in various sections of the present chapter. Such is the belt of commuter parishes stretching down the Tyne valley or that of north Northumberland coastal parishes to the north of Amble. The former units show little agricultural employment but substantial employment in services. In addition - like other units of the class 2 type - they exhibit low unemployment and values which differ quite markedly from the surrounding units for many of the variables discussed, for example in section 6.5. The latter zone of units can be seen to be visibly different from the contiguous inland units in such matters as a high service employment proportion, the intensity of agriculture, or the greater proportion of regular whole-time agricultural workers.

Turning to the third point - the conclusions of previous workers on the rural North-East - it is found that the present chapter re-emphasises many of their findings in a more modern context. For example, the lack of manufacturing employment in the more obviously rural areas is most plainly emphasised in the present chapter, as is the low volume of service employment notwithstanding the slightly higher values which are found in some of the more densely populated units in the more isolated rural tracts. There is ample evidence too of the often postulated inverse relationship between the importance of agriculture and journey to work movements.

Nevertheless, there are other conclusions which are clearly worth making in the context of this study itself. Thus, despite the relative unimportance of journey to work movements in the rural areas there is a marked increase in outward movement to work from units as market towns are approached. Even so, as section 6.3(i) shows, this increased movement is subject to a very pronounced distance decay function. However, one point above all others is perhaps strongly illustrated by this present chapter. Though this entire study is concerned with population in administrative Rural Districts, the ubiquity of urban influence is stressed by the economic variables discussed in the preceding pages. The analysis of journey to work in section 6.3 clearly demonstrates that this phenomenon (whether in terms of significant inmovement or outmovement) is urban related. Likewise, though a high SMD ratio in section 6.4(i) is found to be predominantly a feature of the remoter rural areas, it is also apparent that the extreme (over 40 percent) changes in the index between 1963 and 1967 relate to units whose one common feature is proximity to urban areas. Moreover, measures of agricultural intensity discussed in the final two sections of this chapter are found to be positively associated with a near urban location and to be most variable in change over time in such areas. Indeed, it is an appropriate final comment that the last variable to be discussed - that of the age structure of the agricultural labour force - though showing great heterogeneity in its pattern of distribution nevertheless exhibited its extreme values only in close proximity to urban units of County Durham.

CHAPTER 7

SOCIAL AND SOCIO-ECONOMIC ASPECTS OF RURAL POPULATIONS IN NORTH-EAST ENGLAND

7.1 Introduction

To complete this systematic study of rural population, it is natural and necessary that a consideration of social and socio-economic aspects be added to those of previous chapters. As Bogue (1969) notes, "..such data are significant and meaningful for a wide variety of purposes because they are indexes of cultural background and legal or social status differences within the population of interest or concern at the local, regional, national, or international level"(p.173).

It is not within the scope of the present study, however, that an investigation into rural social facilities be undertaken. Rather must the concern here be directed towards those personal and household social and socio-economic characteristics discernible from the 1961 and 1966 Censuses of Population. Nevertheless, it is useful at this juncture to note the investigations into rural social facilities which have been undertaken by previous workers (see, for example, McKay and Stagg 1961, Edwards 1963 and Ironside 1964) and the general consensus that the quality of life in rural areas suffers from the shortfall apparent in this field. Moreover, "..in discussions about town and country problems too much emphasis has often been placed on the differences in the mental outlook and needs between the country dweller and townsperson......Basically [the farm worker] wants the same things out of life as the urban worker" (Wibberley 1950 p.46). It may be expected that the lack of social facilities in rural areas will therefore have repercussions upon various other population characteristics. Certain aspects of this may become apparent in the ensuing discussion, particularly in the housing and transport fields despite the emphasis noted above.

7.2 Persons Per Household

Household size is a particularly relevant variable in a geographical study of rural population. It has been pointed out (Clarke 1972) that a study of areal variations in the size of households may throw considerable light on patterns of social organisation and demographic trends. It is, of course, obvious that large households are generally found in areas of high fertility whilst the converse - one person households - may be symptomatic of a particular social or economic phenomenon as is found in urban areas attracting many single young persons.

Three measures of household size have been incorporated into this study. The first is based on the 1961 Census County Reports for Northumberland and Durham (GRO 1963a and b) and gives an approximate figure (see section 3.5) for persons per private household aggregated to the unit level. The remaining two parameters are taken from the 1966 10 percent Census enumeration district data and represent, (a) the proportion of private households with one or two persons and (b) the proportion of private households with six or more persons.

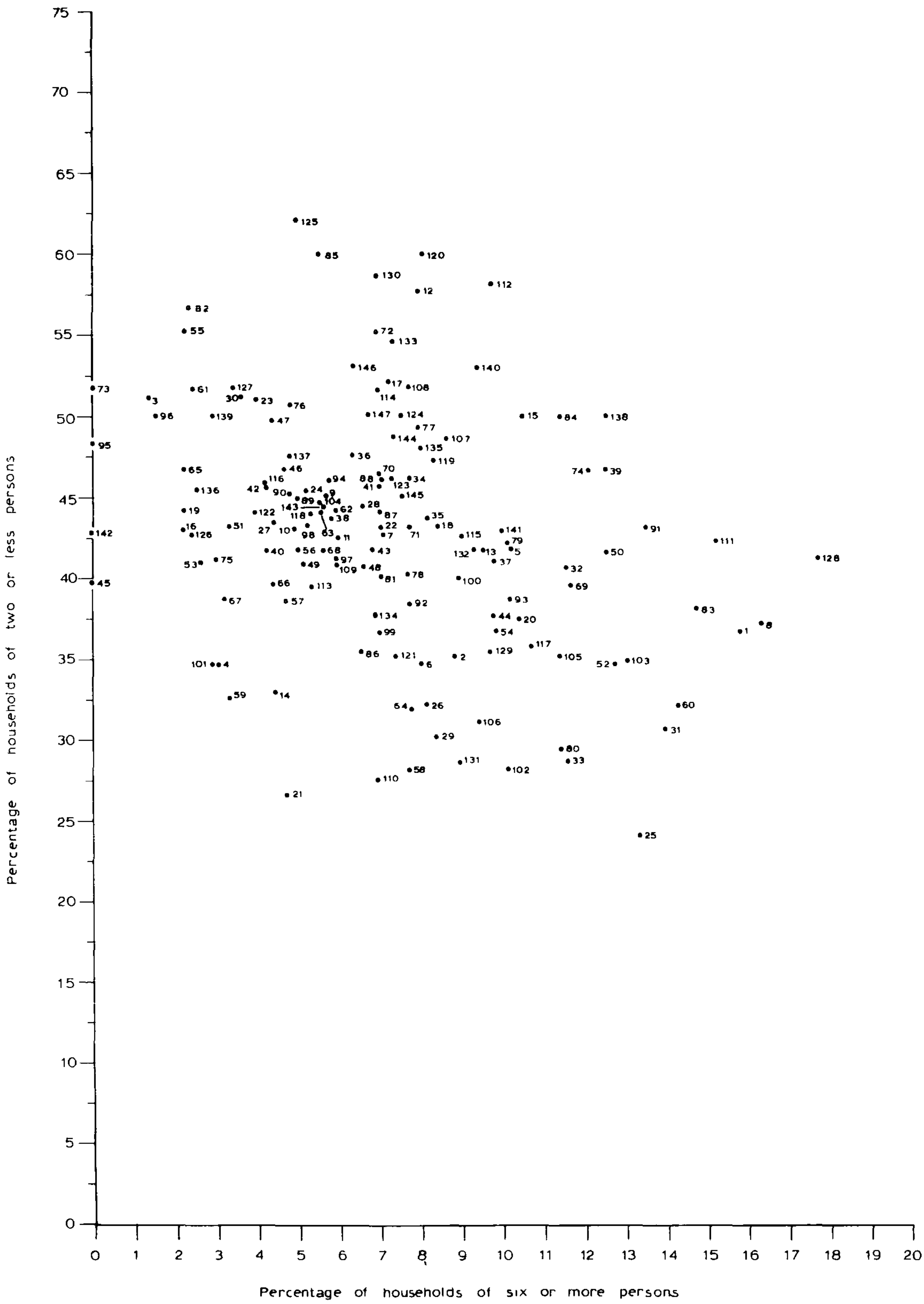
In 1961 Northern England had an average private household size of 3.10 persons (Hammond 1968), a mere 0.04 persons higher than the average for Britain as a whole. The unweighted mean figure for the 147 parish units of this study in 1961 was found to be 3.06 persons per household. This, however, masks great diversity from marginally over 3.66 in the Great Lumley unit, to 2.43 in the Allendale unit. Nevertheless, the familiar contrast already enunciated many times in previous chapters is again apparent. A marked difference occurs between those Durham and Northumberland units with a mining/industrial basis and those in the remoter rural areas. Thus, only one (Low Dinsdale) of the twelve units with the highest person per household values (the West Rainton, Great Lumley, Plawsworth, Peterlee, Kelloe, Trimdon, Langley, Dinnington/Hazlerigg, Pegswood, Ulgham, Shilbottle and Low Dinsdale units) had a 1961 recorded mining employment under 29 percent. On the other hand, all had under 10 percent of their working population employed in agriculture.

The lowest 1961 person per household figure was that of 2.43 which was recorded for Allendale though twelve units in total had a mean value below 2.80. In these, the maximum importance of mining is reached in Stanhope (17.4 percent) - still an undeniably rural unit whilst the only other unit where agriculture employed under 10 percent of the population was Rothbury.

It is not surprising therefore, that 49 percent of this index's variance was found to be included in the Factor 1 of the R-mode factor analysis of Chapter 3. This tendency is further emphasised by the correlation structure of Table 7.1 in which the moderate positive associations with population potential, persons living in Local Authority owned accommodation, a journey to work crossing the parish of residence boundary and a youthful population stand out. Moderate negative correlations reflect the absence of persons of high social class, service employment, car ownership, and small households of elderly persons. At the same time, it will be apparent that units with a high person per household average tend to be near large population centres, have 'normal' one family households and have few people aged over 60 years. Two high correlations are also shown - 0.68 with persons per room in 1961 and 0.74 with the ratio of 1961 Census to Electoral population. The reason for both is obvious though the latter is particularly striking.

The two other person per household indices are shown in Figure 7.1. Here the distinction between units with a high proportion of households (a) possessing six or more persons and those (b) possessing two or fewer persons, is less clear than the contrast revealed by the previous index. Nevertheless, it is apparent that most of the high values for small households refer to rural units, many of them in the remoter areas. Such are the Rothbury, Thirston, Allendale, Denwick, Hepple and Lesbury units. In addition, the Healeyfield, Elton/Norton Evenwood and Barony and Pittington units feature amongst the ten highest percentages for small households. The inclusion of Healeyfield and Elton/Norton is somewhat perplexing but may refer to the recent arrival on newly developed housing estates of young married couples yet to begin their families, in addition to the many young families already resultant from the high birth rates noted in section 5.7. The Evenwood and Barony and Pittington units are the only evidence clearly visible in the present study which supports the contention that a high proportion of small households is becoming a characteristic of certain coalfield areas (House and Knight 1967).

HOUSEHOLD SIZE 1966



(units numbered as in Table 3 1)

Figure 7.1

Table 7.1

Spearman Rank Correlation Matrix of Chapter 7 Variables

Variable	56	57	58	59	104	60	105	106	61	107
1		.58						.52	.63	.62
2		.59						.53	.66	.66
75		.56						.53	.64	.63
3										
4										
77										
7									-.47	-.48
8		.40							.46	.44
10		-.48						-.42		
11	-.40	-.42						-.48		
12	-.44							-.48		
13		-.47						-.48		
14	.46	.55						.58	.47	.47
79	.46	.55						.58	.47	.46
16										
80	.74	.50								
17										
19	-.44									
82	-.46	-.43								
21	-.49									
24										
26	-.49	-.46						-.44	-.44	-.44
27	.45	.44						.42	.42	.42
84	.40									
28					.41					
29										
30										
31	-.40									
32										
85	-.54	-.45								
86	.44									

(1) See Table 3.2 and Appendix C

Table 7.1 cont.

Variable	108	62	63	64	65	66	67	68	109	69
1					-.40		-.56	-.68	-.70	-.52
2					-.42		-.52	-.67	-.67	-.48
75					-.41		-.48	-.65	-.63	-.45
3		.49								
4		.47								
77										
7		.41					.56		.59	.54
8								-.50	-.45	-.54
10									.43	
11										
12										
13								.40		
14					-.44		-.43	-.50	-.53	
79					-.44		-.42	-.50	-.52	
16			-.50							
80			-.52		-.44					
17			-.41							
19			.53		.41					
82					.42					
21										
24			.49	.41						
26					.41					
27					-.43					
84										
28				-.49						
29				.56						
30										
31										
32			-.44							
85					.40					
86										

Table 7.1 cont.

Variable	70	71	72	110	73	74	111	112	113	114
1			-.51	-.63				-.59	.63	
2			-.47	-.59				-.57	.66	
75			-.43	-.56				-.53	.67	
3		.46								-.46
4		.41								-.41
77			.45					.44		
7	.48		.58	.53	-.42			.57		
8			-.49	-.48				-.57		
10										
11									-.54	
12									-.50	
13										
14				-.42					.52	
79				-.41					.53	
16										
80										
17										
19										
82										
21										
24										
26			.41	.44						
27				-.41					.41	
84										
28										
29										
30	.42									
31										
32										
85										
86										

Table 7.1 cont.

Variable	56	57	58	59	104	60	105	106	61	107
34	-.48									
35		-.62						-.55	-.70	-.70
37		-.61						-.53	-.65	-.65
87		-.59						-.56	-.63	-.63
38		.68		.40				.53	.57	.55
88		.68		.43				.56	.58	.56
39								.45	.43	.44
89							.41			
40		-.48		-.51						
90	-.51	-.55		-.42						
42										.42
44		.48						.41	.41	
91	.49	.64							.41	
45		.43								
47	.45									
93								-.42		
49										
53							-.42			
54							-.42			
56	*	.68							.45	.43
57	.68	*	.53	.45				.54	.65	.63
58		.53	*							
59		.45		*	.83					
104				.83	*					
60						*	.98			
105						.98	*			
106		.54						*	.44	.41
61	.45	.65						.44	*	.99
107	.43	.63						.41	.99	*
62										
63	-.49									
64										
65	-.53	-.71				-.45		-.60	-.50	-.48
66		.54	.50							
67	-.41	-.57							-.62	-.62

Table 7.1 cont.

Variable	108	62	63	64	65	66	67	68	109	69
34			.59							
35					.44		.51	.71	.68	.50
37					.40		.52	.67	.67	.49
87					.43		.50	.66	.65	.47
38		-.45			-.48	.52	-.57	-.71	-.73	-.68
88		-.42			-.49	.43	-.57	-.69	-.71	-.66
39								-.42	-.41	
89										
40					.48					.53
90					.40					.53
42					-.40	.41				-.42
44					-.48			-.41		
91					-.51			-.54	-.41	-.45
45										
47										
93								.44	.43	
49								.44		
53										
54										
56			-.49		-.55		-.41		-.44	-.50
57					-.71	.54	-.57	-.69	-.71	-.78
58						.50				-.48
59										-.42
104										
60					.45					
105										
106					-.60			-.53	-.46	-.47
61					-.50		-.62	-.59	-.71	-.58
107					-.48		-.62	-.58	-.71	-.55
62		*								
63			*		.54					
64				*		.47				
65			.54		*	-.47		.52	.48	.61
66				.47	-.47	*	-.43	-.44	-.51	-.55
67						-.43	*	.43	.91	.53

Table 7.1 cont.

Variable	70	71	72	110	73	74	111	112	113	114
34										
35			.50	.62				.60	-.68	
37			.46	.60				.57	-.69	
87			.47	.62				.57	-.64	
38			-.68	-.71	.49			-.71	.47	
88			-.65	-.71	.42			-.69	.46	
39					.40				.67	
89		.48							.56	-.48
40	.45	.41	.54	.43				.53		-.41
90		.44	.54	.48	-.43			.54		-.44
42			-.46	-.48				-.43		
44									.41	
91			-.43	-.51				-.43		
45									.53	
47										
93				.43					-.52	
49									-.54	
53									-.48	
56			-.53	-.48				-.52		
57			-.72	-.77	.45			-.78	.54	
58										
59			-.43							
104										
60		.62	.45			.55		.47		-.62
105		.62	.42			.55		.45		-.63
106			-.47	-.56					.48	
61			-.58	-.62				-.68	.50	
107			-.56	-.61					.51	-.67
62			.47	.43	-.42					
63										
64										
65			.59	.63				.65	-.42	
66			-.52	-.49				-.57		
67			.61	.59				.66		

Table 7.1 cont.

Variable	56	57	58	59	104	60	105	106	61	107
68		-.69						-.53	-.59	-.58
109	-.44	-.71						-.46	-.71	-.71
69	-.50	-.78	-.48	-.42				-.47	-.58	-.55
70										
71						.62	.63			
72	-.53	-.72		-.43		.45	.42	-.47	-.58	-.56
110	-.48	-.77						-.56	-.62	-.61
73		.45								
74						.55	.55			
111										
112	-.52	-.78				.47	.45	-.46	-.68	-.67
113		.54						.48	.50	.51
114						-.62	-.63			

Variable	108	62	63	64	65	66	67	68	109	69
68					.52	-.44	.43	*	.74	.70
109					.48	-.51	.91	.74	*	.70
69					. 61	-.55	.53	.70	.70	*
70										
71										
72		.47			.59	-.52	.61	.70	.74	.74
110		.43			.63	-.49	.59	.71	.75	.79
73		-.42						-.52	-.47	-.46
74										
111										
112					.65	-.57	.66	.73	.79	.77
113								-.54	-.52	-.44
114										

Table 7.1 cont.

Variable	70	71	72	110	73	74	111	112	113	114
68			.70	.71	-.52			.73	-.54	
109			.74	.75	-.47			.79	-.52	
69	.47		.74	.79	-.46			.77	-.45	
70	*	.42	.59	.40				.49		-.41
71	.42	*	.46			.78		.53		-1.0
72	.59	.46	*	.78	-.59			.87	-.46	-.46
110	.40		.78	*				.78	-.47	
73			-.59	-.43	*	.43		-.49	.68	
74		.78			.43	*	.55	.41		-.78
111						.55	*			
112	.49	.53	.87	.78	-.49	.41		*	-.54	-.53
113			-.46	-.47	.68			-.54	*	
114	-.40	-1.0	-.46			-.78		-.53		*

Of the ten highest values for households with six or more persons, half come from obvious coal mining units - Hylton, Shadforth, Dinnington/Hazlerigg, Plawsworth and Cold Hesledon/Hawthorn. The remaining five, however, are of greatly differing type. They vary from the remote rural Alnham unit through the Bellingham, Edmondbyers and Newborough units to that of Low Dinsdale immediately adjacent to Darlington C.B.

The correlation structure referring to the above two variables reflects several pertinent demographic features. Thus, the small household index has nine moderate correlations which most obviously show its positive relationship with old age features as well as other measures of low household density. Similarly the large household index shows by contrast, its association with a large proportion of single people, high fertility, and households with high person per room densities. Even so, it is interesting to note that both these variables had a higher loading on Factor 1 of the R-mode analysis than on any other factor, though the relative strengths were as one might expect - the six or more person per household variable had a higher loading than the two or less person per household index on the 'urban' Factor 1, whilst the converse was true on the 'rural' Factor 2.

7.3 Persons Per Room

Clearly related to the persons per household indices and adding much further information to complement their usefulness, is a measure of persons per room in private households. This latter ratio is, of course, a generalisation ignoring such matters as size of room but, in so far as the influence of household size has already been discussed in the previous section, persons per room may be regarded as "... a useful index of .... housing conditions, and also reflects important regional variations " (Clarke 1960b p. 257).

It is with interest therefore that one may turn to a comparative analysis of person per room values amongst the 147 parish units of the present study. Moreover, though Clarke (1960b) notes that, unlike Scotland, England and Wales exhibit only a small urban-rural contrast in person per room densities, it has been pointed out elsewhere (Hammond 1968, NEPC 1966) that in matters of room numbers and household densities, Northern England more closely approaches Scotland than some other regions of England and Wales.

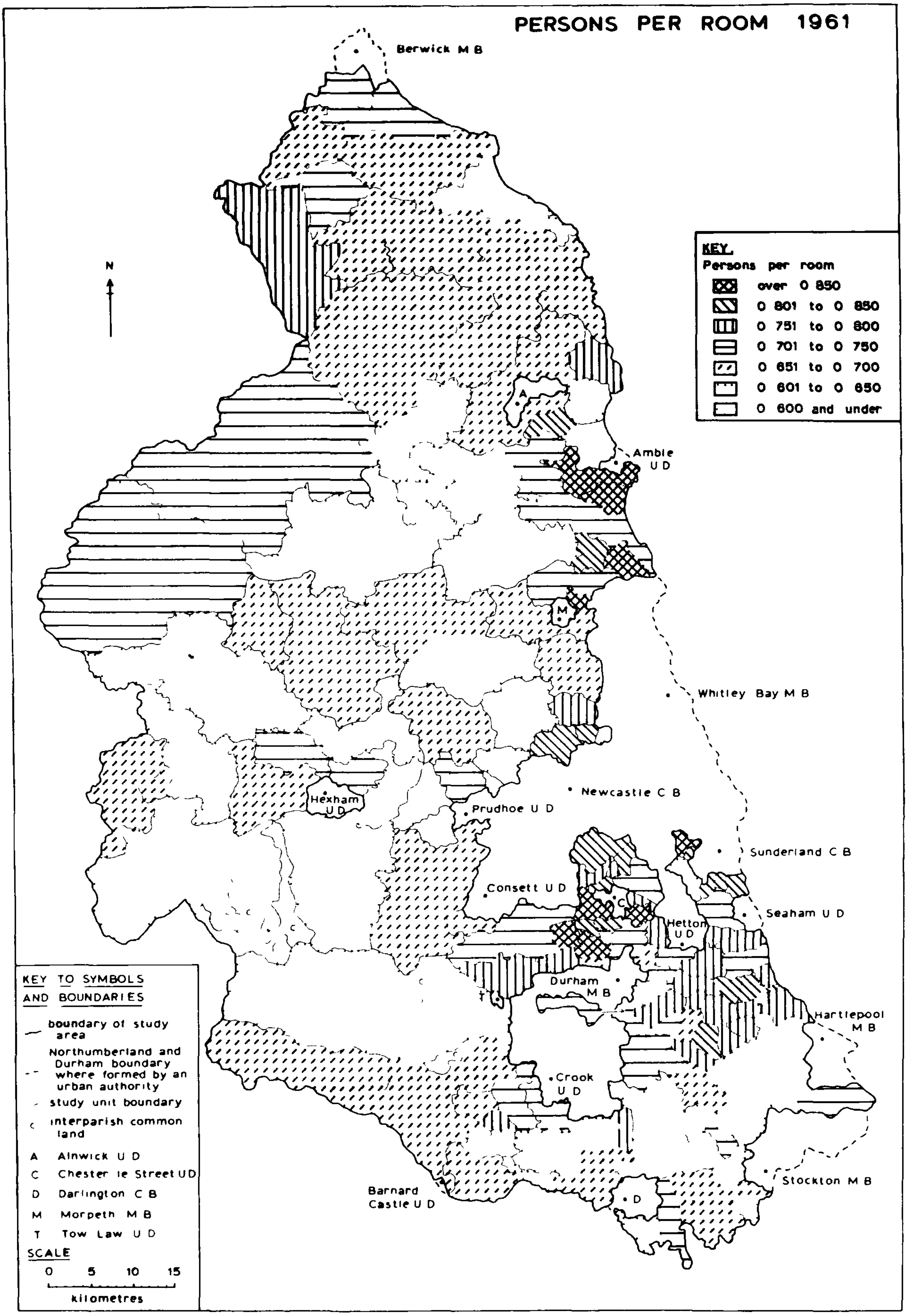
Six measures of person per room values have been calculated. These may conveniently be discussed under four headings :

(a) Persons Per Room 1961

The first index from the 1961 Census 100 percent figures, gives a straightforward person per room value for private households at the unit level. Figure 7.2 shows the resultant pattern and five points may be noted. First, much of central, northern and eastern Durham have high values. The most extreme of these are apparent north of Durham City towards Gateshead and Wearside, but the whole of the eastern coalfield area is covered by uniformly high ratios. The highest value of all, 0.98, is found in Great Lumley.

Second, high person per room densities are apparent in Northumberland in the coalfield parishes to the north of Morpeth. It is noteworthy, for example, that of the eight Northumberland units with a person per room average over 0.80 (Shilbottle, East Chevington, Ulgham, Ellington/Lynemouth, Pegswood, Hazlerigg, the Acklington unit and Woolsington) only one (the last mentioned) does not possess a significant mining interest. Moreover, the first seven were all categorised as class 1a units in section 3.11 with Woolsington falling into class 1b.

Third, although some of the units in Castle Ward R.D.



PERSONS PER ROOM 1961
Berwick M B
N
KEY.
Persons per room
over 0 850
0 801 to 0 850
0 751 to 0 800
0 701 to 0 750
0 651 to 0 700
0 601 to 0 650
0 600 and under
A
Amble U D
M
Whitley Bay M B
Newcastle C B
Hexham U D
Prudhoe U D
Sunderland C B
Consett U D
C
Seaham U D
Hetton U D
Durham M B
Hartlepool M B
Crook U D
Barnard Castle U D
D
Stockton M B
KEY TO SYMBOLS AND BOUNDARIES
boundary of study area
Northumberland and Durham boundary where formed by an urban authority
study unit boundary
interparish common land
A Alnwick U D
C Chester le Street UD
D Darlington C B
M Morpeth M B
T Tow Law U D
SCALE
0 5 10 15
kilometres

Figure 7.2

have quite high values, the particularly low value of North Gosforth (0.59) is apparent together with a belt of other quite low values which stretches down the Tyne Valley commuter zone. The lowest value of all is, in fact, exhibited by the Bywell/Broomhaugh and Riding unit at 0.56.

Fourth, elsewhere, low to moderate values may be seen to predominate. It is particularly striking in this case that west Durham and the vast majority of Northumberland are joined by the south and south-east Durham units which here have a closer association with the more obviously rural areas than the more heavily populated County Durham units to the north. Indeed, there is no person per room value above 0.80 to be found south of Trimdon in County Durham. This would appear limited corroboration of the conclusions reached in Part 1 over the rurality of this south Durham zone and the distinction of a 'rural' class 3a in section 3.11 which included a number of south Durham units.

Finally, in relation to the last mentioned point, one may note that within the vast tract of low to moderate values, the highest person per room figures are in fact to be found in the most remote, least populated and most rugged border units of Kielder, Alwinton and Branxton. This may well be an indication of the difficult economic conditions of many of the inhabitants of this 'marginal' area.

From Table 7.1 it is clear that this person per room index has a large number (41) of significant associations with other variables. This is not surprising in view of the diagnostic nature of this index revealed by its importance in the R-mode (see Table 3.3) and Q-mode (see Table 3.13) Factor 1s. This, indeed, would itself seem unambiguous evidence in support of the contention that : "The density of persons per room ..... appears to be one of the most fundamental indexes of .... spatial differentiation and one which is closely related to a very wide range of social and demographic characteristics" (Robson 1969 p. 240).

The numerous moderate negative correlations exhibited by the persons per room index in Table 7.1 reflect two main attributes. First, it is clear that the lower the room density, the more likely an older age structure. Second, fewer persons per room tend to be associated with increasing distance from sizeable urban populations. It is interesting to note also that there is a negative association between high room densities and service employment.

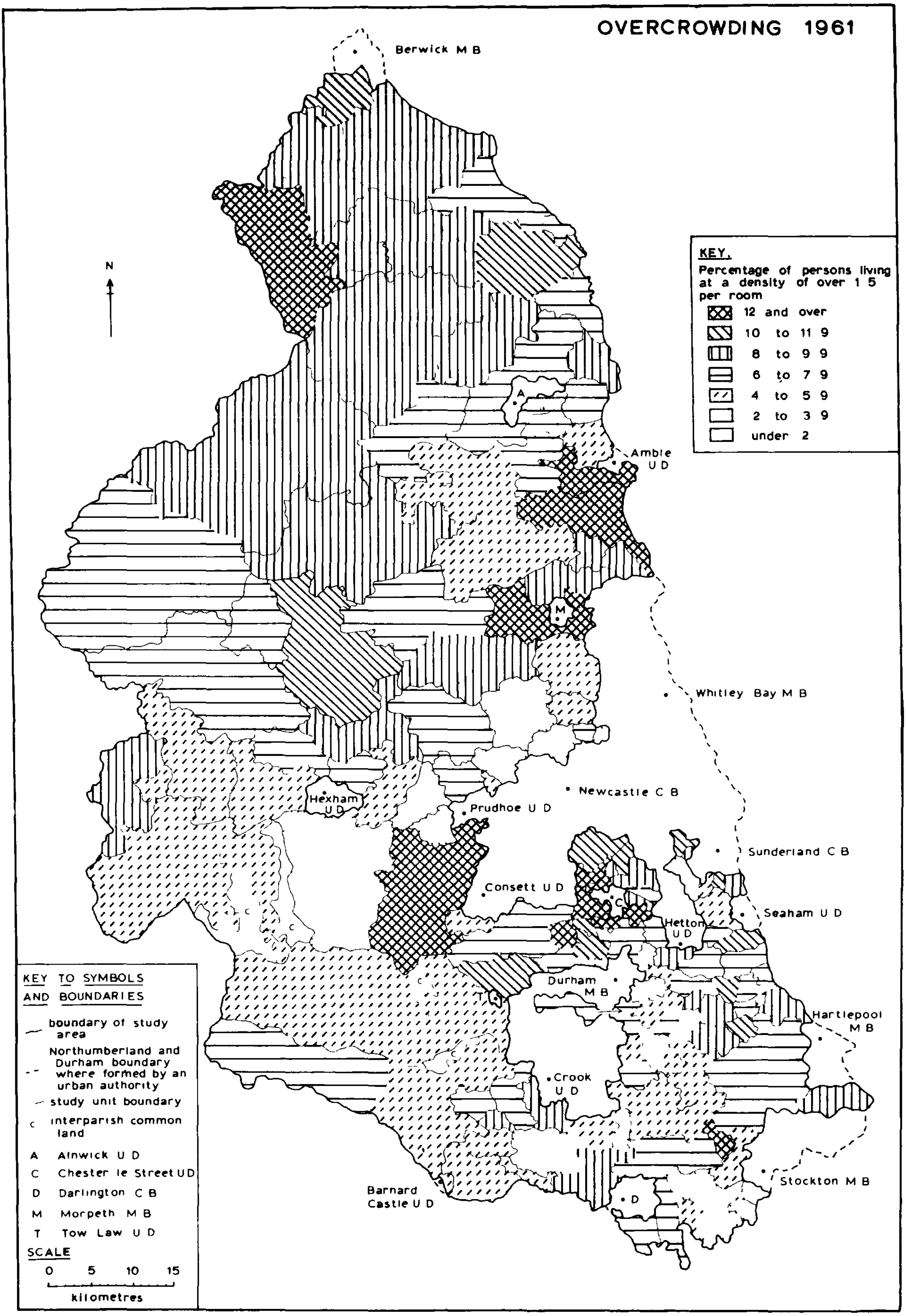
On the other hand the moderate positive associations reflect the converse of the above and, particularly, the close link between a high population density and a high person per room ratio. In addition, correlations appear with short distance mobility, outmovement to work and the supervisory and skilled manual social and socio-economic groupings. Finally, however, it is relevant to note that there is a correlation of 0.54 between the overall 1961 person per room index discussed above and persons per room in owner occupied property in 1966. This reflects that generally higher room densities are consistent under whatever tenure property may be held.

Of the high negative correlations, most reflect the tendency of the socially and economically more favoured populations to live at low room densities. Hence, the -0.71 correlation between access to a car and persons per room, and the -0.78 correlation between the latter index and the proportion of economically active and retired males in 1966 in Social Classes I and II. Rather more interesting , however, are the high positive correlations. Notwithstanding the earlier remark on the consistency of high person per room values over the various types of housing tenure, it is clear that Local Authority housing and high room densities are closely associated. Similarly, mining has an especially close relationship with high room densities. Finally, it is perhaps not surprising that there is a correlation of 0.68 between 1961 persons per room and persons per household.

(b) Overcrowding 1961

In addition to the above index the percentage of persons in 1961 who were adjudged to be living in overcrowded conditions was calculated from the 100 percent Census data. Overcrowding is, of course, a relative concept dependent upon the time, society and part of society considered. However, in 1961 for Census purposes, the percentage of persons living at more than 1.5 per room was regarded a valid index of overcrowding.

Figure 7.3 shows the percentage of unit populations living at over 1.5 persons per room. It appears that the most extreme high values (over 12 percent) are shared between some of the least



OVERCROWDING 1961
Berwick M B
N
KEY.
Percentage of persons living at a density of over 1 5 per room
12 and over
10 to 11 9
8 to 9 9
6 to 7 9
4 to 5 9
2 to 3 9
under 2
A
Amble U D
M
Whitley Bay M B
Hexham U D
Prudhoe U D
Newcastle C B
Sunderland C B
Consett U D
C
Seaham U D
Hetton U D
Durham M B
T
Hartlepool M B
Crook U D
Barnard Castle U D
D
Stockton M B
KEY TO SYMBOLS AND BOUNDARIES
boundary of study area
Northumberland and Durham boundary where formed by an urban authority
study unit boundary
c interparish common land
A Alnwick U D
C Chester le Street U D
D Darlington C B
M Morpeth M B
T Tow Law U D
SCALE
0 5 10 15
kilometres

Figure 1.3

and most rural areas, such as the 21.2 percent of Pegswood and the 18.8 percent of the Branxton unit. This contrast is repeated if one considers the most extensive areas of values over 8 percent. If the minor extent of such values in the mining area north of Morpeth (which contains the highest value of all in the 23.7 percent of the Acklington unit) is excluded, there are two of these tracts. The first is to be found in the north and east of Durham in the heavily populated areas with mining interests. Elsewhere in County Durham there are only isolated areas with over 8 percent of the population living in such conditions. The second area, by contrast, is the large expanse of land mainly in north and north-east Northumberland above Hexham U.D. and reaching Berwick M.B. This is, of course, a predominantly agricultural area. Thus, even at this micro-scale of study, one may agree with the conclusions that the coalfield areas of North-East England possess above average overcrowding consequent upon the tradition of large families and the nineteenth century legacy of small miners' cottages and that "... although the rural areas of England and Wales show little general overcrowding, a tradition of small cottages and large families has not been entirely eradicated despite a century of rural depopulation" (Lawton 1968 p.22).

Turning to the units with little overcrowding (under 4 percent of the population), a far simpler picture presents itself. Although a few exceptions do occur such as the largely agricultural Bolam unit or the mining unit of Cornforth/Mainsforth, the vast majority of such values is restricted to the largely residential urban fringe type parishes, such as Belmont (3.9 percent), Preston-on-Tees (1.8 percent) and Ponteland (2.1 percent). Not surprisingly, the Tyne valley commuter belt is well represented whilst the lowest value of all is that of North Gosforth - a mere 0.1 percent.

The correlation analysis relating to this variable is particularly interesting having a mere three entries in Table 7.1. Two of these relate to other person per room measures whilst the third shows the negative association between overcrowding and a higher than minimum terminal education age. It is obvious that further significant correlations are precluded by the occurrence of overcrowding in both the most and least rural areas. Nevertheless, the theme developed by the R-mode factor analysis is clear - the industrial/mining Factor1 whilst explaining 36 percent of the input variance of all 74 variables, explained over 50 percent of this overcrowding index. By contrast, the residential and favoured social class Factor 3, which explained 20 percent of the total variance, accounted for less than 5 percent of this variable's variance. The two corresponding figures for the largely agricultural Factor 2 were approximately equal at 22 percent.

(c) Low and High Person Per Room Values in 1966

Two measures of person per room densities in private households were derived from the 1966 Sample Census data. Here, in an attempt to show clearly any contrast that might present itself :

(a) the number of persons living at a density of one per room or more was expressed as a percentage of the total unit private household population, and,

(b) a similar percentage figure was calculated for the number of persons living at densities below 0.5 per room.

In fact, both measures stressed that the vast majority of people in the study area (slightly less than 70 percent) lived at an intermediate room density. For the higher density measure a quite clear distinction is apparent between the type of unit with over 20 percent of its population in such a category and that with below 5 percent. In the former case one has largely mining units. Thus, in Northumberland, Pegswood (23.2 percent), Ellington/Lynemouth (20.3 percent), Shilbottle (22.0 percent) and the Acklington unit (24.5 percent) form one half of the examples, whilst in County Durham every one of the twenty units in this category had a substantial mining interest, the highest percentages being recorded by Hawthorn/ Cold Hesledon (32.2), Urpeth (29.6), Hylton (25.4), Plawsworth (25.1), Tunstall (24.7), Thornley (24.5) and Langley (24.4). It is interesting and relevant to note that of the four Northumberland units which form the exception to this general theme - the Thirston, Corsenside, Thirlwall and Horncliffe units - the first three also have slightly above average proportions of persons living at under 0.5 per room (Horncliffe recording 16.9 percent compared to the unweighted mean of 17.2 for that variable).

Rather more variety is shown amongst the type of unit with under 5 percent of its population living at 1.0 or more per room . Nevertheless, 9 of the 16 examples may be considered as residential units, with the lowest percentages exhibited by the Shincliffe unit (0.0), Broomley and Stocksfield (0.0), North Gosforth (1.5) and Ponteland (1.7). The remaining 7 examples vary between the largely rural Humshaugh and Eggleston units to the largely mining Kelloe and Fishburn units. It is appropriate to note, however, that of these 16 units with relatively few people living at higher room densities in 1966, only three also returned below average values for the proportion of persons living at below 0.5 per room. Fishburn and Kelloe were two of these whilst the third, Ouston, showed its young family - residential character in 1966 by combining a value of 3.9 percent of its population living at above the higher room density with one of 9.1 percent at below the lower density.

Looking at the proportion of unit populations living at below 0.5 persons per room, one again has a clear contrast between the type of unit with particularly low values and the type with the highest values. As one might expect, the vast majority of units with less than 10 percent of their population living at densities of below 0.5 per room are mining/industrial in character. Indeed, of sixteen such units, five come from Sunderland R.D. and all but four (Woolsington, Hazlerigg, East Chevington and the Nunnykirk unit) from the Durham coalfield.

By way of contrast, two main types of unit are represented amongst the eighteen units with over one-quarter of their population living at this lower room density. First, a number of largely residential parishes such as North Gosforth, Broomley and Stockfield and Hurworth/Blackwell are represented. A large proportion, however, are rural units which have suffered greatly in the past from rural depopulation. The most obvious examples are Allendale, Rothbury, Ancroft and the Alwinton unit.

Looking at the relevant correlation structures of Table 7.1 for these two 1966 person per room variables, the main themes of the contrasts which have been discussed above may be seen to repeat themselves. Thus, the index of higher room densities may be seen to be negatively associated with favoured social and socio-economic features. Hence, for example, the moderate negative correlations with all three car ownership variables. Conversely, the three positive correlations of note relate to the two mining employment variables and the 1961 unemployment index. It is therefore obvious why this index was the second most important constituent of the R-mode Factor 1, with almost two-thirds of its total variance being incorporated therein. Similarly, the same index was the fourth most significant constituent of the corresponding Q-mode Factor 1.

The index representing low 1966 person per room densities possesses a somewhat larger number of significant correlations in Table 7.1. The reverse of the correlation structure analysed with respect to the preceding variable is apparent - hence the moderate or high correlation with favoured social class and socio-economic indices such as that of 0.65 with the 1966 Social Class I and II index or that of 0.45 with the owner-occupier household variable. Augmenting this picture are the negative correlations with mining employment, high population densities and Local Authority housing. In addition, however, one may appreciate the relationship between low person per room densities and the truly rural areas, although, quite clearly, different processes have been at work here as compared to those causing the association between such low densities and residential-type unit populations. Hence the moderate positive correlations with the three straightforward agricultural employment variables, the tendency towards an older age structure and the telling association with households possessing no family unit.

This dual allegiance of low person per room values is further reflected in both the R and Q-mode factor analyses. In the R-mode study, 28 percent of the variable's total variance was accounted for by the agricultural Factor 2 and 35 percent by the residential Factor 3. A similar pattern occurred in the Q-mode analysis where scores in excess of 1.0 were achieved by both variables on the corresponding Factor 2 (1.08) and 3 (1.41).

(d) Persons Per Room in Owner Occupied and Local Authority Rented Accommodation.

Finally, two other room density indices were calculated from the 1966 Census data - persons per room in owner-occupied property and in Local Authority rented property. In view of the influence of small sample sizes, it would be prudent to treat individual values carefully, and only a brief discussion will therefore be undertaken. Low room densities in owner occupied property tend to be restricted to two types of unit. First, many rural units in Northumberland showed values of under 0.50. Second commuter/residential areas also tended to possess relatively few persons per room in owner-occupied property. This is particularly the case in the Tyne valley where only the Heddon and Ovington units of those numbered 90 to 100 on Figure 3.1 had more than 0.50 persons per room in this property type. On the other hand, relatively new residential developments with in-migrant young families tend to have somewhat higher values, such as the 0.65 of Ouston or 0.59 of Belmont.

Even in owner-occupied property, the contrast between units with low person per room values and those with high values is clear. Thus, of the 15 units with 0.65 or more persons per room in owner-occupied property, only one (the Capheaton unit) has any clear affinity with the rural area. Of the remainder, nearly all are County Durham mining units with Hylton (0.66), Silksworth (0.70), Pelton (0.75), Shadforth (0.68), Horden (0.67), Hutton Henry (0.68) and Langley (0.71) being typical.

Turning to room densities in property rented from the Local Authority, there is a complete absence of any clear picture. Indeed, values below 0.60 and above 0.75 appear to be shared equally between the agricultural rural and industrial mining units. In the case of the low values there appears to be some association between the age of the population and the low person per room densities in Greatham/Seaton or the Shincliffe unit, but even this exhibits inconsistency. It is noticeable, though that densities in Local Authority housing are generally substantially higher than in owner-occupied property with a number of values in excess of 0.80 in the former case. Indeed, the unweighted mean values for the 147 units were found to be 0.69 and 0.53 respectively.

From the correlation structure relating to these two variables two main points may be made. First, the lack of any obvious pattern in the person per room variable for property rented from the Local Authority is again shown in a complete absence of any correlations at or above the level of $\pm$ 0.40. Second, the correlation structure exhibited by the person per room variable for owner-occupied property is similar to, but more extensive than, measures of overall room density. Moderate negative associations are thus shown with variables representing high social class or relative affluence (car ownership for example). On the other hand, a correlation of 0.48 with the proportion of economically active and retired males in Social Class 111 in 1966 shows that where this intermediate social class can be associated with home ownership, it is at a relatively high density of occupation. Similarly, it may be seen that high room densities in owner-occupied property correlate with a high proportion of property being owned by the Local Authority in the same area, high population densities and proximity to urban centres. Likewise, moderate negative correlations may be seen with agriculture and moderate positive ones with employment in mining and production.

7.4 Household Type

The proportion of a unit population living in private households was calculated from both the 1961 and 1966 Census data. The main characteristics of these variables will already be apparent from discussions in Section 5.7 and the reference material in Appendix A and obviates the need for a lengthy discussion here. With regard to the distribution of values for the 100 percent data of the 1961 variable, it is sufficient to note the paucity of units with under 90 percent of their population living in private households. Indeed, particularly in the Durham coalfield area many populations composed entirely of private households are to be found. In 1961, only 14 units possessed an institutional population exceeding 10 percent. Most of these will already be familiar. In Ryhope, Sedgefield, Heighington, the Slaley unit, the Hebron unit and Stannington, major hospitals are the cause and it is amongst these units that the lowest proportions of private household populations are to be found with below 50 percent at Sedgefield (47.4) and Stannington (39.9). In Middleton St. George, the Otterburn unit and Longhoughton, service camps are the obvious institutions. The remaining units which have a large institutional population (the Woodham, Gainford, Bellingham, Horncliffe and Shincliffe units) all possess varying types of educational establishment to cause this except the last mentioned where the Sherburn House Hospital (primarily an Old Persons' Home) is the major inflence.

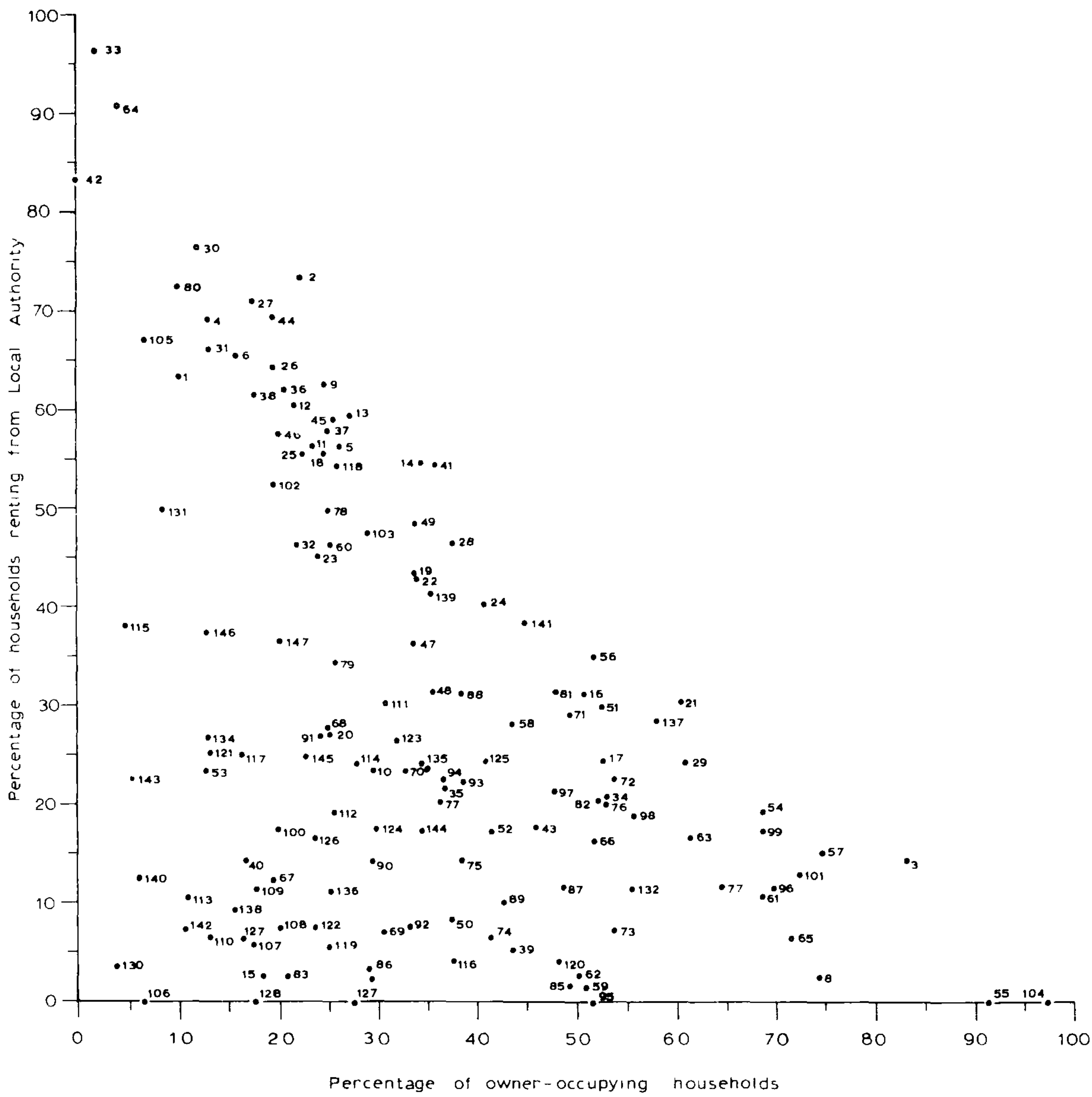
No comment needs to be made on the comparable distribution of values for the 1966 Sample Census data other than the favourable remark that it shows a close similarity (r_s=0.83) with the 1961 variable. Neither variable possesses many Spearman rank correlations of note. Apart from that already mentioned, the 1961 variable shows seven associations at or above ± 0.40, with 1961 and 1966 service employment (-0.42 and -0.51 respectively), a high terminal education age (-0.42), the professional socio-economic groups 1966 (-0.43), mining employment in 1961 and 1966 (0.43 and 0.40 respectively) and persons per room 1961 (0.45). The logic behind these associations is clear. The negative association of service employment and private household population obviously reflects the influence of large institutions on increasing service employment opportunities. Correspondingly, the lack of institutional population in mining areas (which clearly also has an influence on the social and socio-economic aspects) has already been noted above. It is interesting to reflect that in the factor analyses of Chapter 3, the 1961 private household variable was found to be associated, albeit at a restricted level, with both Factors 1 and 2 of the Q-mode study, whilst quite highly linked also to the R-mode Factor 1. The discussions of these associations were undertaken in section 3.8.

From the available 1966 Census data, it was also possible to investigate the type of private household. For each of the 147 units, the proportion of households living in (a) owner-occupied property, and (b) dwellings rented from the Local Authority, were established and similar proportions calculated for persons in order to ascertain any differential effect of household size between the two types.

Figure 7.4 neatly illustrates a three-way dichotomy in the distribution of owner-occupier and Local Authority renting households. Though occasional exceptions do occur, one can clearly see that the units possessing the highest proportion of owner-occupying households tend to be those which, in the factor analyses of Chapter 3, came out strongly on the favoured residential Factor 3s. Indeed, nine of the ten highest percentages are achieved by such units varying from the 97.6 percent of North Gosforth through Herrington/Offerton, Elton/Norton, Egglescliffe, Hurworth/Blackwell, Heighington, Broomley and Stocksfield, and Ponteland to the 68.4 percent of Heddon-on-the-Wall. The commuter nature of these units is most apparent.

On the other hand, those units with the largest proportion of their households occupying property rented from the Local Authority tend to be industrial in nature and heavily populated. Some are typical mining units, but this is a connection of variable strength as many units previously identified as being mining in character also possess much housing belonging to the National Coal Board. Quite naturally, the very highest proportions of households living in Local Authority owned property, are to be found in the new towns of Peterlee (96.1 percent) and Newton Aycliffe (90.8 percent). The latter is the obvious explanation of the dichotomy noted by House and Fullerton (1960) who pointed out that whereas 1945-57 saw 525 Local

HOUSEHOLD TENURE 1966



(units numbered as in Table 3 1)

Figure 7.4

Authority and 282 private dwellings constructed in Stockton R. D., the same period witnessed 3,457 Local Authority and 254 private houses built in Darlington R.D. The remaining units with a particular leaning to Local Authority accommodation, however, are older established settlements - Ford (73.6 percent), Silksworth (69.3 percent), Bearpark (71.0 percent), Sherburn (76.6 percent), Kelloe (83.3 percent), Trimdon (69.4 percent), Langley (72.7 percent) and Dinnington/Brunswick (67.1 percent).

Thirdly, it is clear from Figure 7.4 that a number of units have low proportions of households who either are owner-occupiers or who rent from the Local Authority. Though generally one may agree with the observation that Northumberland and Durham coalfield areas have relatively few owner-occupiers (NEPC 1966), these are not the units which appear in the bottom left hand corner of Figure 7.4. Rather are those units ones which are rural or at the very least, not industrial. The main examples are the Kielder, Branxton, Kirkwhelpington, Akeld, Stannington and Denwick units showing a further prevalent feature of many remoter rural areas - a lack of owner-occupied property and a corresponding lack of Local Authority dwellings. The lack of Local Authority housing is undoubtedly the most significant factor, for, as Ross (1967) has pointed out in the Northumberland Rural Districts (excluding Castle Ward), 70 percent of the 5,500 houses built between 1945 and 1965 were of this type. Overall, it is clear that for the truly rural area in the study "...the tendency towards concentration on the main villages is the main feature of construction" (Ross 1967 p. 49). It is therefore not surprising that the remoter units with the highest proportion of households renting from the Local Authority included Belford (41.2 percent). Wooler (38.6 percent) and Haltwhistle (31.3 percent).

From the chorological analysis above one may appreciate the showing of the two variables in the factor analyses of Chapter 3. The proportion of owner-occupied households showed a very close relationship with the residential Factor 3s and by contrast, the proportion of households renting from the Local Authority an equally close relationship to the industrial/mining Factor 1s. This contrast is further reflected in the correlation structure of Table 7.1 . For the former variable moderate to high associations are shown with variables representing high, or intermediate and high socio-economic groupings, and a corresponding negative correlation with the less favoured social classes. Apart from these there are only two other correlations of note : that of 0.45 with the proportion of persons living at person per room densities in 1966 of below 0.5 perhaps reflecting the favoured nature of housing conditions in owner-occupied property, and that of 0.98 with the proportion of persons living in owner-occupied property. The latter correlation, together with one of 0.99 between the proportion of households living in property rented from the Local Authority and the similar index for persons shows the almost perfect correspondence between the household and person measures.

The correlation structure for households (and therefore persons renting from the Local Authority, is considerably more extensive. The variable shows a high (r_s = 0.63 to 0.66) level relationship with population density indices and a moderate association with high population potential values. Similarly, two correlations of 0.41 show an association of such areas with a high proportion of workers in the 15-44 age group. In employment terms, the areas with high proportions of Local Authority housing shows affinities with mining and, to a lesser extent, production. High negative associations are shown with all agricultural variables. In social and socio-economic terms, a near mirror image is found in comparison with the corresponding owner-occupier variable. Three features however are worthy of note. First, Local Authority housing is negatively associated with a high terminal education age (r_s = -0.58). Second, in terms of social class the one notable positive correlation (0.50) is with the proportion of economically active and retired males in Social Class 111 rather than the semi-skilled and unskilled groups. Third, it is very obvious from Table 7.1 that Local Authority housing is strongly associated with a lack of car ownership.

Finally, one may note that, compared to other forms of tenure, Local Authority dwellings tend to be associated with high person per household and person per room values. It is particularly interesting that those areas with a high proportion of their population living in Local Authority housing are also the areas which have the highest person per room values in owner-occupied property.

7.5 Household Facilities

The 1966 Census included information on the possession of certain basic amenities by each household. It was thus possible to calculate for each of the 147 parish units, the proportion of households which had exclusive use of a hot water tap, a fixed bath and an inside WC. The resultant distribution of values (shown on Figure 7.5) is of particular significance for the possession of basic household amenities has for long been recognised as one of the main shortfalls of rural as compared to urban life. Indeed, the renowned Scott Report (HMSO 1942) commented particularly vehemently on the unsatisfactory nature of rural housing facilities, a complaint illustrated in graphic style by other research at the time (AERI 1944). There is no doubt that the rural North-East for long conformed to this general position, and in the early post-war years many adverse comments were made regarding the household amenities of communities in such areas as Northumbrian Tweedside (House 1956) or Bellingham R.D. (House 1953).

Nevertheless, nearer the present day the critical comments have not ceased. It has been said that the "... largest areas of low quality housing are in the rural parts of the country .... Outside the towns, the scattered rural housing is expensive to connect to the main water pipes and sewerage systems, so that many households lack the facilities " (Humphrys 1968 p. 83). Equally it is apparent that strenuous efforts have been made in recent years to improve the situation in rural areas. It has even been remarked that the results of these efforts may be seen so that in Northumberland, for example, it is only the most isolated areas which suffer from a lack of basic household amenities to any significant degree (Ross 1967).

Figure 7.5, therefore, is of particular interest in view of the allegedly changing position of many rural areas. It is at once apparent from the distribution pattern that high values for the possession of basic household amenities, as here defined, are found in two zones. Firstly, values of over 90 percent are frequent in the urban fringes with Offerton/Herrington (96.7 percent) on Wearside ; Elton/Norton (93.5 percent) and Egglescliffe (92.9 percent) on Teesside ; Heddon-on-the-Wall (96.5 percent), Ponteland (94.1 percent), Woolsington (95.0 percent) and North Gosforth (100 percent) on Tyneside being typical

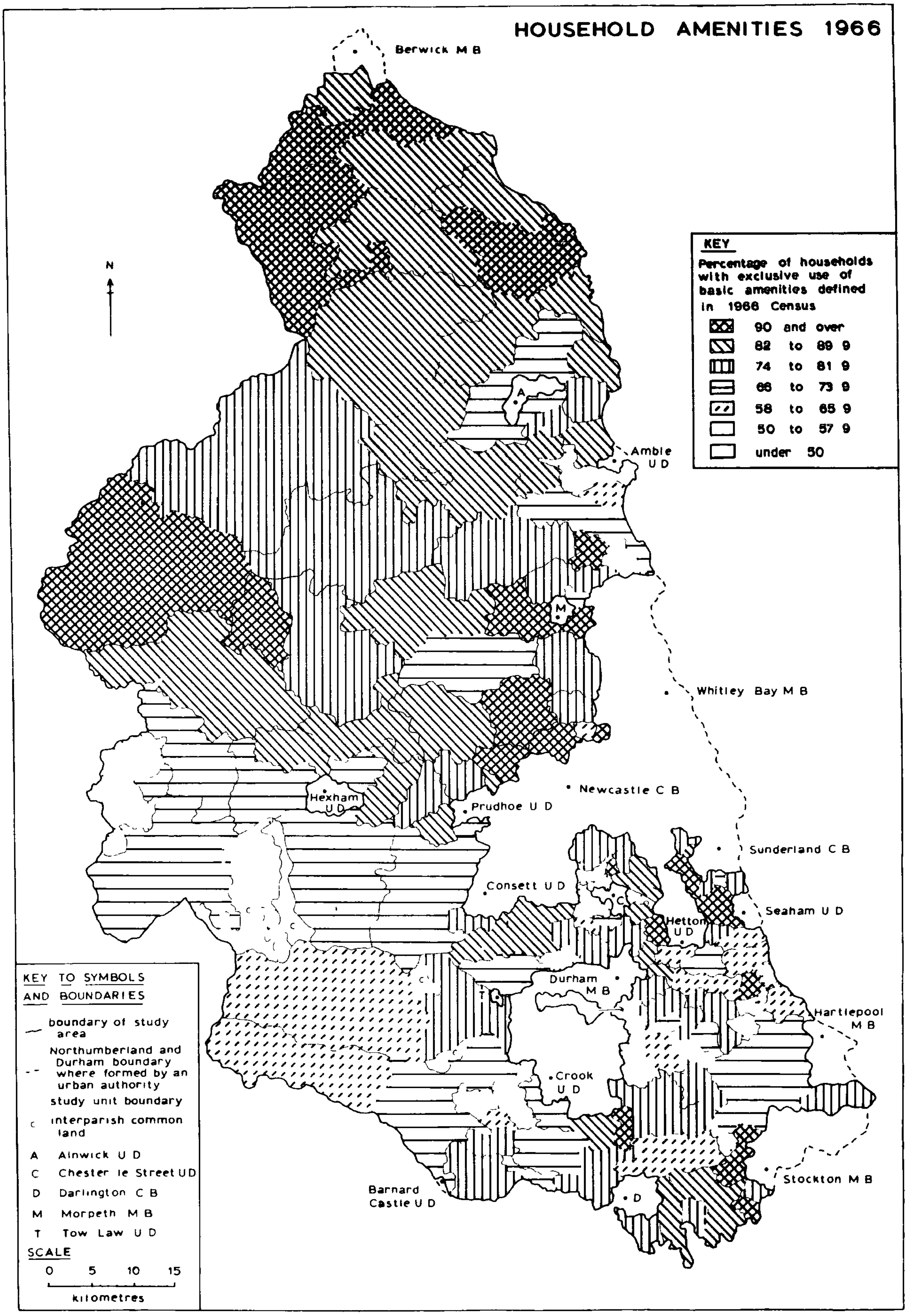

HOUSEHOLD AMENITIES 1966
Berwick M B
N
KEY
Percentage of households with exclusive use of basic amenities defined in 1966 Census
90 and over
82 to 89 9
74 to 81 9
66 to 73 9
58 to 65 9
50 to 57 9
under 50
A
Amble U D
M
Whitley Bay M B
Newcastle C B
Hexham U D
Prudhoe U D
Sunderland C B
Consett U D
C
Seaham U D
Hetton U D
Durham M B
Hartlepool M B
T
Crook U D
Stockton M B
Barnard Castle U D
D
KEY TO SYMBOLS AND BOUNDARIES
boundary of study area
Northumberland and Durham boundary where formed by an urban authority
study unit boundary
interparish common land
A Alnwick U D
C Chester le Street UD
D Darlington C B
M Morpeth M B
T Tow Law U D
SCALE
0 5 10 15
kilometres

Figure 7.5

examples. It is also noticeable that, yet again, the relative affluence of the Tyne valley commuter belt is shown in the more favoured values of the relevant units as compared to the contiguous parishes. Secondly, quite surprisingly, it is clear that, contrary to Ross's (1967) contention, many of the isolated rural areas in Northumberland come out relatively well on this measure with most having over 74 percent of their households possessing the exclusive use of these basic amenities, and a fair proportion over 90 percent. Some of the highest values in the remoter rural areas are to be found towards the Anglo-Scottish borderlands with all Kielder unit households (no doubt due to Forestry Commission influence) for example, possessing basic amenities. Perhaps more noticeable, however, are the high values towards Tweedside in such units as Belford (91.2 percent), Wooler (94.3 percent), the Branxton unit (100 percent), Ford/Milfield (91.7 percent) and Ancroft (100 percent). The situation shown on Figure 7.5 for Northumberland lends support to the statement that, on Tweedside "....the standard of housing has greatly improved as a result of the ambitious programme carried out since 1950" (Ironside 1964 p.547).

By comparison, it is clear that particularly low values are largely a feature of coalfield areas in the Rural Districts, though such units as Thirlwall (51.2 percent) and Allendale (52.7 percent) in south-west Northumberland also show an impoverished situation which is scarcely better in parts of rural west Durham. Nevertheless, it is clearly the mining units which exhibit the worst provision of household amenities, with extreme values to be found in Little Lumley (28.9 percent) and Hutton Henry (35.1 percent). It is just these conditions which were instrumental in the planning leading up to the concept of Peterlee New Town: "....the inadequate living conditions in the villages and their unsuitability for expansion to a new centre, led to .... Peterlee" (Durham County Council 1960 p.4). It is noticeable that Peterlee (99.4 percent) and the other County Durham New Town, Newton Aycliffe (97.7 percent), stand out as particularly favoured parishes.

From the above discussion of the proportional distribution of households possessing basic amenities, the nature of the relevant correlation structure shown in Table 7.1, if restricted, is nevertheless much as one would expect. The moderate positive correlations with the indices of professional and managerial socio-economic groups is straightforward, whilst the moderate negative associations with mining employment in 1961 and 1966 follow clearly from the analysis of low values for the amenities index. The link between the areas of economic decline in the North-East and the worst household amenities is no new theme (HMSO 1963). Rather less apparent is the -0.42 correlation between the index and the 1966 socio-economic group variable representing the skilled and supervisory manual workers. However, as many such persons will undoubtedly be employed in mining and will live amongst even less favoured socio-economic groups in consequence of the manual (albeit partly skilled) nature of their employment, the association may not be quite as paradoxical as at first sight.

Of the remaining three correlations, that of 0.41 with the percentage of the population having entered the 1961 parish of residence from outside the corresponding Local Authority Area during the previous year shows the attraction of good quality housing to in-migrant populations, no doubt partly on account of the recent housebuilding in many such parishes. A similar reasoning may be adduced to account for the two associations with the density change indices for 1951-67 and 1961-67.

7.6 Car Ownership Patterns in Rural Areas

It has been said that "... the keystone of the major part of rural industry and life is still the adequate provision of transport, particularly public bus services " (Ironside 1964 p. 196). Similarly, much concern has been expressed in recent years over the inadequacies of public transport in rural areas. The critical nature of the 1950s and early 1960s regarding the declining provision of rural railway and bus services has been well researched both generally (Thomas 1963) and locally in the North-East (Snaith, Robinson and Mennear 1957). Indeed, concern with rural Northumberland bus services has been a constant theme in the reports of the Northumberland Rural Community Council from its very first report in 1952/53 to the present day.

Equally, whilst it is undeniably true that the declining availability of public transport in rural areas frequently acts to the detriment of employment opportunities and social life, the view is quickly gaining support that "... the future of movement in the countryside lies with the private motor vehicle and the roads and not the frequency of the trains or the bus services " (Bracey 1970 p. 75). Largely to test the degree of truth behind this view, three variables were calculated from the 1966 Census, covering the proportion of private household population having access to : (a) one car, (b) two or more cars, and (c) a car. The first two of these measures were incorporated into the factor analyses of Chapter 3. The third, overall index, is shown in Figure 7.6.

It is at once apparent from Figure 7.6 that the remoter rural areas do indeed show a high level of population accessibility to private cars. Though occasional lower values are visible, it is clear that some of the highest values of all in the rural North-East are to be found in the remotest areas. Thus 85.5 percent of all private household population enumerated in the 1966 Census in the Branxton unit had access to at least one car. The Alwinton, Callaly, Cartington, Nunnykirk, Otterburn, Greystead, Slaley and Healey units also have values in excess of 75 percent. Even in County Durham three of the only six units having over 70 percent accessibility are to be found in the largely rural Barnard Castle R.D. with a maximum value of 76.3 percent in the Bolam unit.

This having been said, it is apparent that some of the lowest values in the remoter rural areas are to be found in units containing the larger population centres - Rothbury (36.4 percent), Belford (45.3 percent), Bellingham (42.9 percent) and Haltwhistle (40.5 percent) for

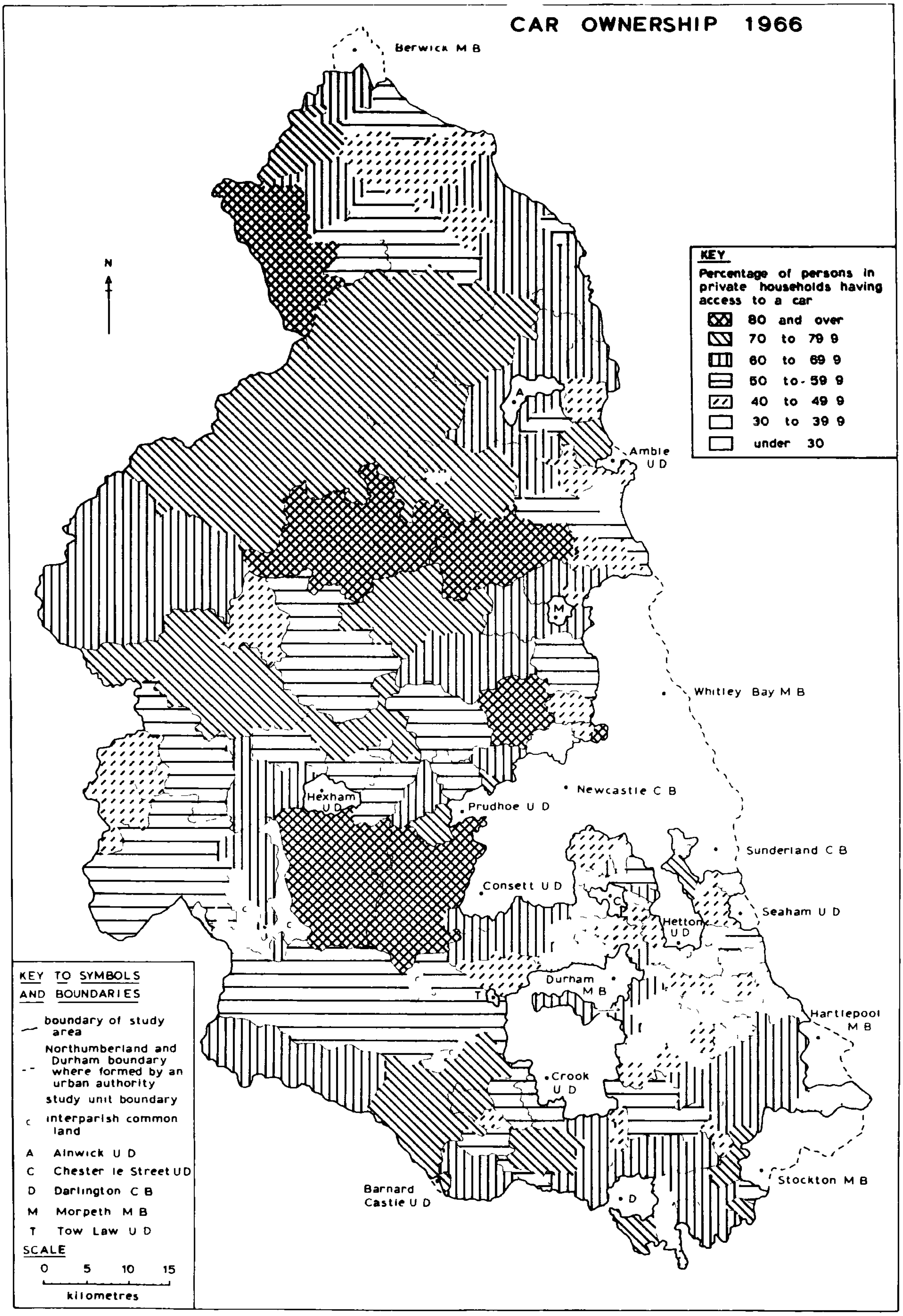

CAR OWNERSHIP 1966
Berwick M B
KEY
Percentage of persons in private households having access to a car
80 and over
70 to 79 9
60 to 69 9
50 to-59 9
40 to 49 9
30 to 39 9
under 30
N
A
Amble U D
M
Whitley Bay M B
Newcastle C B
Hexham U D
Prudhoe U D
Sunderland C B
Consett U D
C
Seaham U D
Hetton U D
Durham M B
T
Hartlepool M B
Crook U D
Barnard Castle U D
D
Stockton M B
KEY TO SYMBOLS AND BOUNDARIES
boundary of study area
Northumberland and Durham boundary where formed by an urban authority
study unit boundary
c interparish common land
A Alnwick U D
C Chester le Street U D
D Darlington C B
M Morpeth M B
T Tow Law U D
SCALE
0 5 10 15
kilometres

Figure 7.6

example. The explanation of this may well rest with the greater social and economic opportunities offered to the populations of such units thus offsetting the functional necessity of car ownership. Consequently there appears to be some small negative relationship between access to larger population centres and car ownership in the rural area. Figure 7.6 lends further support to this hypothesis in so far as values decline noticeably towards Berwick and, to a lesser extent, as Alnwick is approached. Confirmation of this may be sought in the correlation analysis below.

One other type of unit also appears to have high car ownership values from Figure 7.6. As one might expect, these units are those already identified as being favoured in terms of social class and socio-economic status. Thus values of over 70 percent are to be found in Elton/Norton and Hurworth/Blackwell in Durham and Broomley and Stocksfield, Wylam, Ponteland and North Gosforth in Northumberland.

Car ownership is most clearly not a feature of the coalfield units and it is remarkable to note that every one of the 24 units in this study which had less than 35 percent population access to a private car is situated in County Durham and none could remotely be described as rural. Indeed, an enumeration of those units with a value below 30 percent - Ryhope, East Murton, Birtley, Edmondsley/Waldridge, Plawsworth, Shotton, Horden and Thornley clearly shows the poverty of car ownership in the coalfield areas.

The above distinctions are emphasised when one turns to the possession of two or more cars. Again, it is remarkable how high values (over 20 percent) are shared exclusively between rural and urban commuter type units. Conversely of 17 values below 2 percent, 14 are to be found in County Durham in industrial/coal mining units of Sunderland, Chester le Street, Easington and Durham R.Ds. Moreover, the three Northumberland representatives are little different in type - Ellington/Lynemouth, East Chevington and the Widdrington unit.

From this analysis it is clear why in Chapter 3, both of the car ownership indices used showed a strong association with both Factor 2 (agricultural/rural units) and Factor 3 (high social class/commuter units) of the Q-mode analysis. Further confirmation of this pattern is apparent from the relevant part of Table 7.1. The correlation structure for all three car ownership variables is similar and shows a particularly strong association with high social and socio- economic rankings. This appears to be particularly so for persons having household access to two or more cars. On the other hand, moderate negative correlations are shown with the skilled and supervisory manual worker social and socio-economic classes. Likewise it is clear that car ownership is quite strongly negatively associated with Local Authority housing, high person per household values and high person per room totals.

Other significant correlations are however more interesting. Thus, from the relevant employment indices, high positive associations of car ownership (particularly multiple car ownership) may be seen with all simple agricultural employment variables and corresponding negative correlations with mining employment. In addition moderate negative correlations appear with respect to employment in production lending credence to the relative lack of car ownership amongst even skilled manual workers.

Moreover it is clear that, notwithstanding the obvious link between often densely peopled commuter type units and car ownership, there is in general a strong negative association between car ownership and density slightly lessening in intensity between 1951 and 1967. As the above analysis has further indicated, the correlation structure confirms the significance of increasing distance from large (over 7,000) population centres and car ownership.

Of the other associations little need be said. The links with the long and short distance residence change indices are obviously of a triangular nature reflecting the close but opposite connections of those variables with social class indicators. The correlations with SMD ratio variables are the results of a similar triangular relationship; it having already been shown that SMD ratios (section 6.4(i))tend to be higher in the remoter rural areas. Finally, car ownership shows a negative association with the proportion of the workforce aged 15-44. Undoubtedly, two factors contribute to this. First, it may be postulated that car ownership increases with age as a result of normal economic developments, and, second, it has already been shown (section 5.2) that units in the remoter rural areas with their extensive car ownership, generally possess a more unfavourable age structure than their more densely populated industrial counterparts. There is, however, nothing to suggest that any significant correlation exists between those units experiencing the greatest population loss 1951-67 or even 1961-67, and low car ownership values. Both relevant correlations indeed show almost entirely random values.

7.7 Terminal Education Age

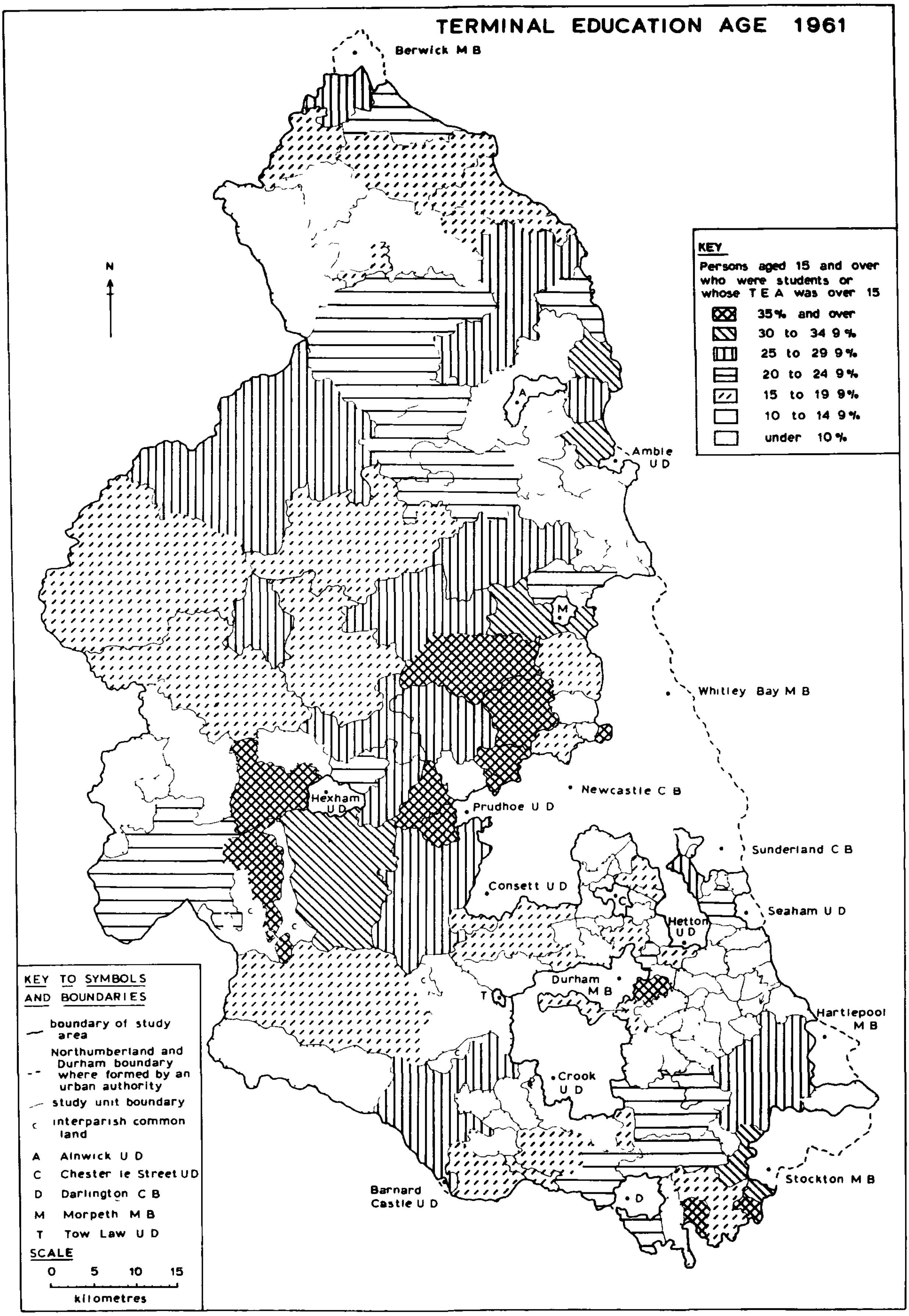
The educational attainment of a population is both an important and emotive topic in so far as rural areas are concerned. It is important because of the relevance of education as a sensitive measure of social status (Bogue 1969). At the same time it is a particularly emotive topic in rural areas for two reasons. First, the provision of educational facilities in many areas is considerably worse than in towns. It is small consolation to those most immediately concerned that in Northumberland economic necessity led the 1959 Education Plan to state that ".. only in four or five areas ... has the retention of one-teacher schools been proposed " (Ross 1967 p.46). Similarly, in his study of the rural Solway counties, Hutchinson (1949) noted the dissatisfaction of a large proportion of the population with the available educational facilities; fully 41 percent of parents consulted considered their children would do better educationally if they moved away from the rural area.

The emotiveness of the topic has, however, another aspect. It is indisputable that "... there is no generalization more widely accepted in common thinking than that which speaks of the rural exodus as the draining away from the rural population of their brightest and best " (Saville 1957 p. 125). This contention, that there is a 'rural' poverty of intelligence' which is caused by the greater propensity of the more intelligent to migrate from rural areas, is one which has received much comment (see Ashby 1939 p. 366). Though modern opinion is sceptical of the view that rural populations are inherently less intelligent than their urban counterparts with the evidence of IQ tests being dismissed as invalid because of the alleged urban bias of these tests (Bosanquet 1950), the dispute still continues. Lee (1966) argues that, as a generality, the education of migrants from rural areas is, at the same time, greater than that of non-migrants at the point of origin, and less than that of the population at the place of destination. In his study of rural migration in Central Wales, Jones (1965) came to the conclusion that there was " ... heavy depletion by migration in the ranks of the better educated young people " (p.42), and felt that this adversely affected the quality of the rural population.

Whatever the truth of this matter may be, the intelligence or educational attainment of a population is certainly a factor of great social, economic and demographic importance. It is thus appropriate that some measure of rural educational attainment be made in this study from the material which is available from the 1961 Census. The terminal education age data from the sample part of the 1961 Census has therefore been analysed. For each unit, the number of persons aged 15 or over for whom a terminal education age was stated, has been taken and the proportion of this total found of those whose age on ending their full-time education was 16 or over (or who were aged 15 or over and still in full-time education). The results are shown in Figure 7.7.

In this instance, a rough threefold division appears. Again it is the coalfield which clearly shows through as the least favoured area, with vast tracts having less than 15 percent of their adult (15 years of age and over) population having a terminal education age of 16 or above or still being in full-time education. The very lowest values of below 7.5 percent are, almost without exception, units which have already been found(see section 6.1) to have strong mining associations. The sole exception , Ouston (6.9 percent), is explained by the educational data being derived from the 1961 Census, at which time the rapid residential population increase which occurred in this parish during the 1960s had yet to take place. Even in Ouston in 1961, almost 13 percent of the enumerated economically active population were to be found in mining. Few Northumberland units occur amongst those with extreme low values but it is clear that those which do - Ulgham (7.0 percent), the Acklington unit (6.6 percent), Pegswood (4.8 percent) and Shilbottle (4.1 percent)-share the mining characteristic of their Durham counterparts.

At the other extreme with values in excess of 28 percent one largely finds the units which have clearly been identified earlier in the study as being of a residential/commuter type. Four main zones stand out in Figure 7.7. First there is the tract on north Tyneside which includes such obvious units as Ponteland (40.7 percent) or North Gosforth (59.2 percent). Second, the Tyne valley to the west, again appears as a favoured area from Heddon-on-the- Wall (43.6 percent) as far west as Haydon Bridge (35.4 percent) and even Allendale (42.3 percent). Third, part of the north Northumberland coast forms an area of high value and includes Warkworth (32.3 percent) and Longhoughton (34.4 percent). Finally, there is the area to the north of Teesside in County Durham which includes Elton/Norton (30.5 percent), Preston-on-Tees (33.6 percent) and Egglescliffe (40.7 percent). It is noticeable



TERMINAL EDUCATION AGE 1961
Berwick M B
KEY
Persons aged 15 and over who were students or whose T E A was over 15
35% and over
30 to 34 9%
25 to 29 9%
20 to 24 9%
15 to 19 9%
10 to 14 9%
under 10%
N
A
Amble U D
M
Whitley Bay M B
Newcastle C B
Hexham U D
Prudhoe U D
Sunderland C B
Consett U D
C
Seaham U D
Hetton U D
Durham M B
T
Hartlepool M B
Crook U D
Stockton M B
Barnard Castle U D
D
KEY TO SYMBOLS AND BOUNDARIES
boundary of study area
Northumberland and Durham boundary where formed by an urban authority
study unit boundary
interparish common land
A Alnwick U D
C Chester le Street U D
D Darlington C B
M Morpeth M B
T Tow Law U D
SCALE
0 5 10 15
kilometres

Figure 1.1

that, in parallel, units with armed service or hospital populations often have a similar propensity to relatively high values perhaps on account of highly educated staff members. This would appear to be the case, for example, in the Slaley unit (31.8 percent) in the former instance and in the Middleton St George unit (37.2 percent) in the latter.

In between these two extremes there occurs the vast majority of the more obviously rural areas. Values vary quite markedly, but on the whole there is an obvious tendency for these units to group between 15 and 25 percent.

From Table 7.1 it may be seen that this variable has a wide range of significant correlations. Generally, however, the two extremes noted above are clearly reflected. Thus, the highest positive correlations (up to $r_s = 0.79$) are shown with the indices representing the managerial and professional classes. Likewise, variables already shown to have a close correlation with these social indices - car ownership and in-migration 1961 - 66 from outside the Local Authority Area of residence - also show a high degree of association with this education variable. On the other hand, skilled manual workers are found to exhibit a fair degree of disassociation with an above minimum terminal education age.

In line with the socially favoured nature of the variable, its close negative links with unfavourable housing conditions are not surprising. However, the strength of the correlation with persons per room in 1961 ($r_s = -0.78$) is striking. Significant inverse associations are shown with other measures of household density such as persons per household (-0.50) or the proportion of persons living at densities of over 1.5 per room in 1961 ($r_s = -0.48$). Other features associated with the coalfield area similarly show such negative associations - Local Authority housing, high unit population density, unemployment and intra Local Authority area migration 1961 - 66 in particular.

The remaining correlations of note (excepting that of -0.42 with the proportion of 1961 unit populations living in private households, which reflects the tendency noted above for certain institutions to have a relatively large proportion of their inmates/staff of above minimum terminal education age) refer to employment indices. The strongest of these are those which show the negative correlation with mining employment. In addition, however, one notes a moderate ($r_s = 0.53$) association with service employment in both 1961 and 1966, reflecting the tendency for service industries to attract the more highly educated members of the population. More surprisingly, similar levels of association are shown with the three direct measures of agricultural employment revealing that notwithstanding the intermediate position of the vast majority of rural units noted above, certainly those with a high level of agricultural employment have more affinity in terms of terminal education age with the residential/commuter type parish than the coalfield zone. Nevertheless, it is clear from the correlation analysis where the main associations of this variable lie. The pattern presented in the factor analyses of Chapter 3 is emphasised. There the terminal education age index was third in importance in the R - mode Factor 3 and fifth in importance in the Q - mode Factor 3. Whilst nearly 55 percent of its variance in the R - mode analysis was incorporated into the residential/high social class Factor 3, only 21 percent was taken up by the agricultural Factor 2 and a mere 11 percent by the mining - oriented Factor 1.

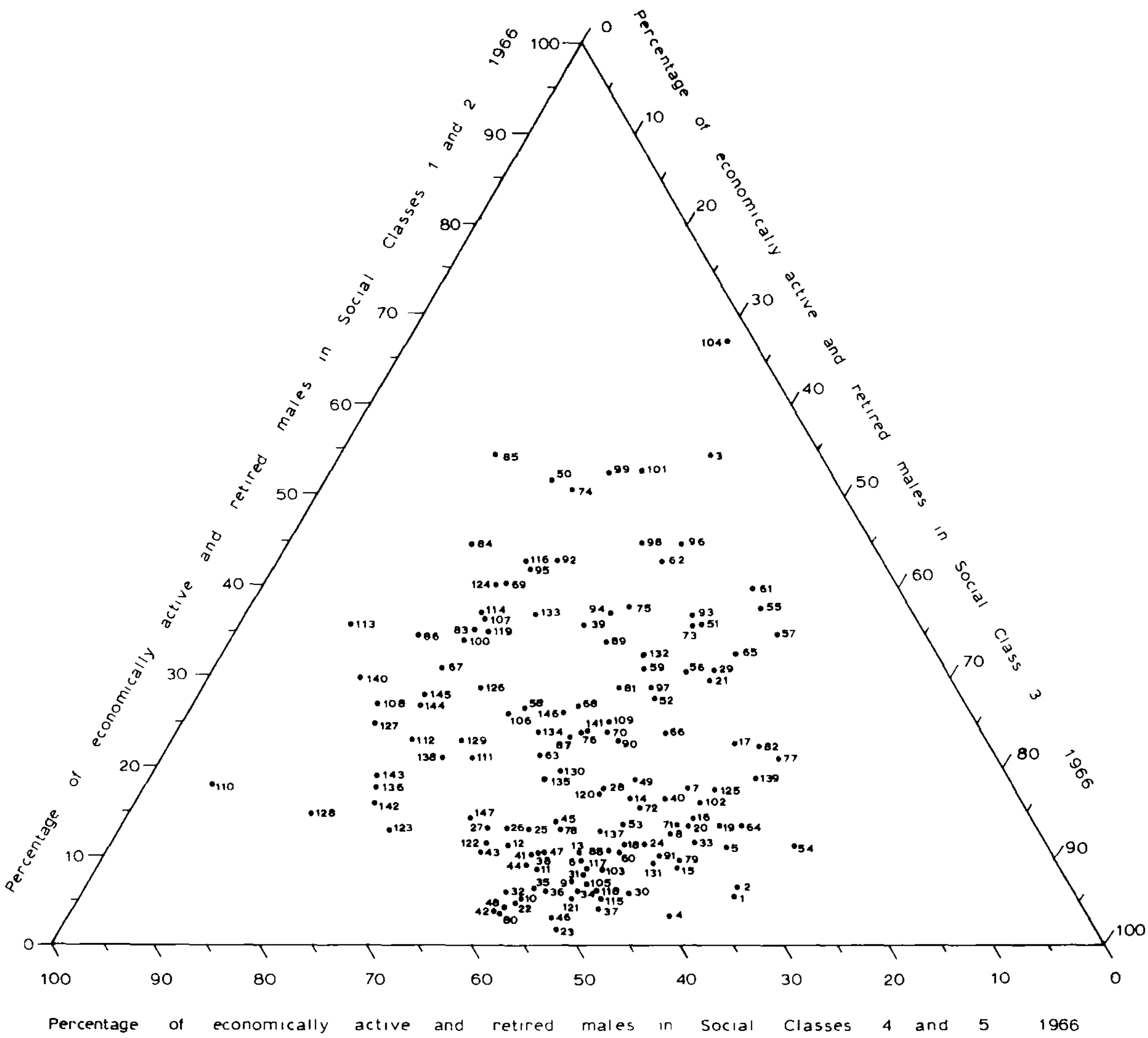
7.8 Social Class

It will already be apparent both from the factor analyses of Chapter 3 and the numerous significant correlations with previously discussed variables, that social class is a particularly diagnostic parameter in the population geography of North-East England. Thus, in the R-mode factor analysis, the variable representing the professional social classes (as defined by social class I in the 1966 Census) had over threequarters of its variance accounted for in Factor 3, of which it was clearly the most significant constituent.

The distribution pattern shown by the various social classes is therefore of more than average interest. This pattern is portrayed quite effectively in the triangular graph of Figure 7.8 in which the economically active and retired males enumerated in 1966 have been divided into Social Classes I and II (professional and intermediate), Social Class III (skilled) and Social Classes IV and V (semi-skilled and unskilled). The resultant percentages illustrate clear groupings of units in Figure 7.8.

Units showing a high percentage of persons in the first two Social Classes tend, not surprisingly, to be those already identified as commuter/residential types with North Gosforth clearly the most extreme example. In addition, however, there is an admixture of more obviously rural units such as the Allendale, Slaley, Woodham and Hamsterley units. The institutional effect noted in Section 7.7 may similarly be an important causal factor in the Slaley and Woodham cases whilst in the remaining two, the influence of labour employing farmers may be relevant. In all instances it is particularly noticeable that the units lie toward the left of the graph showing the relatively large numbers also of Social Classes IV and V and the lack of the buffer Social Class III. It is significant that neither the Hamsterley nor the Allendale unit is to be found amongst the highest values when Social Class I is considered. Emphasising the favoured demographic structure of the Tyne valley are the ten highest values for Social Classes I and II (seven over 50 percent and the remainder about 45 percent), amongst which are found those of Broomley and Stocksfield, Wylam, Ponteland and Heddon-on-the-Wall (one may even include North Gosforth and the Slaley unit, if not Allendale). A similar pattern is presented by a consideration of the highest values for the professional social class variable used in the factor analyses of Chapter 3. Here, the

SOCIAL CLASS 1966



(units numbered as in Table 3 1)

Figure 7.8

Northumberland values over 10 percent are restricted to the Corbridge, Broomley and Stocksfield, Broomhaugh and Riding, Wylam, Ponteland and North Gosforth units. Durham examples come from the largely residential units of Hurworth/Blackwell, Elton/Norton, Belmont, Herrington/Offerton, Shincliffe and Woodham.

Whilst few units possess over half of their economically active and retired males in Social Classes I and II, many more have such a proportion of skilled occupations (Social Class III). Although several of the units with the highest Social Class III values (55 percent and over) have a strong mining association, their main link is naturally with employment in production. Indeed such units as Esh, Hylton, Tunstall and Lamesley, all have indigenous manufacturing industry (the last mentioned possessing part of the Team valley Trading Estate), or are in close proximity to conurbations offering such employment. Quite naturally both Peterlee and Newton Aycliffe have high Social Class III values. In addition, however, a number of more rural units are shown by Figure 7.8 to have such high values. These tend to be the larger centres such as Belford, Rothbury and Wolsingham, in which one might expect local manufacturing and skilled occupations to centre.

Lastly, there are many units with the majority of their economically active and retired male population to be found in Social Classes IV and V. It is clear that these units fall into two groups. First, many of the remote rural units have such values. Indeed, those in excess of 60 percent are almost solely of this type - the Kielder, Alnham, Felton, Beadnell, Branxton and Milfield units. Similarly all those units except Wooler which are numbered from 140 to 147 on Figure 3.1 have over one-half of persons in Social Classes I to V in the least favoured two categories. This reflects a continuation of the socially imbalanced situation on north Tweedside previously noted by House (1956). It is clear that one is seeing the dichotomy in rural areas between labour employing farmers and agricultural workers. By contrast, the second type of unit with high values for Social Classes IV and V has a moderate representation of skilled occupations but has a dearth of the professional and intermediate Social Classes. The nature of these units can not be doubted - the cluster of units in Figure 7.8 all with well under a 10 percent Social Class I and II value but with approximately 50 percent or more in Social Classes IV and V comprises Edmondsley/Waldridge, Cornforth/Mainsforth, East Chevington, Easington, Shotton, Horden/Castle Eden, Wingate, Kelloe, Chilton and

Langley. Represented here is one of the main sociological features of County Durham; the predominance of working class populations, itself linked to the coalfield (Bulmer 1970).

Turning to the correlation structure presented by the five social class indices in Table 7.1, a brief synthesis will suffice as nearly all the significant associations shown have already been discussed in relation to the other variables. The index representing Social Class I alone, has few correlations at or above $\pm$ 0.4. It does however show moderate positive associations with other indices representing professional and intermediate social and socio-economic groups, above minimum terminal education age, service employment and long distance in-migration. Not surprisingly a moderate negative correlation is shown with the joint Social Class IV and V variable.

The variable representing Social Classes I and II together, has a rather more interesting and extensive set of correlates. In terms of employment there is a moderate positive association (as discussed in relation to Figure 7.8) with service and agricultural employment but a strong negative link with mining employment (r_s = -0.71 in relation to the 1966 mining variable). In terms of household features, a strong negative link is shown between the professional and intermediate Social Classes and Local Authority housing, high person per household and room densities and a moderate positive association with owner occupation. Correlations with other indices of social class and socio-economic groupings are as one might expect, though it is somewhat surprising to note that the negative association with the variable representing Social Classes IV and V at r_s = -0.53 is little different from the similar correlation with the Social Class III variable (r_s = -0.54). Apparently, in the Rural Districts of North-East England the professional and intermediate Social Classes show a similar repulsion from skilled, and semi-skilled and unskilled workers. In addition, there are obvious strong associations with car ownership (as high as r_s = 0.79) and an above minimum terminal education age. Finally, though this index representing the top two Social Classes shows an association with long distance in-migration, it shows a noticeable repulsion from areas of high population density in rural areas. This association however has declined in strength between 1951 (-0.59) and 1967 (-0.53) showing one or both of the effects of the build-up of population in certain of these areas and/or the decline in population density in many of the mining parishes over the same period.

If one then takes a composite index including the first three social classes, the correlation structure shows a marked change. A moderate correlation still exists with service employment, but a reflection of the skilled occupations of Social Class III may be seen in the correlation of 0.48 with 1966 employment in production. Apart from the linkages with appropriate socio-economic indices (see section 7.9) two associations of note remain. The first shows the highest correlation of all the social class variables with owner occupancy (r_s=0.63 for persons and r_s=0.62 for households). The second shows moderate correlations with density change 1951-67 and 1961-67, thus exemplifying the association between in-migration and the higher intermediate social classes.

Turning to Social Class III alone, one finds a correlation structure whose main theme is a connexion with the more densely peopled areas in the rural districts - even more so than for Social Classes IV and V. Thus, for example, all three density variables correlate at a high level with lower order associations between Social Class III and population potentials. In terms of employment, Social Class III shows a moderate association with mining employment, an obvious high correlation with production and an equally high but negative link with agriculture. Despite the fact that the addition of Social Class III to Social Classes I and II gives a higher association with owner occupancy than the latter two variables together, it is clear that Social Class III shows its main links in the housing field with Local Authority dwellings and high person per room densities so uncharacteristic of the Social Class I and II index. Likewise, moderate negative correlations are shown with car ownership, above minimum terminal education age and the various indices of higher social and socio-economic group. The remaining correlations of note are largely explicable by the variable's association with urban proximity - for example the negative association with large agricultural holdings - whilst the fact that skilled employment is to be largely found in manufacturing, which is itself urban-centred, is shown in the correlation between high values for Social Class III in the rural districts and outmovement to work.

Finally one may turn to the semi-skilled and unskilled occupations of Social Classes IV and V. The highest correlations here are those which show the positive association of this variable with Local Authority housing and the negative association with owner occupancy, and, of course, the more favoured social and socio-economic classes. The remaining links above $r_s = \pm 0.4$ show the antipathy of Social Classes IV and V with employment in service industries and (for 1961) in production. The latter most certainly reflects the lack of manufacturing employment over much of the coalfield and in the agricultural rural areas where high proportions of people are included in these Social Classes. The two correlations with density change variables show that those parish units with a high proportion of their inhabitants in Social Classes IV and V are associated with stagnant or decreasing populations. Again this is what one has already been led to expect in the coalfield or remoter rural areas.

7.9 Socio-Economic Groupings

The 1961 and 1966 Censuses of England and Wales classify the economically active and retired male population into seventeen socio-economic groupings. Whilst it is recognised that ideally these groupings should contain people whose social, cultural and educational standards and behaviour are similar, practical considerations have resulted in the Census groupings being based on employment status and occupation (Hall and Smith 1968).

In considering the seventeen socio-economic groups, two composite groupings are undoubtedly of the greatest significance:

(a) professional workers (socio-economic groups 3 and 4) who are normally in work requiring a university degree standard of education;

(b) managerial workers (socio-economic groups 1 and 2) which include all who employ, plan and supervise administration, industry and commerce, and those who rent or own farms, forests or market gardens and employ labour other than family workers (socio-economic group 13).

"The proportion of such groups in any community gives a measure of its affluence; these are the groups which particularly raise the quality of the infrastructure of service employment.....The proportion of professional and managerial talent in a community is therefore a useful, if crude, index of its socio-economic status" (Waugh 1969 p.159).

Accordingly for each unit the proportion has been calculated of economically active and retired males who were classed in these groups in 1961 and 1966. The resultant pattern in the latter year is shown on Figure 7.9. It is very clear that the least favoured areas are once more in the coalfield with a particularly noticeable tract extending eastwards to the coast from Durham City and Crook. Low values also cover much of the remainder of Durham including some of the rural units in the extreme west. In Northumberland, values below 10 percent are less apparent and, excluding the isolated instances in Haltwhistle R.D. are restricted to the east of the county in two bands. The first is the well known mining area between Morpeth and Alnwick, the second the smaller coalfield zone between north Tyneside and Morpeth. The predominance of coalfield units amongst the low

SOCIO-ECONOMIC CLASSIFICATION 1966

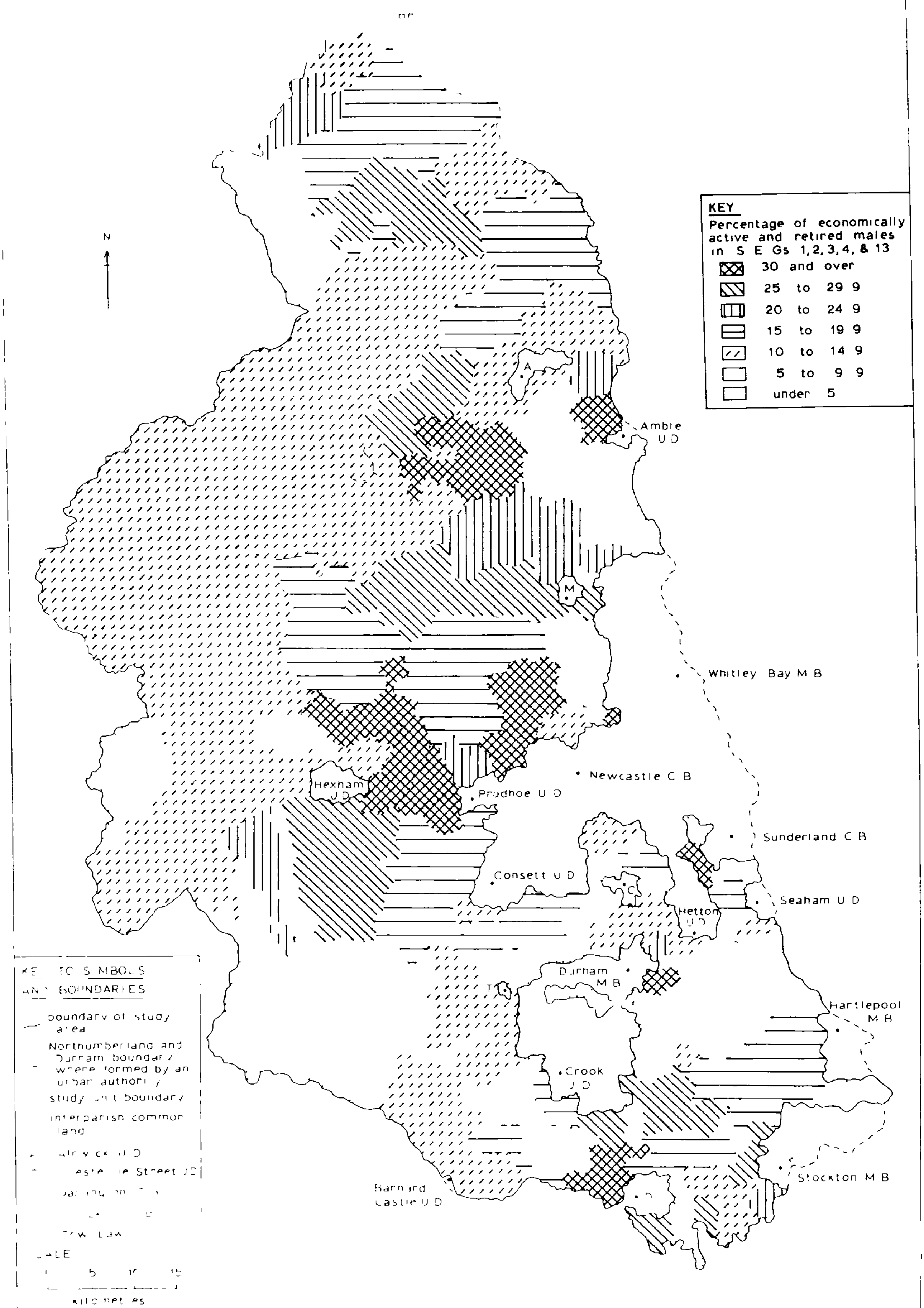


Figure 7.9

values is clear and parishes with a significant mining interest in 1966 are all units with values below 5 percent (Table 7.2).

Table 7.2

Percentage of the Economically Active and Retired Male Population in the Professional and Managerial Socio-Economic Groups in 1966.

Unit number on Figure 3.1	Parishes in unit	percentage in S.E.G.s 1,2,3, 4 and 13
31	Shadforth	1.4
54	Carlton, Whitton	2.3
118	Ulgham	2.4
30	Sherburn	2.7
4	Silksworth	2.7
46	Cornforth, Mainsforth	3.0
32	Shotton	3.2
44	Trimdon	3.2
9	East Murton	3.4
37	Thornley	3.5
48	Chilton	3.5
43	Hutton Henry	3.7
80	Langley	3.7
53	Greatham, Seaton	3.9
121	East Chevington	3.9
6	Ryhope	4.0
10	Easington	4.0
42	Kelloe	4.0
115	Pegswood	4.1
23	Edmondsley, Waldridge	4.3
120	West Chevington, Cresswell, Thirston, Widdrington	4.3
2	Ford	4.5
27	Bearpark	4.5
34	Monk Hesleden, Nesbitt	4.5
45	Fishburn	4.5
131	Shilbottle	4.5
22	Pelton	4.6
1	Fylton	4.7
35	Horden, Castle Eden	4.8

Though none is included in Table 7.2, most units of a more 'rural' employment nature only have a low or moderate proportion of their male population in these favoured socio-economic classes. Hence, one finds the extensive belt of land along the Anglo-Scottish borderlands where values are within the 10 to 15 percent range. Remoter rural units with high values are infrequent and caused by a combination of retired persons of high socio-economic status or large labour employing farmers. The Hartburn (25.6 percent), Cartington (30.2 percent), Whittingham (26.7 percent), Warkworth (30.0 percent) and Chatton (26.5 percent) values may all be thus explained.

Quite naturally, most of the highest values occur in urban fringe residential parishes around Tyneside, Teesside, Wearside and Darlington. The most extreme of all is North Gosforth where, in 1966 fully 55.1 percent of the economically active and retired population were classed in the professional or managerial socio-economic groups. Ponteland with 45.1 percent, the Piercebridge unit with 42.4 percent and Herrington/Offerton with 40.4 percent were other notable units. The existence of the Tyne valley commuter belt is clearly shown up by this variable and it is significant that none of the Humshaugh, Corbridge, Bywell, Broomhaugh and Riding, Wylam and Heddon-on-the-Wall units has a value under 30 percent.

Overall, therefore, there is great variation in the proportion of professional and managerial status persons amongst the 20 pre-1967 Rural Districts of North-East England. Whilst the unweighted mean for all 147 parish units of 14.1 percent is only slightly lower than the national average in 1966, there is an obvious and enormous distinction between coalfield units and the residential urban fringes. The latter truly show up, as Duncan and Reiss (1966) have noted, as islands of high value between rural areas and the central city.

A similar calculation for 1961[1] gives almost parallel results. A number of additional points are however worth making. First, though the unweighted mean (14.4 percent) was little different from 1966, individual values were generally less extreme in the earlier year. Thus, in 1961, 19 units had over 25 percent of the relevant population

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[1] A slight difference exists between Census practice in 1961 when students and inmates were included with the retired population, and 1966 when they were excluded from the socio-economic tabulations. The effect is minimal (Waugh 1969).

in socio-economic groups 1, 2, 3, 4 and 13, compared to 21 in 1966. Similarly, only 25 units had values below 5 percent in 1961 compared to 30 in 1966. Second, whilst the unit character of both extremes was similar in 1961 and 1966 there is nevertheless a noticeable tendency for more rural units to be at the more favoured end of the scale in 1961. Thus, amongst the 19 values rising above 25 percent were the Capheaton, Greystead, Hartburn, Nunnykirk, Whittingham, North Sunderland and Ancroft units.

There is some evidence here therefore to support the contention (Waugh 1969) that between 1961 and 1966 there was a sharpening of social gradients as a result of increasing residential segregation. Likewise there appears to be some support at the micro-scale for Waugh's view that it is rural areas which mainly suffered between 1961 and 1966 from a decline in high status residents.

It will be recalled from the factor analysis variable selection procedure (see section 3.5), that, in addition to the professional and managerial socio-economic groups it was decided to include an index of skilled manual classes in the study. This index covered socio-economic groups 8, 9, 12 and 14 (foremen and supervisors - manual, skilled manual workers, own account workers - not professional). The unweighted mean value for this index in all 147 units was 34.7 percent. Against this, there were nine values exceeding 50 percent. Some of these were quite naturally units seen to have a high level of employment in production; these include Ford (53.6 percent of economically active and retired males in S.E.G.s 8, 9, 12 and 14), Carlton/Whitton (61.4 percent), Healeyfield (51.2 percent) and Cockfield (50.0 percent). Others are more noted for their mining employment in which a fair substratum of skilled manual workers may in any case be expected: Hylton (52.7 percent), Silksworth (51.8 percent) and Shilbottle (53.7 percent). In the remaining two units - Forest and Frith (54.5 percent) and North Sunderland (52.8 percent) - it is highly likely that the cause lies in relatively large numbers of own account (non-professional) workers, possibly in agriculture in the former and fishing in the latter. Generally it is as one would expect, however; the more densely populated near urban units rank high on this variable and, for example, the Little Lumley, Peterlee, Greatham, Great Aycliffe and Esh units all have values of between 45 and 50 percent.

At the other extreme there is similarly no doubt as to the character of those units with under 20 percent of the relevant male population in these socio-economic groups (Table 7.3). The vast majority

Table 7.3

Percentage of the Economically Active and Retired Male Population in Socio-Economic Groups 8, 9, 12 and 14.

Unit number on Figure 3.1	Parishes in unit	Percentage in S.E.G.s 8,9,12 and 14
110	Kielder, Falstone, Tarset	8.9
128	Alnham, Ingram, Roddam, Earle, Ilderton, Lilburn, Bewick, Chillingham	11.6
140	Akeld, Chatton, Ewart, Doddington	11.8
104	North Gosforth	11.9
95	Bywell, Broomhaugh and Riding	13.3
134	Longhoughton	14.3
113	Hothley, Hartburn, Wallington Demesne, Kirkwhelpington	15.4
126	Whittingham, Callaly, Snitter, Netherton, Thropton	15.6
142	Branxton, Carham, Kilham, Kirknewton	15.6
100	Matfen, Stamfordham	16.0
98	Wylam	16.1
143	Ford, Milfield	18.9
101	Ponteland	19.0
138	Middleton, Easington, Bamburgh	19.4
146	Ancroft	19.4

are truly rural types in which there is obviously a dearth of skilled manual occupations. In addition, a small number of prosperous urban fringe type units are also included in the table, resulting from their largely non-manual residential population type.

Finally, a composite index of professional, managerial and skilled manual socio-economic groups was calculated to see whether any distinct pattern existed when the top strata of both manual and non-manual occupations were considered together. Unfortunately, no such pattern emerged. Rather, those units which had particularly high or low values for one or other of the previous two variables, reappeared. Thus, units in 1966 with over 60 percent of their economically active and retired population in S.E.G.s 1, 2, 3, 4, 8, 9, 12, 13 and 14 were either residential urban fringe units such as North Gosforth (66.9 percent) or Ponteland (64.2 percent) or units already noted to have substantial skilled manual type population such as Carlton/Whitton (63.6 percent) or North Sunderland (68.1 percent). In both instances the units concerned possessed just sufficient of the other socio-economic groups to add to their own professional or manual predominance, to exceed the 60 percent level. No discernible new theme emerges. Values of under 38 percent, as one might imagine, are largely restricted to remoter rural units having almost no skilled manual occupations and few professional or managerial. The Branxton (25.0 percent), Middleton (33.3 percent), Alnham (23.3 percent) and Kielder (22.2 percent) units are typical. In addition, units with strong defence interest (members of the armed forces being classed under socio-economic group 16) are also represented in Matfen/Stamfordham, East Chevington (both 34.0 percent) and Longhoughton (24.5 percent).

The correlation structure in Table 7.1 which refers to the professional and managerial socio-economic group variables for 1961 and 1966 is extensive and revealing. Both variables show similar associations intercorrelating at $r_s = 0.78$. In employment terms moderate links are shown with services and strong links with agriculture. The latter obviously reflects the inclusion of S.E.G. 13 (farmers employing labour) in the professional and managerial category. Whilst the level of correlation increased for service employment between 1961 and 1966, there was a corresponding marked decrease in agriculture. This latter trend may reflect rationalisation inthe amalgamation of agricultural holdings. The strongest employment link of all is perhaps not surprisingly the negative one with mining.

Numerous correlations are also shown with housing variables. Essentially, these show a positive association with low person per room densities (r_s between professional and managerial S.E.G.s in 1961 and persons per room in 1961 = -0.77) and with the possession of basic household facilities, and a negative association with Local Authority housing. A moderate negative association is shown with household size. Somewhat surprisingly there are only two correlations of note with any index of owner occupancy (the highest being $r_s = 0.45$ between the percentage of households living in owner occupied property and the 1966 index of the top S.E.G.s). This may reflect the propensity of such people to rent certain types of property. The only negative correlation, with private household population, perhaps represents the fact that certain types of highly qualified professional people (such as doctors or teachers) may live in the associated institutions.

Various other indicators of social and economic status quite naturally correlate at significant levels with the two variables representing the top socio-economic groups in 1961 and 1966. Particularly high associations are shown with car ownership, a high terminal education age and the variable representing social classes I and II. It is therefore not surprising that the 1966 professional and managerial socio-economic groups variable was the second most important constituent of both Q and R-mode Factor 3s in Chapter 3. Equally interesting, however, is the fact that the moderate negative link with the variable representing the semi-skilled and unskilled social classes is only at the same level ($r_s = -0.46$) as that with the skilled manual social classes (Social Class III). The correlation between the variable representing the professional and managerial socio-economic groups and that representing the skilled and supervisory manual grades ($r_s = -0.59$) is confirmatory of the opposite polarity of these indices.

Amongst the remaining correlations the most significant are those negative ones with density and population potential. Despite the fact that top socio-economic groups are not inordinately represented in the agricultural and remote rural areas, their repulsion from the densely populated mining parishes of the coalfield is obviously an overriding feature. However, the 1966 top socio-economic group variable correlates at a lower level than does that for 1961. Similarly, the highest negative correlation is with the 1951 density figure, with a progressive decline through 1961 to 1966. This suggests that those units with a high proportion of the professional and managerial groups have progressively increased in population over the past few years - an example of the residential segregation noted by Waugh (1969).

As one might expect, unemployment is shown by the correlation structure to be unimportant in areas with a favoured socio-economic structure. In addition, inmovement to parishes from outside the relevant Rural District is shown to be an associated feature of such areas, though intra-Rural District movement is obviously not so.

The remaining correlations of note show a lack of young people in areas of high socio-economic status in 1961 which will result both from the older age structure of persons having attained such favoured positions, and from a smaller juvenile family size. The association with the Standard Man Day Ratio variable testifies to the efficiency of agricultural labour usage in the relevant units, whilst those with the age at death variables may in part reflect both a longer life expectancy of the professional and managerial socio-economic groups (and lower infant mortality) and the possibly older age structure noted above.

Fewer correlations are shown by the skilled and supervisory manual socio-economic group variable in 1966. However, in employment terms it is clear that this index is associated with mining and production but negatively with the service industries. It featured prominently in the Factor 1s of both the Q and R-mode analyses. In social and socio-economic terms, negative links are shown with indices of higher status. Likewise, moderate negative correlations are shown with the 1966 longer distance inmovement, car ownership and high terminal education age variables. All these, of course, were earlier shown to be associated with the indices of high social and socio-economic status. The remaining associations are with high person per room densities and a lack of basic household facilities. Overall, therefore, it is clear that the skilled and supervisory social and socio-economic grades are not so favoured by their position at the apex of the manual groups.

When considered together, both for 1961 and 1966, the professional, managerial and skilled manual socio-economic grades show an even more restricted correlation structure. The correlations which are shown in Table 7.1 are largely attenuated versions of strong links shown by the professional and managerial variable alone as, for example, is the case with car ownership. Most of the remainder are obvious positive links with social or socio-economic indices from which the composite variable was derived or negative links with contrasting low status measures. On the other hand, it is the composite variable which shows the highest correlation ($r_s = 0.55$) of all with owner occupancy. Nevertheless, this index has shown itself to be of limited interest.

7.10 Conclusion to Chapter 7

The factor analyses of Chapter 3 showed the great importance of social and socio-economic indices in forming significant dimensions of similarity and difference within and between the administratively rural populations of North-East England. Each of the major variable types discussed in the present chapter show a clear leaning towards one of the three primary axes found to exist in Chapter 3.

High person per household values have an obvious affinity with the industrial/mining units. This is particularly so in relation to the 1961 person per household variable which shows a marked distinction between the coalfield and rural units. There is no evidence in the present study, that with the decline in mining during the 1960s, small households were becoming a characteristic feature of many coalfield parishes, whether as a result of emigration or any other cause.

The discussion of person per room indices shows that high values are again a characteristic primarily of the Northumberland and Durham coalfield units In this case, however, very low values are largely confined to those units of a residential/commuter nature such as are found in the Tyne valley. Elsewhere in the more rural units, person per room levels tend to be low to moderate. The widespread correlation matrix relating to the 1961 person per room variable, confirms the view of earlier workers that such an index has a far-reaching significance through many economic, demographic, social and socio-economic features.

Turning to household type, the main variables relating to owner-occupancy and Local Authority dwellings, reveal clear affiliations, the former with the class 2 high social class/commuter type parishes of section 3.11, the latter with the corresponding industrial/mining class 1 units. The agricultural and rural units on this occasion tend to show quite low values in both cases. A similar categorisation is shown in section 7.5 in the discussion of household facilities, though here there are some surprisingly favourable values in the remoter rural areas.

Another feature on which the rural type units tend to lean towards the socially favoured commuter type is in car ownership. Here, low values are almost exclusive to the coalfield although there is an apparent inverse relationship between unit population size and car ownership within the rural areas. In addition, car ownership diminishes as market towns are approached in the rural areas showing the lessened functional necessity of private transport as population nodes are approached.

The educational and social class variables discussed in the present chapter reveal the unfavourable and unbalanced nature of the coalfield units. Thus, the worst (lowest) values for the terminal education age variable are almost invariably to be found on the coalfield, with even the remoter rural units showing significantly more favourable values. The greatest concentration of the manual social classes is also to be found on the coalfield though the rural units also possess a high proportion of their economically active and retired males in Social Classes IV and V. Conversely, it is hardly surprising in view of the above, that the residential/commuter type parishes show particularly favoured values for the terminal education age variable and the professional and intermediate social class index. As usual, many of the Tyne valley units epitomise such favoured parishes and it is significant that once again the Northumberland coast north of Amble reveals itself to have higher values than the units immediately inland, especially in terms of the educational index.

Perhaps the most interesting of the variables discussed in the present chapter are in the section on socio-economic groupings. Though a similar unit categorisation is shown as in social class, two additional features are worthy of emphasis. First, the discussion of the professional and managerial socio-economic group variables for 1961 and 1966 clearly shows that residential segregation took place between those dates with an increase in extreme values. At the same time there was a decline in the number of rural units that could be said to possess favoured values. Second, despite its otherwise somewhat disappointing lack of apparent significance, the composite index taking the professional, managerial, skilled and supervisory manual socio-economic groups together, demonstrates the overall lack of such people in the rural areas, though it is clear that there is in any case a negative correlation between the professional and managerial segment on the one hand and the skilled and supervisory manual segment on the other.

CHAPTER 8

CONCLUSION

This study of rural populations in North-East England has demonstrated that "The heterogeneity of the rural population is a common phenomenon in advanced economies" (Clarke 1972 p.62). Indeed, if it served no other purpose, Part 1 clearly exemplified the heterogeneity of administratively defined rural populations from four fundamental geographical points of view. As one might expect, clear contrasts emerged between the obviously rural areas covering the west of County Durham and almost the entire area of Northumberland away from the urban dominated south-east corner, and the quasi-urban populations particularly of the coalfield Rural Districts in County Durham.

The classification of individual parishes based upon an integration of the four indices of population density, occupation, situation and land use (see Figure 2.11) is interesting and significant not least because it quantifies rurality from a geographical standpoint. In addition, when the exercise is repeated for an earlier date, a comparison of the quantified values for 1963 and 1967 quite strongly suggests the progressive polarisation of the rural and non-rural extremes.

It was most encouraging to note in Part 2 of the study, when a far broader look at rurality was taken, that a more sophisticated classification based upon multivariate analysis, generally of somewhat larger areal units, possessed a close affinity to the Part 1 classification (see section 3.11). Nevertheless, a basic threefold classification of rural population appeared from the work undertaken in Chapter 3 through the Q and R-mode factor analyses. First, there exists a group of populations which have no claim to rurality other than through their administrative status. Apart from this, they are clearly urban/industrial/mining oriented. With the undoubted importance of mining and its associated social, demographic and economic attributes (it was remarked in section 6.2(ii) that only 32 of the 147 parish units in the 1966 Rural Districts possessed no mining employment), it is perhaps not surprising that the basic dimension of the administratively rural populations in the North-East, whether looked at from the spatial emphasis of a Q-mode analysis or the variable emphasis of the R-mode analysis, turns out to be one in which mining and poor quality housing predominate. Second, there is a group of populations which live in the administratively rural area but which clearly are not a functional part of it. These consist of populations which are situated close to urban areas (hence the inclusion of population potential as a significant constituent of the third factor identified in the Q-mode analysis of section 3.9), are generally of a commuter type and possess the largest proportions of persons of high social class or socio-economic status. Finally, there are the undoubted rural populations in which agriculture has a significant position but which vary from the agricultural near urban parish units of class 3a (section 3.11) to the truly isolated, almost entirely agricultural, parish units of class 3d.

This differentiation, graphically illustrated by Figure 3.12 is further exemplified and strengthened by the succeeding systematic studies of individual variable characteristics. Repetition of the main elements of those studies would add little to previous analysis. Consequently, as an appropriate and meaningful conclusion to this analysis of rural populations, a PL-1 computer programme was written to test the overall significance of each variable discussed in this study in terms of the classification of rural parish units which was undertaken in section 3.11. By means of a comparative analysis of variance within the various classes and between them, it proved possible to test the proportion of an individual variable's variance which was explained through the multivariate classification. Correspondingly it may truly be said that those variables which possess the highest such explanation are the fundamental indices in so far as similarity and difference of rural population in North-East England are here concerned.

It is clear that an analysis of variance being a parametric statistical technique assumes several preconditions, primarily normally distributed data. Equally clearly the distribution of many of the indices commented upon in this study was not normal. In consequence the absolute values and the levels of significance established by the present study cannot be regarded as more than general guides. Nevertheless, the relative positions and importance of the individual indices may be regarded as entirely realistic.

The most diagnostic variables in terms of the classification of section 3.11. are shown in Table 8.1. From this, it is clear that

TABLE 8.1.

Variable Significance in the Classification of Rural Population

Variable	% of variance explained by section 3.11 classification
Agricultural Employment 1966	41.6
Agricultural Employment 1961	39.4
Land under rough grazing and common 1967	37.9
Mining Employment 1961	37.1
Mining Employment 1966	37.0
Primary Employment 1963	36.2
Distance from nearest centre of 24,000 people	34.8
Social Class 1 percentage 1966	33.1
Distance from nearest centre of 7,000 people	30.3
Average size of agricultural holding 1967	29.0
Distance from nearest centre of 70,000 people	25.9
Population Density 1951	24.5
Professional and Managerial SEG percentage 1966	24.1
Population Density 1961	23.5
Professional and Managerial SEG percentage 1961	21.8
Population Density 1967	20.5
Social Class I and II percentage 1966	20.5
Household access to two or more cars 1966	20.1

density, already identified as a prime component of rurality in Section 2.2, has a similarly important role to play in an analysis of the heterogeneity of rural population in North-East England.
The small decline in the significance of density variables between 1951 and 1961, and 1961 and 1967 is noteworthy. It is probable that this reflects the complex interplay between the dynamic and increasing populations of the commuter and urban fringe parishes and those of the already densely populated mining/industrial parishes, and between the declining density of many mining parishes and the

already low rural densities. In both cases the progressive effect between 1951 and 1967 will have been to decrease the differentiation in density contrast between the units comprising the three primary classes (1, 2 and 3) as identified in section 3.11. Nevertheless there is no doubting the importance of density in the context of this classification and, moreover, despite the lessening of its significance over the study period, there is strong evidence presented in sections 4.2 and 4.3(i) of the polarisation of administratively rural units at the two extremes of the density spectrum. There is indeed , disquieting evidence of a hastening of the tide of rural depopulation in some of the remoter rural areas of the North-East during the 1960s.

If density was identified in Part 1 of this work as being a fundamental component of rurality, so too was situation. Though this was looked at in Section 2.5 in terms of population potential, it is not unexpected that this element appears here in the form of distance from population centres of varying sizes. It is however remarkable that the most diagnostic of the three variables involved is the middle-sized one, of distance from the nearest centre of 24,000 people. Its relative importance in Table 8.1 is marked, and situation as such is clearly of the greatest importance in exposing similarities and differences in rural population (at least in the North-East) over a wide span of variables.

Occupational influences are similarly in evidence in Table 8.1. Indeed agricultural and mining employment are clearly of the utmost diagnostic significance in a classification of North-East England rural populations. The premier position of agricultural employment is clear from Table 8.1 and makes obvious the fundamental importance of occupation in this study of ruralpopulations. Similarly, mining employment is a particularly important index in the present study. However, this, unlike agriculture, may be regarded as a factor peculiar to the North-East. Thus whilst agriculture may be expected to be a prime influence in any study of rural population, mining, for the reasons discussed in Section 2.3 is not an integral part of a rural organism. The obvious importance of mining in the present study is clearly related to the existence in the administratively rural areas of the North-East of significant populations, non-rural in character, for whom mining is the occupation of primary importance. Elsewhere too, mining, though relatively unimportant, often managed a sufficiently strong presence to make its influence felt in such a wide ranging study as the present.

Other employment indices are considerably less diagnostic in the overall study and none are to be found in Table 8.1. Indeed, employment in both production and services was found in Chapter 6 to be generally low amongst populations in both the remoter rural areas and the administratively rural coalfield areas. Similarly whilst the journey to work analysis of Section 6.3 was fascinating in its own right, demonstrating the largely self-contained nature of the truly rural units (though inevitably this must in part be a function of unit size) and the mass outmovement to work of the commuter fringe parishes, it does not appear at all to be an important basic index.

Density, occupation and situation were identified as being prime characteristics of rurality in Chapter 2. All three have clearly shown through in the subsequent analysis and, in one form or another in Table 8.1 as primary diagnostic elements in the much more comprehensive study of the various population types. The fourth factor identified in Section 2.4, that of land use, is equally apparent in Table 8.1. In Section 2.4 it was noted that the opinion has been expressed (Wibberley 1960) that the dominant feature of rural areas in many advanced lands is extensive land use. Thus, it is most interesting to find amongst the variables of Table 8.1 two - the percentage of primary land in a parish unit which was under rough grazing or common in 1967, and the average size of agricultural holdings in 1967 - which most obviously represent extensive land use. This is further clear evidence of what was found in Sections 6.4 and 6.5 : the existence of a Von Thünen type effect in the rural North-East in an extensification of agriculture with increasing distance from major urban centres.

There remains only one type of variable in Table 8.1 which has not so far been mentioned. Throughout this study the existence of a commuter type population, which, whilst numerically small and spatially intermittent is nevertheless significant, has been a constant theme. This adventitious element amongst the administratively rural populations quite naturally emerges in Table 8.1 also. It will be remembered from Section 3.11 that the predominant feature of this population type was its favoured social and socio-economic status. Hence the occurrence in Table 8.1 of the variables representing the proportion of economically active and retired males in 1966 defined as belonging to Social Class I, Social Class I and II (though at a noticeably lower level than the former variable despite the far more extensive correlation structure possessed by the latter in Table 7.1) and the professional and managerial socio-economic groups. In addition, the variable representing the proportion of persons possessing household access to two or more cars similarly appears as a diagnostic element, but this will reflect both its significance to Class 2 commuter type parish units and to some of the remoter agricultural rural units where the possession of two or more cars per family appears less as a social commentary than as a functional and even economic necessity.

Possibly one of the most surprising features about Table 8.1, however, is the entire absence from it of any of the demographic indices which were discussed in Chapter 5. Undoubtedly rural areas - particularly those of the remoter Class 3c and 3d type - have a generally unbalanced age structure (though there was an apparent lack of any such evidence when the age structure of the agricultural labour force alone was discussed in section 6.5). Likewise, it may be said that rural fertility is relatively low though the present study used largely unrefined measures without any great account being taken of age structure. Nevertheless, none of these indices either of age structure or of fertility, appears to be significant in terms of Table 8.1. In both cases one may see the example of indices which, whilst important in their own right, have shown themselves to be relatively unimportant as diagnostic parameters. The same may be said of mortality. Indeed, it is remarkable that, of the indices discussed in Chapter 5, the most diagnostic appears to be that of the percentage of 1961 households possessing no family unit, at a mere 4.0 percent. Other variables which appeared to show an extremely clear pattern in that systematic study now seem to be unimportant in a diagnostic sense. Such are the 1966 age indices representing the critical 15-44 (0.3 percent) and 60 plus (1.9 percent) age groups, or the Crude Birth Rate (0.9 percent) or Crude Death Rate (1.5 percent).

In conclusion, therefore, one may point to the complementary nature of Parts 1 and 2 of this study. The main distinguishing features of rural population in the North-East have been agreed - population density, occupation, land use and situation. In addition, the importance of significant groups of adventitious /commuter populations within the administratively rural area is strongly evidenced in Part 2. Overall, therefore, one may stress the undoubted three main population types found in the post-war rural areas of the North-East: the urban-oriented industrial or mining groups predominant over much of County Durham; the remoter more obviously rural populations, and the commuter enclaves found on the periphery of the conurbations and extending down the Tyne corridor. Within each of these types there is variety and the further sub-division of section 3.11 may be attempted. This evolving pattern has further significance in the systematic analysis of individual variables in Chapters 4, 5, 6 and 7. All three population types have their own characteristics in terms of these individual variables. The units of commuter-type populations are quite obviously the most favoured. Those of the other two classes have many problems, on the one hand of unbalanced age structure, remoteness and continued depopulation often with the rural nodes the worst affected, and on the other hand of declining mining employment and a physical environment that leaves much to be desired. It is hoped that this study will have led to a greater appreciation of these characteristics, their significance and of their intercorrelations.

APPENDICES

APPENDIX A

POPULATION ESTIMATES ADOPTED IN PART 1

i) The Estimation of Parish Populations from the Electoral Rolls

The Register of Electors for any one year within an administrative subdivision (here taken at the Civil Parish level) contains the total number of adult residents who are entitled to vote in parliamentary and/or local elections during the operation of the register. The registers are compiled on the 10th of October each year and run for twelve months from the 16th February. Effectively, therefore, if one excludes the extremely insignificant modifications caused by the now defunct business vote and the non-inclusion of certain aliens, the registers for each year contain all persons who will be of voting age (21 in both 1963 and 1967) by 15th June in that year.

Consequently, for an estimate of a total parish population during an intercensal year, the non-institutional population of that parish has been taken and then multiplied by the coefficient obtained in dividing the 1961 Census population enumerated in private households by the 1961 electoral population (less any persons adjudged to have been included in the Census as of other than private household status), with an addition thereafter being made for any institutional population. Such treatment of all non-private household population is necessary for it is apparent that in taking the 1961 electoral population as being representative of the total population over twenty-one years of age, the coefficient derived from it and the 1961 Census is essentially a dependency or age structure ratio. Thus, the occurrence of an old persons' home or children's hospital, for example, will, if ignored, seriously distort the coefficient obtained. In the first case, being included in the electoral register the effect of the old people will be to understate the factor with the obvious consequent effects on estimates for intercensal years when population changes outside the home have occurred. In the latter case, as children are obviously not included on the electoral register, the effect will be entirely the reverse. Therefore, where a parish contains any resident institutional population who are predominantly single, or married without children, account must be taken of this when deriving the coefficient.

The method outlined above may now be clarified by example of three characteristic parishes.

A. Where no population of non-private household status is involved, e.g. Cockfield C.P. in Barnard Castle R.D.

i) 1961 Census population 2,121 entirely enumerated in private households.

ii) 1961 Electoral population 1,473.

The coefficient required to scale up subsequent electoral totals to estimates of total population is 2,121/1,473 or 1.44. A 1967 electoral population of 1,383, therefore, gives an estimated total population of 1,991.

B. Where the 1961 Census population contains persons not of private household status, e.g. Gainford C.P. in Barnard Castle R.D.

i) 1961 Census population of 1,130 of whom 976 were in private households, giving a residual of 154 'institutional' population. The latter were traced to St. Peter's Approved School.

ii) 1961 Electoral population 677 of whom 24 (presumably staff) were resident at the Approved School

The coefficient required to scale up subsequent electoral totals to estimates of total population is 976/653 or 1.49. In 1967, the electoral population was 708 of whom 22 were staff at the Approved School. The equation to estimate the 1967 total population, therefore, becomes (686 x 1.49)+154. The last figure, except as in case 'C' is held as a constant estimate of non-private household population in the years subsequent to 1961 in the absence of there being any better estimate available. It is impossible to differentiate between staff and occupants of any institution, even should this be desirable.

C. Where non-private household population included on the electoral register in some year subsequent to 1961 is of itself larger than that recorded in the 1961 Census, e.g. Great Aycliffe C.P. in Darlington R.D.

i) 1961 Census population 12,868 entirely enumerated in private households.

ii) 1961 Electoral population 7,472

The coefficient required to scale up subsequent electoral totals to estimates of total population is 12,868/7,472 or 1.72. The 1967 electoral population of 10,319, however, included 44 persons in Shafto House Old Persons' Home, which had been opened in March 1963. The estimate of the total 1967 population consequently becomes (1.72 x (10,319 - 44) + 44).

In the very few cases where it is known that an institution closed during the period under consideration as, for example, did the Chilton Hall Hostel in Chilton C.P. of Sedgefield R.D., the intercensal estimates have obviously been amended accordingly.

All parishes with any non-private household population in the 1961 Census, were checked for institutional population when going through the electoral registers to obtain totals for the required years. It is felt that this, together with information obtained from the relevant district level Census tables concerning non-private household population (G.R.O. 1963a and b), and from the Northumberland and Durham Electoral Registration Offices and Health Statistics Departments, has given an adequate coverage of institutions of all types, including those opened post-1961.

However, whilst it has been possible to derive reasonable intercensal parish population estimates partly by laboriously counting the total electoral 'institutional' population for each parish and year required in the study, a further difficulty in this regard should be noted as possibly causing some slight inaccuracies in a few cases. This relates to the question of what precisely constitutes non-private household population for Census purposes. The problem mainly relates to defence establishments and hotels. For the former, local arrangements and security considerations mean that in some circumstances, forces' personnel of a similar type may be classed as non-private household population at one place but as private household population elsewhere. This is especially problematic where the populations of married quarters within the overall confines of a station boundary are concerned[1]. Altogether it was felt to be most realistic and practical if, for the purposes of total population estimation, all forces personnel within camp confines were held to be institutional when dealing with the electoral registers.

With regard to hotels and boarding house , it was frequently difficult to ascertain which hotels specified as residences in the electoral register were guest-taking hotels or inns with, therefore, staff and residents enumerated in the Census as institutional. Fortunately, in no case was the hotel population a large proportion of the 1961 total and the fact that generally any 'double counting' in the electoral register would be confined to the small proportion of that population represented by staff, has meant that this could be regarded in the electoral register as being of little consequence except for obvious cases such as the Percy Hotel at Otterburn where, for instance, nineteen resident persons were included on the 1967 electoral register. In such cases, the normal procedure for dealing with institutional populations was adopted.

Excluding that which is associated with institutional populations, other minor problems do arise in relation to this technique of estimating intercensal population. Thus, insofar as the coefficient is a function ofthe 1961 total population and 1961 population aged 21 and over, subsequent estimates assume a constant proportion here. This is, of course, unlikely to be so but fortunately only in a restricted number of cases will the deviation be at all likely to be more than very slight. Indeed, such cases mainly, if not entirely, consist of parishes which, previously having few inhabitants, saw the rapid advent

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[1] Information from a personal communication with the Office of Population Censuses and Surveys.

of in-migrants to new housing estates between 1961 and 1967. Consequently, in Stockton R.D., it may well be that the coefficient of 1.34 derived for Elton C.P. in 1961 when it had a mere 250 inhabitants is rather low for 1967 when rapid housing estate development attracting mainly young married persons with families had raised the population to over 1,000. However, only in this case and possibly those of Offerton C.P. in Sunderland R.D. and Lambton C.P. in Chester-le-Street R.D., did this occur to any marked extent in the study area between 1961 and 1967. Elsewhere, in parishes experiencing rapid population increase, the age structure in 1961 was already relatively youthful consequent upon previous housing development.

Overall, therefore, it is held that except in a very few restricted cases - either where the nature of a large institutional population contained in the electoral registers is dubious in its comparability with the Census as is the case with some defence establishments or where some of a large institutional population is composed of non-single persons as for example is the case with persons in staff houses situated within the grounds of large hospitals and, therefore, presumably also included in the 1961 Census as non-private households (this did, in fact, prove somewhat problematic with regard to Stannington C.P. in Castle Ward R.D. with its numerically and proportionately large institutional population), or where rapid in-migration began on a large scale, during the intercensal period - this method of estimating parish populations is both valid and of great use, adding to the many similar research uses of the registers (Dickinson 1958, Johnston 1967, House 1966). Certainly it helps to minimise one of the main problems in studying rural population (Jackson 1968).

A comparison of the summed estimates derived from this source with those of the Registrar General (G.R.O. 1969) for the corresponding Rural District areas in 1967, gives the following results:

Rural District	Sum of 1967 Parish Estimates	R.G. 1967 mid-year estimates
NORTHUMBERLAND		
Alnwick	11,763	12,320
Belford	5,311	4,820
Bellingham	5,127	5,120
Castle Ward	33,287	34,820
Glendale	6,583	6,640
Haltwhistle	6,581	6,690
Hexham	20,135	20,470
Morpeth	16,907	17,910
Norham & Islandshires	3,708	3,810
Rothbury	5,370	5,240
DURHAM		
Barnard Castle	16,426	17,520
Chester-le-Street	45,213	45,680
Darlington	29,152	28,990
Durham	37,170	37, 660
Easington	86,821	86,220
Lanchester	14,630	14,900
Sedgefield	35,555	35,170
Stockton	13,598	15,020
Weardale	8,088	8,190

In general it may be seen that the two sources correspond closely. Concerning the few marked deviations one may note several points. Firstly, (and finally insofar as problems of using the electoral registers are concerned), as the Electoral Registers are compiled in the October preceding the year of their operation and contain all persons eligible to vote and aged 21 (prior to the recent lowering of the voting age to 18) and over by 15th June following, the estimates made from them for the mid-year population of a parish obviously assumes no net in-migration or out-migration in the period between compilation and the age qualification date. Where a marked trend of population increase or decrease is in evidence (though note the possible ameliorating influence of the October derived electoral population being divided into the following April Census population), this may well be understated by the electorally derived estimate as compared to that of the Registrar General. Hence the rapid population increase in the parishes of Ponteland and Woolsington in Castle Ward R.D., and Norton and Elton in Stockton R.D. during the period 1961-7 may, in terms of the above well account for the discrepancies in the table.

Secondly, whilst when aggregated to a Rural District level, the estimates of total population derived from the electoral registers may deviate from the actual totals to some extent, this is equally true of the Registrar General's mid-year estimates, which especially towards the end of an intercensal period may be significantly inaccurate in some cases. For example, it may well be that the 16,426 estimate of the 1967 population for Barnard Castle R.D. from the electoral registers is substantially more accurate than the official 17,520 especially when viewed in terms of a 1961 Census population of 17,027 and a 1971 preliminary Census figure of 15,892.

ii) <u>Modifications of mid-1967 Urban Population Estimates</u>

To correspond with the areas to which the 1967 June Returns of the Ministry of Agriculture relate, it was necessary to discount the effects of the April 1967 boundary changes with reference to Civil Parishes and urban administrative areas. The former was particularly simple insofar as the number of electors within the pre-existing parish area was available and the normal procedure for estimating total population could be followed. However, where the Registrar General's mid-year estimates of population were used for urban areas modifications were made if 1967 boundary changes necessitated this, by one of two methods.

First, where Rural District population was involved in the transfer, as the electoral population involved was known, it was a relatively simple matter to estimate the total population concerned and deduct it from the estimate for the urban area, thereafter reallocating it to the parish of origin. Thus, Houghton-le-Spring U.D. gained the following totals from Sunderland R.D. in 1967.

a) From Ford C.P. 4 electors, multiplied by the respective coefficient to give a total estimate of 6 persons.

b) From Herrington C.P. 76 electors, multiplied by the respective coefficient to give a total estimate of 107 persons.

c) From Offerton C.P. 74 electors multiplied by the respective coefficient to give a total estimate of 98 persons.

Therefore, in total it is estimated that 211 persons were transferred from Sunderland R.D. to Houghton-le-Spring U.D. This total was then deducted from the 1967 mid-year estimate of 31,550 for the latter to give a revised total of 31,339 relating to the pre-boundary change area.

Second, where the boundary changes and population transfers merely concerned urban areas, the following procedure for reallocation was used. As the Registrar General in specifying boundary changes, gives details of the population in 1961 of the areas involved, it is possible to derive figures for the post-boundary change area in terms of the 1961 Census. The percentage increase or decrease in this revised area between 1961 and 1967 may then be estimated and the 1961 population involved in the transfer increased or decreased accordingly. For Boldon U.D. the 1967 mid-year population estimate was 24,790 though, in addition, an area which contained 1142 persons in 1961 had been transferred from the district in consequence of the April boundary changes of that year. Therefore, the 1961 population in the post-April 1967 area was 21,264 (22,406 less 1,142). Assuming that the area containing the 1,142 transferees was characteristic of the whole Urban District, an estimate of the total actually transferred in 1967 may be made from the equation:

$$\text{1967 population transferred} = \text{1961 population of transferred area} \times \frac{\text{mid-1967 population}}{\text{1961 population outside transferred area.}}$$

Here this is $\frac{24,790 \times 1,142}{21,264}$ giving an estimate of 1,332.

The population estimates may then be amended accordingly to refer to the area as constituted before the boundary changes occurred. Though the conditions postulated may not hold entirely and population in such transferred areas may have grown at more or less than the total district rate between 1961 and 1967, any deviation is likely to be of such small consequence especially bearing in mind the overall totals involved, that the estimate of 1967 density and subsequently, primary employment and population potential, are only insignificantly affected.

A similar procedure to the above was adopted with regard to Hartlepools C.B. Here, separate population estimates for the two constituent parts (West Hartlepool C.B. and Hartlepool M.B.) were required for 1967. Consequently, the 1967 mid-year estimate for the total area was taken and divided according to the 1966 proportions possessed by the then separate parts.

APPENDIX B

1 R-MODE FACTOR ANALYSIS : TABLE OF VARIMAX FACTOR MATRIX

Variable Number in Table 3.2	Commun-ality	FACTORS 1	2	3	4	5
1	0.9669	0.5349	-0.0186	0.0917	0.0594	0.0093
2	0.9785	0.5096	-0.0413	0.1354	0.0586	0.0076
3	0.9062	0.3625	0.1365	0.4402	0.1168	0.0206
4	0.9649	0.5887	0.3533	0.5254	0.1695	0.0631
5	0.9302	0.5338	0.3016	0.4659	0.1540	0.0340
6	0.8676	0.4830	0.3282	0.5303	0.1539	0.1115
7	0.9686	0.6099	0.4176	0.4925	0.1644	0.1565
8	0.9041	0.7695	0.3988	0.2314	0.1372	0.0684
9	0.9400	0.3759	0.3625	0.6234	0.1590	0.2023
10	0.9318	0.2975	0.8393	0.2017	0.0889	0.1350
11	0.9645	0.2697	0.8752	0.2006	0.0514	0.0464
12	0.9740	0.3651	0.8374	0.2472	0.0803	0.0587
13	0.9352	0.4605	0.7163	0.3523	0.1661	0.1264
14	0.9666	0.7565	0.1295	0.4535	0.2096	0.0250
15	0.9977	0.6769	0.4638	0.4733	0.2123	0.0863
16	0.9768	0.7032	0.4108	0.4416	0.1698	0.1069
17	0.9851	0.6775	0.4285	0.4665	0.2129	0.1045
18	0.9597	0.6568	0.4843	0.4707	0.2275	0.0534
19	0.9581	0.6078	0.5584	0.4526	0.2140	0.0442
20	0.9737	0.6660	0.5027	0.4464	0.1806	0.0770
21	0.9957	0.6684	0.4706	0.4927	0.1954	0.0583
22	0.9644	0.6664	0.3968	0.4558	0.1715	0.1502
23	0.9304	0.6895	0.4262	0.3988	0.1373	0.1431
24	0.9644	0.6938	0.4650	0.4187	0.1687	0.0950
25	0.9578	0.6840	0.5140	0.4145	0.1651	0.0519
26	0.9965	0.6643	0.4919	0.4756	0.2088	0.0822
27	0.9479	0.7455	0.3247	0.4188	0.1764	0.0674
28	0.9914	0.6846	0.4552	0.4685	0.2042	0.0817
29	0.9882	0.6066	0.4770	0.4597	0.2139	0.0913
30	0.8105	0.3233	0.2488	0.6423	0.0963	0.4573
31	0.9290	0.6103	0.5480	0.4624	0.1570	0.0513
32	0.9923	0.6789	0.4470	0.4685	0.2183	0.0915
33	0.7876	0.7078	0.2611	0.1178	0.1701	0.0601
34	0.9585	0.6343	0.5248	0.4760	0.1714	0.0443
35	0.9551	0.1589	0.8281	0.3250	0.1529	0.0302
36	0.9796	0.6593	0.4658	0.4805	0.2033	0.0668
37	0.9460	0.1466	0.8680	0.2834	0.0964	0.0223
38	0.8668	0.8741	0.0540	0.0065	0.2329	0.0177
39	0.9174	0.7192	0.1591	0.4405	0.1824	0.0497
40	0.9619	0.5661	0.4491	0.5895	0.1903	0.1339
41	0.9605	0.0853	0.1657	0.1831	0.0773	0.9395
42	0.8659	0.7088	0.2669	0.1841	0.1296	0.0288
43	0.8047	0.7009	0.2825	0.2752	0.1352	-0.0165
44	0.9890	0.7041	0.4148	0.4483	0.1966	0.1112
45	0.9608	0.7625	0.1947	0.5067	0.1738	0.0459
46	0.9967	0.2838	0.1342	0.1363	0.9344	0.0321
47	0.9900	0.5403	0.1812	0.3225	0.7320	0.0430
48	0.9906	0.3751	0.3756	0.2222	0.8012	0.0690
49	0.9757	0.6141	0.5855	0.4220	0.2054	0.0795
50	0.9767	0.7256	0.2548	0.5228	0.2157	0.0724

Variable Number in Table 3.2	FACTORS				
	6	7	8	9	10
1	-0.0103	0.8174	0.0052	-0.0044	-0.0073
2	0.1352	0.8226	-0.0009	0.0041	0.0162
3	0.7317	0.1082	0.0188	0.0295	0.0070
4	0.4159	0.1013	0.0352	-0.0008	0.0175
5	0.5539	0.0615	0.0331	-0.0238	0.0051
6	0.4364	0.0894	-0.0734	0.0023	0.0734
7	0.3365	0.1139	0.0299	-0.0328	0.0061
8	0.1428	0.2007	0.0644	0.0946	-0.0448
9	0.4385	0.0234	-0.0035	-0.1317	0.0468
10	0.0944	-0.0008	0.2134	0.1301	0.0245
11	0.0941	0.0291	-0.1648	0.2084	0.0210
12	0.0751	0.0010	-0.1569	0.1905	0.0422
13	0.1313	0.0254	-0.0809	0.1322	0.0209
14	0.1949	0.2718	0.0450	-0.1126	0.0285
15	0.1711	0.1256	0.0296	-0.0204	0.0387
16	0.2298	0.1285	0.0371	-0.0659	0.0574
17	0.2153	0.1410	0.0201	-0.0346	0.0269
18	0.0841	0.0979	0.0060	-0.0172	0.0249
19	0.0387	0.1062	0.0630	0.0676	0.0544
20	0.1345	0.1140	0.0620	0.0051	0.0692
21	0.1557	0.1297	0.0217	0.0089	0.0398
22	0.2721	0.1493	0.0386	-0.0495	0.0530
23	0.2267	0.1015	0.0631	-0.0811	0.0521
24	0.1713	0.1053	0.0460	-0.0674	0.0831
25	0.0323	0.1151	0.0700	0.0501	0.0466
26	0.1412	0.1186	0.0291	-0.0150	0.0392
27	0.2279	0.1354	0.0345	-0.0516	0.0396
28	0.1745	0.1258	0.0367	0.0002	0.0101
29	0.1663	0.1231	0.0175	-0.0600	0.0647
30	0.0620	0.0227	-0.0790	-0.0444	-0.0235
31	0.0412	0.0963	0.0168	0.0144	0.0605
32	0.1889	0.1295	0.0371	-0.0205	0.0425
33	0.0398	0.1266	-0.1352	-0.2418	-0.2787
34	0.0329	0.1109	0.0678	0.0668	0.0183
35	0.0762	-0.0525	0.0110	-0.3242	0.0176
36	0.1790	0.1189	0.0405	-0.0250	0.0537
37	0.0528	-0.0309	0.0002	-0.2767	0.0265
38	0.0009	0.1530	0.0002	0.1011	-0.1072
39	0.2968	0.2022	0.1139	0.0044	0.0553
40	0.1383	0.0951	-0.0055	0.0528	0.0841
41	0.0444	0.0222	0.0264	-0.0047	0.0209
42	0.0644	0.0642	-0.0266	-0.0182	0.4811
43	0.0852	0.0974	0.0278	-0.0211	0.3484
44	0.2081	0.1510	0.0303	-0.0182	0.0415
45	0.1921	0.1120	0.0158	-0.0415	0.0303
46	0.0571	0.0422	0.0006	-0.0093	0.0184
47	0.1261	0.0797	0.0075	-0.0251	0.0264
48	0.0763	0.0758	0.0165	-0.0016	0.0310
49	0.1435	0.0264	-0.0357	-0.0681	0.0433
50	0.1593	0.1602	-0.0837	-0.0126	0.0437

Variable Number in Table 3.2	Communality	FACTORS				
		1	2	3	4	5
51	0.9342	0.5528	0.5934	0.3413	0.1881	0.0533
52	0.9305	0.1712	0.8018	0.0531	0.0654	0.0284
53	0.8930	0.3419	0.8122	0.1817	0.1407	0.0931
54	0.9681	0.6538	0.5070	0.4473	0.1788	0.0747
55	0.8166	0.5839	0.1275	0.5278	0.1478	0.0387
56	0.9949	0.6996	0.4435	0.4460	0.2210	0.0972
57	0.9942	0.7336	0.4310	0.4046	0.2090	0.0883
58	0.8748	0.7284	0.4712	0.2252	0.1827	0.0800
59	0.9932	0.6921	0.4662	0.4567	0.1906	0.0745
60	0.9243	0.5134	0.2638	0.7200	0.1174	0.0495
61	0.8729	0.8008	0.1489	0.1408	0.1645	0.0220
62	0.9811	0.6000	0.4949	0.5033	0.2083	0.0840
63	0.9811	0.6483	0.5025	0.4872	0.1960	0.0626
64	0.8733	0.6898	0.4390	0.3025	0.1435	0.0966
65	0.9509	0.4952	0.5310	0.5892	0.2146	0.0919
66	0.8958	0.8095	0.3732	0.1926	0.1499	0.0811
67	0.9662	0.5357	0.5353	0.5455	0.1858	0.0987
68	0.8913	0.2460	0.5917	0.6232	0.1349	0.0851
69	0.9354	0.3301	0.4550	0.7448	0.1603	0.1387
70	0.8370	0.1982	0.1527	0.8583	0.0558	0.0458
71	0.9868	0.6360	0.3754	0.5854	0.2048	0.0783
72	0.9481	0.2689	0.4238	0.8137	0.1168	0.0381
73	0.9630	0.7768	0.3634	0.3519	0.2208	0.0406
74	0.9838	0.6609	0.4131	0.5407	0.2019	0.0429
	Variance	35.620	21.518	19.767	5.555	2.108
	Cum. Var	35.620	57.138	76.905	82.460	84.568

Variable Number in Table 3.2	FACTORS				
	6	7	8	9	10
51	0.1828	-0.0065	-0.2696	-0.0752	0.0997
52	0.1030	0.0402	0.4877	-0.0116	0.0157
53	0.1996	0.0197	-0.0355	-0.0994	0.0591
54	0.1754	0.1152	-0.0247	-0.0148	0.0337
55	0.2511	0.2643	-0.1570	-0.0013	0.0002
56	0.1735	0.1326	0.0212	-0.0425	0.0393
57	0.1767	0.1463	0.0158	-0.0269	0.0392
58	0.0939	0.1026	-0.0492	-0.0994	-0.0033
59	0.1675	0.1295	0.0341	-0.0166	0.0133
60	0.1245	0.0503	0.1909	0.0437	-0.0128
61	0.2363	0.2804	-0.0853	0.1056	0.0960
62	0.2228	0.1369	-0.0183	-0.0042	0.0610
63	0.1100	0.1130	0.0447	0.0308	0.0276
64	0.1462	0.1139	0.0031	-0.2028	0.0883
65	0.0794	0.0694	0.0827	0.0541	0.0348
66	0.1084	0.1297	0.0248	-0.0586	0.0491
67	0.1990	0.0682	0.0656	-0.0288	0.0384
68	0.0459	-0.0180	-0.0420	-0.2491	0.0216
69	0.1108	0.0570	0.0352	-0.0543	0.0128
70	0.1369	0.0751	-0.0426	0.0567	0.0557
71	0.1776	0.1061	0.0770	0.0001	0.0433
72	0.1175	0.0389	-0.0123	-0.0589	0.0036
73	0.1595	0.1171	0.1179	0.0185	0.0004
74	0.1574	0.0991	0.0818	-0.0070	0.0016
	4,144	3,129	0.857	0.840	0.775
	88,712	91,841	92,698	93.538	94,313

2 R-MODE FACTOR ANALYSIS : TABLE OF FACTOR SCORE MATRIX

Unit Number in Table 3.1	FACTORS				
	1	2	3	4	5
1	2.1695	-0.2359	-0.6692	-0.1648	0.1741
2	0.4214	0.1453	-0.1170	-0.1048	-0.1636
3	-0.0306	-0.4050	2.5026	-0.2123	-0.5308
4	1.2992	-0.3879	-0.1704	0.8961	-0.1157
5	0.9393	-0.1617	0.1049	-0.4153	-0.2539
6	0.8963	-0.1413	-0.1828	0.0558	0.0996
7	1.1238	-0.1847	0.9591	-0.2623	-0.3280
8	1.9903	-0.4012	0.0733	0.3189	0.2935
9	1.3026	-0.0198	-0.1508	-0.1094	-0.2437
10	1.6495	-0.1617	0.0386	-0.0519	-0.1894
11	1.5017	-0.0799	-0.0560	-0.0586	0.1093
12	1.8250	-0.0914	0.1015	-0.4307	-0.3780
13	1.3830	-0.2034	0.1819	0.1156	-0.2307
14	1.1155	-0.3757	0.5767	-0.2443	-0.1726
15	1.5470	-0.1992	0.3160	-0.0830	-0.4647
16	0.8629	-0.2650	0.6290	0.0447	0.0615
17	0.8943	-0.3807	0.9525	0.3409	-0.1419
18	0.4210	-0.1321	0.1335	1.0598	-0.0887
19	0.9888	-0.2982	0.5241	1.2833	-0.2919
20	1.9638	-0.1096	-0.0216	-0.3821	-0.1053
21	0.5326	-0.6709	1.2557	-0.2430	-0.4155
22	1.0981	-0.1053	-0.0347	-0.2263	-0.1160
23	2.2773	-0.0550	-0.4328	-0.5172	-0.2041
24	0.9532	-0.0054	0.1728	-0.1431	-0.0176
25	2.3456	-0.2893	-0.3427	-0.4434	-0.1464
26	1.7368	-0.2045	-0.1049	-0.3110	-0.2063
27	1.0795	0.0020	-0.0210	0.3766	-0.1517
28	0.8413	-0.1460	0.6799	0.5718	0.0671
29	0.3252	-0.4210	1.3340	0.4241	0.0317
30	1.3621	0.0248	0.1133	-0.2438	-0.0755
31	2.0372	0.0061	-0.4600	-0.4541	-0.0241
32	1.6494	-0.0285	-0.3974	-0.2429	-0.0004
33	1.1807	-0.3178	-0.3393	-0.1429	0.1946
34	1.6315	-0.1906	0.1606	-0.0274	0.0360
35	1.3210	-0.0080	-0.0269	-0.0501	-0.0884
36	1.4788	0.0362	-0.1603	0.0218	-0.1761
37	1.3735	-0.1292	-0.6305	1.8190	0.0043
38	1.5768	0.0339	-0.1677	0.0737	-0.1423
39	-0.1813	-0.3255	2.9741	0.3552	0.2435
40	1.0621	0.0376	0.3959	0.0083	0.8260
41	1.6123	-0.1047	-0.0544	-0.1881	0.1410
42	0.9855	-0.0031	-0.8432	3.9603	-0.4373
43	1.6289	-0.0889	-0.0164	-0.3513	-0.2096
44	1.8144	-0.0924	-0.4650	-0.1636	0.1764
45	1.0555	-0.0185	0.1893	0.7182	0.0416
46	1.3199	-0.0385	-0.2059	1.0677	-0.1873
47	1.0444	-0.0286	0.3044	-0.1289	-0.2211
48	1.4449	-0.0693	0.0477	-0.2639	-0.1458
49	1.2245	-0.0105	0.6921	-0.2615	0.3158
50	-0.1597	0.4012	1.5736	1.3804	-0.5142

Unit Number in Table 3.1	FACTORS				
	6	7	8	9	10
1	0.1996	0.3730	0.1299	-1.2129	-1.5925
2	-0.0970	5.6240	0.1222	-0.9782	1.0385
3	1.1888	0.0206	-0.3842	0.3548	-0.3299
4	0.7183	0.6317	0.1092	0.4824	-0.3060
5	-0.0179	4.6159	-0.7417	-0.8952	-0.3142
6	-0.1202	4.2736	-0.4848	-0.7174	0.4856
7	-0.0909	-0.6320	0.1496	-1.1064	-0.2973
8	-0.5078	-1.1944	0.4360	-1.4992	-1.1496
9	-0.3234	2.7076	-0.4026	0.3121	-0.8753
10	-0.4233	0.4766	-0.1646	0.4777	-0.8351
11	-0.0655	0.0266	0.3046	0.5446	-0.3570
12	-0.5070	-0.6462	0.2830	0.1859	2.8784
13	0.1316	-0.2355	0.0075	0.2889	1.6231
14	1.1225	-0.1414	-0.3763	-0.1193	1.0729
15	-0.4693	-0.1469	0.3312	0.0444	-0.6061
16	1.3288	-0.0094	0.2719	0.1473	0.6912
17	0.2276	-0.2129	0.7583	-0.0541	-0.2608
18	-0.1457	3.9566	0.6347	-0.6534	0.0709
19	0.2119	-0.3396	0.0831	0.2105	-0.5747
20	-0.4651	-0.6477	-0.0427	-1.1389	-1.0212
21	2.9807	0.5062	-0.8177	-0.1239	-0.5424
22	0.1807	2.6607	0.5892	-0.2534	-0.3615
23	-0.2115	-0.8820	0.1854	-0.7885	-0.2663
24	-0.4696	2.1376	1.2771	0.4629	0.9281
25	-0.3783	-0.7304	-1.3533	-2.0930	2.3315
26	0.4959	-0.5536	-0.1364	-0.2051	1.1571
27	0.1575	0.7708	0.1297	0.7391	0.9525
28	0.0064	-0.0304	0.2547	0.2549	0.2840
29	0.9656	0.7034	0.6015	0.0371	-0.0443
30	-0.0765	0.4457	0.0186	0.5505	0.0982
31	0.1699	-0.7200	-0.3010	-0.6431	-0.6206
32	-0.0921	1.2150	-0.2201	-0.1243	-0.3393
33	2.4645	0.9562	-0.4394	-0.0829	0.9015
34	-0.5817	0.3948	0.0641	0.4227	-1.0020
35	-0.3274	1.9792	-0.5325	0.3122	-0.6524
36	-0.1198	0.5479	-0.0155	0.8816	-0.0377
37	-0.3648	1.2152	-0.1586	0.1399	0.1326
38	0.0762	-0.2051	-0.1494	0.3356	-0.7255
39	-0.8851	-0.0228	-0.3855	0.2270	0.0667
40	0.0652	-0.6592	-0.0087	-0.2421	0.6849
41	-0.4703	1.0091	-0.0386	0.1618	-0.5445
42	0.1418	-0.4592	-1.3086	0.7032	-0.4112
43	-0.1851	-0.3407	0.7567	-0.1580	0.9336
44	-0.0313	0.1731	-0.3022	0.1048	1.1067
45	0.3147	-0.1232	-0.3303	1.2934	-1.4209
46	0.1831	0.1830	-0.1328	0.9048	-1.2110
47	-0.2808	1.9073	0.1022	0.5472	-0.1739
48	0.0296	0.4333	0.0121	0.1663	-0.5120
49	-0.1864	-0.3859	-0.1706	0.8833	-1.1464
50	-0.4087	-0.0957	-0.1465	-1.6714	-0.0942

Unit Number in Table 3.1	FACTORS				
	1	2	3	4	5
51	0.3161	-0.1192	1.0683	1.3594	-0.1178
52	0.4896	0.4416	0.9007	0.0096	-0.4677
53	-0.5696	-0.2418	-0.3765	8.9110	-0.6944
54	1.7233	-0.1963	0.1320	0.0519	-0.1086
55	-0.3993	-0.6337	2.0962	-0.2506	-0.6478
56	0.1091	-0.3366	2.0199	-0.1278	0.6940
57	-0.1058	-0.5176	1.8194	0.7304	1.6831
58	0.3923	0.4533	0.7424	0.2676	-0.0439
59	-0.3800	-0.4848	1.5034	0.6427	7.1413
60	1.0224	0.0550	0.0713	-0.0940	1.0691
61	0.2526	-0.2566	2.2250	-0.1792	0.1438
62	0.1892	0.3320	1.4682	0.8914	-0.4617
63	0.9887	0.2141	1.3792	-0.2008	0.3118
64	-0.0501	-0.3542	0.0285	0.7018	0.0489
65	0.4955	-0.1120	1.2769	0.6715	-0.4535
66	1.2950	-0.1739	0.7671	-0.2500	-0.2919
67	0.3400	0.7365	0.7874	-0.0091	-0.5884
68	0.5282	0.3289	0.8840	-0.0786	0.4494
69	0.3608	0.4748	0.2683	0.2302	3.4014
70	0.7456	0.3300	0.8910	-0.1420	0.2212
71	1.2053	0.3118	0.1435	-0.3618	-0.0184
72	1.3277	-0.0739	0.3768	-0.2588	0.4683
73	0.8646	0.4937	0.6063	-0.2178	-0.4538
74	0.0415	1.0390	1.0018	-0.0583	0.9133
75	0.4857	1.5104	-0.0881	-0.2107	0.0240
76	0.5415	1.3246	-0.0646	-0.0916	-0.2103
77	0.4467	0.7896	0.5056	0.2054	-0.0908
78	1.5880	0.2910	-0.1819	-0.2071	-0.3536
79	1.3580	-0.1311	0.4652	-0.2122	-0.0786
80	1.8501	-0.0914	-0.7961	0.9098	-0.0006
81	0.8726	-0.0154	0.8238	0.2197	-0.3312
82	0.7185	-0.1041	1.0983	0.1323	-0.4083
83	0.2972	1.2692	0.2276	0.5641	-0.4005
84	0.0464	1.4761	0.7152	-0.0066	-0.5353
85	0.1405	1.1830	1.2865	-0.2659	-0.6246
86	-0.7222	1.9998	0.0072	1.4368	-0.4218
87	1.0241	1.3886	-0.4067	-0.3388	-0.1851
88	0.7837	1.0109	-0.0882	-0.1842	-0.0729
89	0.3984	1.3995	0.0511	0.8470	-0.3110
90	0.4983	1.0352	0.5413	-0.2036	-0.3319
91	1.1993	0.9325	-0.4333	-0.1362	0.1771
92	-0.1940	0.9925	1.5980	0.1264	-0.7240
93	0.7482	0.2861	0.6204	0.4475	0.0001
94	0.1125	0.3042	1.9252	-0.0597	-0.2705
95	-0.5564	0.5267	2.5469	0.2082	-0.3650
96	-0.2880	-0.0854	3.1079	0.1058	-0.4741
97	0.4990	-0.0559	1.3092	-0.0685	0.1992
98	-0.2481	-0.3610	3.0549	-0.1145	-0.2383
99	0.0024	-0.2164	2.2297	-0.1550	-0.2543
100	0.0622	0.6397	0.6895	0.1932	3.2638

Unit Number in Table 3.1	FACTORS				
	6	7	8	9	10
51	-0.4860	-0.0287	0.3008	0.7989	4.2287
52	0.3573	-0.3821	0.0933	-2.0179	-0.4043
53	-0.4566	0.0011	0.4752	0.4562	-0.1589
54	-0.1301	-0.9206	0.6884	-0.9146	-0.8807
55	5.4596	-0.7643	0.9576	0.4529	-0.9462
56	-0.1320	0.5756	0.1540	0.7315	0.0686
57	1.2534	0.3414	0.4051	0.2410	-0.0637
58	0.2813	-0.2985	0.1252	-0.9973	0.4317
59	-0.2008	0.3353	0.3356	0.1923	0.3233
60	0.4134	-0.5342	-0.0733	-1.0746	1.5514
61	-0.4602	-0.2041	0.1448	0.3387	1.4530
62	-0.2838	-0.2959	-0.3499	-1.1637	-1.2571
63	-1.1059	-0.7182	-0.2366	-2.0121	-2.5060
64	5.0830	1.2403	-0.0387	0.9016	0.2290
65	0.2720	-0.5054	0.5927	-0.3326	-0.3257
66	-0.2138	-0.7508	0.7770	0.1340	0.5089
67	-0.1991	-0.1936	-0.0624	-1.3916	0.3433
68	0.1757	-0.1773	-0.5972	-0.3026	-0.8200
69	0.3840	-0.2972	0.1005	-0.8448	1.6121
70	-0.3024	-0.3363	0.0936	0.7533	-0.1371
71	-0.0234	0.0021	2.2737	0.4777	-0.2296
72	-0.1357	-0.6437	0.7675	0.3434	0.6547
73	-0.4617	-0.4232	1.2260	0.4898	0.4338
74	-0.2878	-0.1236	0.9718	-1.3868	-0.7528
75	0.0234	-0.2069	2.9681	1.4897	0.0359
76	0.0865	-0.2234	2.7952	0.9231	0.6008
77	-0.1611	-0.1974	1.5940	0.2138	0.7225
78	-0.1037	-0.7839	0.5716	-0.6098	0.6845
79	-0.3696	0.4634	-0.1478	0.1470	-0.5885
80	0.1638	-0.6602	-0.1680	-0.1800	1.2415
81	0.2228	-0.4926	0.6373	-0.3859	0.0185
82	0.2876	-0.4900	1.3136	0.5947	0.7940
83	-0.3071	-0.0970	0.9454	-3.5643	-0.1150
84	-0.6689	0.0284	1.6603	-1.6985	1.3384
85	-0.7970	-0.0861	0.9211	0.9380	0.2882
86	0.6769	0.3922	1.8084	-0.5807	0.1032
87	0.3343	-0.6451	2.5508	0.4637	-0.4740
88	0.0028	0.2022	2.0584	2.0198	0.1759
89	-0.0135	-0.2398	1.8265	1.2026	-2.0378
90	0.1571	-0.2989	0.3922	0.5397	-0.7179
91	0.1222	-0.6775	0.1464	-0.2259	2.1947
92	-0.4395	0.0369	-0.4261	-0.2355	-0.3638
93	-0.3284	-0.4919	0.0358	-0.0734	2.5185
94	-0.5062	-0.0320	-0.2375	0.9011	0.0867
95	-0.7567	0.1708	-0.4309	-0.0138	0.0110
96	-0.7999	0.0980	-0.2730	0.6075	-0.8359
97	0.2405	-0.3688	0.1282	-0.3037	1.5797
98	-0.5954	0.8867	-0.2438	0.6596	-0.4400
99	1.0739	-0.3277	-0.0166	-0.4229	-1.0097
100	-0.1385	0.0003	-0.3438	-1.4038	-0.1684

Unit Number in Table 3.1	FACTORS				
	1	2	3	4	5
101	-0.3164	-0.3435	2.9396	0.2095	-0.3430
102	0.5206	-0.6886	0.0988	-0.2506	-0.3277
103	1.3413	-0.3755	0.3418	0.0907	0.0911
104	-0.8546	-0.7451	4.0766	-0.1865	-0.3400
105	1.4479	0.0026	-0.1792	0.1869	0.2516
106	0.0956	0.5205	0.2627	1.3307	-0.1676
107	0.2842	1.2185	0.7319	-0.1046	-0.6382
108	0.1657	1.7640	-0.0112	0.0949	-0.1735
109	0.0265	1.9333	0.0435	-0.0721	-0.3139
110	-0.7546	2.9204	-0.5624	-0.0907	-0.1390
111	0.5397	1.7075	-0.1725	-0.3707	-0.0347
112	-0.1296	2.0865	-0.6371	0.2579	3.3422
113	-0.1994	1.5718	0.6087	-0.1242	-0.1143
114	0.2886	0.6067	1.4358	0.0772	-0.4205
115	1.9088	0.0907	-0.6022	-0.1724	0.3213
116	-0.6496	0.4612	0.9124	3.4830	-0.6091
117	1.3903	-0.1555	-0.5769	2.8079	0.0164
118	1.8013	0.0730	-0.3182	-0.3399	0.4047
119	-0.0328	1.2991	0.9167	-0.1257	-0.2003
120	0.6764	0.5797	0.0004	1.8145	0.1908
121	1.3093	0.2268	-0.4339	-0.2804	2.7183
122	1.4503	0.3603	-0.0820	0.5731	0.7038
123	0.6581	0.7977	0.1729	0.7663	0.0929
124	0.2264	1.3393	0.8459	-0.2768	-0.4800
125	0.3213	0.7213	1.1439	-0.1558	0.3247
126	-0.3054	1.9892	0.5643	-0.1467	-0.2342
127	-0.8307	3.1820	-0.6963	-0.0060	1.5049
128	-0.5052	2.8766	-0.5834	0.2399	-0.3240
129	0.0246	1.6682	0.4492	-0.0748	-0.3508
130	0.3755	1.6142	0.1027	0.0500	-0.4084
131	1.3896	0.4427	-0.5182	0.4917	-0.0167
132	0.2803	0.5491	1.4634	-0.1169	0.0901
133	0.4956	0.5172	1.3470	-0.2445	0.6722
134	0.1896	0.6301	0.1091	0.4889	5.7210
135	0.5198	1.1991	0.5651	-0.2819	0.1859
136	-0.0322	1.7835	0.2997	-0.1628	0.6935
137	0.7362	1.3246	0.3402	-0.3711	-0.4298
138	-0.1237	2.0299	-0.1144	0.3257	-0.4529
139	0.5952	1.4223	0.4628	-0.2200	-0.4250
140	-0.1150	2.9798	-0.3408	-0.2855	-0.4761
141	0.3678	1.5717	0.2221	-0.2251	-0.0939
142	-0.5650	3.2393	-0.7338	0.1599	-0.5142
143	0.6180	2.1845	-0.5016	-0.3404	-0.3404
144	0.0803	2.1648	0.1752	-0.2374	-0.4877
145	0.0063	1.9236	0.7505	-0.2106	-0.2270
146	0.0339	1.8856	0.4169	-0.2050	-0.6234
147	0.3612	1.7542	0.3819	-0.2448	0.0875

Unit Number in Table 3.1	FACTORS				
	6	7	8	9	10
101	-0.0737	-0.0576	0.0172	-0.2861	-0.1563
102	6.8070	-0.7024	-0.5150	-0.6868	0.0562
103	0.3901	-0.0849	-0.3397	-0.6899	0.0674
104	-0.2104	1.2368	0.5852	0.2853	-0.1296
105	0.6801	-0.5670	-0.7736	-0.3582	0.1928
106	0.6800	-0.1257	-1.0204	-0.9443	2.5498
107	-0.4894	-0.1424	-0.6307	-2.5438	-0.1383
108	0.0904	-0.0168	1.0632	-0.6798	-0.4416
109	0.3133	0.0872	1.7166	-0.1915	-0.8517
110	1.1217	0.7157	1.8428	-1.0210	0.5634
111	0.3821	-0.1079	1.5628	0.7492	-0.7952
112	0.6548	0.2424	1.8596	0.2739	-1.2103
113	-0.0139	0.1256	0.1155	-1.2048	1.2736
114	-0.6614	-0.2210	-0.9927	-2.2397	-0.7302
115	0.2043	-0.0425	-0.6520	-0.3040	-1.0834
116	0.4198	0.0432	-0.3866	-0.6377	-0.1949
117	-0.3092	-0.5664	-0.2354	0.3754	-1.0188
118	0.1164	-0.8191	-0.0555	0.2895	-0.2890
119	-0.2009	-0.0571	-0.3021	-2.3948	-0.0166
120	0.2427	-0.6780	-0.0560	-0.4159	0.8345
121	0.3749	-0.3678	-0.4215	0.6271	0.0502
122	-0.1883	-0.9897	-1.0173	0.3031	-1.6506
123	-0.0591	-0.3791	-0.1058	1.2189	-0.2125
124	-0.4693	-0.0865	0.6023	-0.4007	0.8383
125	-0.9749	0.7350	0.3737	2.7574	0.4311
126	-0.0239	0.2980	0.3512	0.0102	0.1530
127	0.9391	0.7183	2.0877	-0.0932	-0.6272
128	1.0320	0.4225	-0.2076	-1.4730	1.1285
129	0.2903	-0.0237	-0.8120	-0.8810	-0.4355
130	0.1053	-0.2084	-0.9202	-1.1243	-1.1299
131	0.4883	-0.6894	-1.0439	0.8821	-0.0151
132	-0.1177	-0.2529	-0.2648	0.8797	-0.6854
133	-0.7132	-0.2788	-0.7526	0.9160	1.2190
134	-0.1487	-0.0618	-1.8672	-0.0911	-0.4943
135	-0.0701	-0.2924	-1.3482	0.8049	-0.4016
136	0.1855	-0.0451	-1.3252	0.1876	0.9717
137	-0.1969	0.0193	-0.7999	2.3420	-1.0931
138	0.5229	0.0541	-1.6852	0.5843	3.0475
139	-0.3008	-0.3431	-0.5617	3.2495	0.8395
140	0.2511	0.3032	-1.1308	-0.9352	-0.9058
141	0.0479	0.1378	0.2132	2.8308	-0.1409
142	0.9576	0.5511	-1.4040	0.0892	-0.7561
143	0.5623	-0.2189	-2.6376	0.5537	-1.1497
144	0.1168	0.0052	-1.9057	1.0342	0.0515
145	-0.2260	0.0153	-3.1667	1.1525	-0.4782
146	0.2707	0.0305	-2.8706	1.4834	1.2590
147	-0.1917	-0.1870	-3.0000	0.6065	-0.2612

3 Q-MODE FACTOR ANALYSIS : TABLE OF VARIMAX FACTOR MATRIX

Unit Number in Table 3.1	Communality	FACTORS				
		1	2	3	4	5
1	0.9785	0.8228	0.4248	0.3202	-0.0192	-0.0439
2	0.9516	0.7850	0.3863	0.3760	0.0869	0.0255
3	0.9737	0.5398	0.4637	0.6758	-0.0127	0.0246
4	0.9724	0.8039	0.4091	0.3893	0.0489	0.0176
5	0.9639	0.8122	0.3742	0.3868	-0.0044	-0.0501
6	0.9796	0.8249	0.3836	0.3661	0.0190	-0.0301
7	0.9773	0.6540	0.5085	0.5282	0.0046	0.0654
8	0.9712	0.7212	0.4607	0.4006	0.0371	-0.0266
9	0.9856	0.8054	0.4433	0.3417	0.0334	0.0392
10	0.9888	0.7793	0.4742	0.3711	0.0401	0.0585
11	0.9890	0.7738	0.4919	0.3757	0.0543	0.0310
12	0.9636	0.7156	0.5209	0.3619	0.0697	-0.0625
13	0.9848	0.7435	0.4942	0.4165	0.0266	0.0526
14	0.9720	0.7211	0.4403	0.4886	-0.0557	0.0124
15	0.9619	0.7486	0.4639	0.3793	0.0749	0.0665
16	0.9749	0.6797	0.4675	0.5239	0.0201	0.0245
17	0.9762	0.6692	0.4643	0.5463	0.0816	0.0631
18	0.9737	0.7846	0.3936	0.4065	0.0972	-0.0085
19	0.9747	0.7131	0.4725	0.4707	0.0511	0.1248
20	0.9700	0.7522	0.4891	0.3658	0.0225	0.0438
21	0.9607	0.6545	0.3891	0.5887	-0.0490	-0.0396
22	0.9820	0.8029	0.4085	0.3929	0.0635	-0.0539
23	0.9569	0.7708	0.4880	0.3290	0.0222	-0.0077
24	0.9543	0.7491	0.4382	0.4061	0.1794	-0.0105
25	0.9492	0.7660	0.4569	0.3217	-0.0729	-0.0057
26	0.9898	0.7741	0.4796	0.3883	-0.0005	-0.0381
27	0.9853	0.7455	0.5060	0.3921	0.0370	0.0291
28	0.9847	0.6822	0.5080	0.4998	0.0562	0.0848
29	0.9770	0.6547	0.4502	0.5734	0.0485	-0.0667
30	0.9801	0.7411	0.5010	0.4005	0.0595	0.0801
31	0.9823	0.7852	0.4946	0.3371	-0.0328	0.0140
32	0.9899	0.8135	0.4676	0.3254	0.0214	-0.0120
33	0.9776	0.7730	0.4096	0.4135	-0.0393	-0.0865
34	0.9851	0.7658	0.4873	0.3746	0.0717	0.0341
35	0.9701	0.7863	0.4668	0.3493	0.0014	-0.0072
36	0.9921	0.7797	0.5028	0.3476	0.0545	0.0331
37	0.9743	0.8128	0.4596	0.3083	0.0529	0.0173
38	0.9864	0.7568	0.5130	0.3796	0.0318	0.0665
39	0.9614	0.5102	0.5341	0.6232	0.0490	-0.0777
40	0.9725	0.6661	0.5534	0.4575	0.0116	0.0215
41	0.9819	0.7780	0.4645	0.3822	0.0732	0.0350
42	0.9584	0.7273	0.4971	0.3090	-0.0391	0.2708
43	0.9751	0.7491	0.4946	0.3825	0.0802	0.0079
44	0.9889	0.7952	0.4911	0.3323	0.0027	-0.0107
45	0.9799	0.7255	0.4973	0.4237	0.0153	0.1161
46	0.9869	0.7715	0.4918	0.3700	0.0548	0.0725
47	0.9884	0.7621	0.4685	0.4124	0.0981	0.0349
48	0.9840	0.7628	0.4856	0.4001	0.0376	0.0472
49	0.9611	0.6934	0.5124	0.4540	0.0458	0.0267
50	0.9571	0.5266	0.6146	0.5192	-0.0717	-0.0242

Unit Number in Table 3.1	FACTORS				
	6	7	8	9	10
1	0.0821	0.0298	-0.0318	-0.0688	-0.0532
2	0.0069	-0.0067	-0.0513	-0.1824	-0.0242
3	-0.0536	-0.0038	0.0000	0.0828	-0.0117
4	-0.0317	0.0497	-0.0282	-0.0031	-0.0145
5	0.0113	0.0119	0.0404	-0.0963	-0.0292
6	-0.0205	0.0030	0.0056	-0.1270	-0.0065
7	0.0828	0.0154	0.0093	0.0224	0.0062
8	0.2694	-0.0108	0.0353	0.0485	0.0029
9	-0.0794	0.0032	0.0852	-0.0784	-0.0363
10	-0.0187	0.0053	0.1091	0.0360	-0.0175
11	-0.0321	0.0377	0.0263	-0.0087	-0.0024
12	-0.0130	0.0538	0.1179	0.0359	0.1488
13	-0.0238	0.0183	0.0112	-0.0032	0.0986
14	-0.0095	0.0026	-0.0948	0.0756	0.0367
15	0.0883	0.0576	0.1345	0.0524	0.0233
16	-0.0333	0.0375	-0.0562	0.1153	-0.0056
17	0.0507	0.0118	0.0016	0.0153	-0.0252
18	0.0254	0.0222	-0.0272	-0.1480	-0.0677
19	0.0074	0.0309	0.0325	0.0347	-0.0019
20	0.1517	-0.0149	0.0723	-0.0087	0.0144
21	-0.0271	0.0273	-0.1442	0.0822	-0.0365
22	0.0032	0.0489	-0.0000	-0.0294	-0.0768
23	0.0773	0.0216	0.0766	0.0601	-0.0035
24	0.0066	0.0402	0.0288	-0.0309	-0.0225
25	0.1615	-0.0776	-0.0039	-0.0222	0.1106
26	0.0277	0.0165	-0.0321	0.0329	0.0727
27	-0.1025	0.0368	0.0318	-0.0130	0.0672
28	-0.0112	-0.0045	0.0180	-0.0067	0.0251
29	0.0463	0.0041	-0.0816	-0.0207	-0.0293
30	-0.0686	-0.0072	0.0486	-0.0409	0.0276
31	0.0696	0.0089	-0.0271	-0.0067	0.0232
32	0.0273	-0.0019	0.0289	-0.0380	-0.0051
33	-0.0340	0.0144	-0.1731	-0.0239	0.0205
34	0.0319	-0.0090	0.1073	0.0236	-0.0382
35	-0.0260	0.0202	0.1000	0.0227	-0.0156
36	-0.0541	0.0131	0.0559	0.0052	0.0143
37	0.0458	-0.0147	0.0249	-0.0349	-0.0112
38	-0.0085	-0.0228	0.0136	-0.0121	-0.0010
39	0.0259	-0.0041	0.1209	-0.0299	0.0528
40	0.0253	0.0389	0.0202	0.0921	0.0396
41	0.0171	-0.0463	0.0582	-0.0405	-0.0268
42	-0.0894	-0.0593	-0.0036	-0.0125	0.0117
43	0.0796	0.0331	0.0490	0.0736	0.0358
44	0.0008	-0.0015	-0.0021	-0.0088	0.0697
45	-0.0947	-0.0081	0.0065	0.0397	-0.0484
46	-0.0451	0.0025	0.0289	0.0154	-0.0396
47	-0.0372	0.0006	0.0616	-0.0209	-0.0391
48	0.0163	-0.0108	0.0174	0.0298	-0.0331
49	-0.0694	0.0160	0.0398	0.0269	-0.0390
50	0.1055	0.0798	0.0434	-0.0507	0.0701

Unit Number in Table 3.1	Communality	FACTORS				
		1	2	3	4	5
51	0.9490	0.5804	0.5539	0.4978	0.1314	0.0621
52	0.9778	0.5762	0.5951	0.5127	-0.0216	0.0575
53	0.8921	0.6457	0.4989	0.3735	0.0872	0.2610
54	0.9804	0.7126	0.4824	0.4194	0.1104	0.0375
55	0.9519	0.4938	0.4449	0.6899	0.0310	0.0022
56	0.9769	0.5899	0.4820	0.6219	0.0811	0.0343
57	0.9806	0.5660	0.4779	0.6457	0.0356	-0.0303
58	0.9705	0.5878	0.6098	0.4892	0.0121	0.0508
59	0.9333	0.4873	0.5134	0.6449	0.0091	-0.0993
60	0.9626	0.6687	0.5292	0.4327	-0.0097	0.0142
61	0.9765	0.5375	0.5316	0.6154	0.1269	0.0108
62	0.9709	0.5199	0.5998	0.5565	0.0204	0.1275
63	0.9565	0.5660	0.5874	0.4980	0.0063	0.0326
64	0.9515	0.6873	0.4271	0.4850	0.0147	-0.0187
65	0.9559	0.5565	0.5209	0.5917	0.0868	0.1084
66	0.9878	0.6797	0.5145	0.4817	0.1225	0.0544
67	0.9505	0.5405	0.6376	0.4712	-0.0262	0.1298
68	0.9710	0.5823	0.5956	0.5135	0.0297	0.0549
69	0.9549	0.5521	0.6352	0.4678	-0.0223	-0.1192
70	0.9769	0.6220	0.6023	0.4641	0.0827	0.0403
71	0.9684	0.6909	0.5228	0.3992	0.2070	0.0059
72	0.9794	0.6875	0.5253	0.4399	0.1437	0.0630
73	0.9684	0.6020	0.5963	0.4481	0.1726	0.0804
74	0.9663	0.4914	0.6860	0.4774	0.0589	0.0445
75	0.9848	0.5434	0.7063	0.3454	0.2421	0.0369
76	0.9834	0.5623	0.7012	0.3444	0.2207	0.0357
77	0.9780	0.5787	0.6577	0.4318	0.1262	0.0365
78	0.9838	0.7219	0.5638	0.3616	0.0349	0.0558
79	0.9789	0.7492	0.4876	0.4121	0.0437	-0.0177
80	0.9693	0.7922	0.4920	0.2987	0.0150	0.0121
81	0.9892	0.6535	0.5440	0.5104	0.0428	0.0099
82	0.9830	0.6251	0.5259	0.5331	0.1451	0.0451
83	0.9740	0.5226	0.7084	0.3675	-0.0530	0.0195
84	0.9733	0.4726	0.7397	0.3982	0.0754	0.0386
85	0.9704	0.4838	0.6982	0.4364	0.1963	-0.0171
86	0.9781	0.4491	0.7777	0.3856	0.0248	0.0349
87	0.9748	0.5912	0.6901	0.3070	0.1559	-0.0474
88	0.9812	0.6280	0.6389	0.3368	0.2512	0.0055
89	0.9816	0.5625	0.7007	0.3662	0.1653	0.0313
90	0.9761	0.5622	0.6749	0.4403	0.0818	0.0468
91	0.9754	0.6531	0.6541	0.3196	0.0225	-0.0430
92	0.9697	0.4761	0.6849	0.5073	0.0133	0.0990
93	0.9740	0.6062	0.5975	0.4514	0.1239	0.0508
94	0.9843	0.5446	0.6075	0.5472	0.0956	0.0136
95	0.9744	0.4185	0.6322	0.6053	0.0494	0.0622
96	0.9824	0.4701	0.5488	0.6593	0.0772	0.0338
97	0.9794	0.6117	0.5481	0.5425	0.0438	0.0031
98	0.9693	0.5159	0.5000	0.6596	0.0916	-0.0359
99	0.9795	0.5238	0.5177	0.6596	-0.0034	-0.0089
100	0.9659	0.5127	0.6643	0.4953	-0.0765	-0.0181

Unit Number in Table 3.1	FACTORS				
	6	7	8	9	10
51	-0.0147	-0.0361	0.0203	0.0034	0.1857
52	0.1338	0.0686	-0.0285	-0.0249	0.0300
53	0.0956	0.0112	0.0353	0.0010	0.0231
54	0.2170	-0.0251	-0.0460	-0.0010	-0.0238
55	0.0064	0.0062	-0.1277	0.1025	-0.0796
56	-0.0133	-0.0282	0.0060	-0.0287	0.0185
57	0.0234	-0.0034	-0.0918	0.0519	-0.0323
58	0.0535	0.0571	-0.0453	-0.0175	0.0504
59	0.0253	-0.0378	-0.0099	0.0428	-0.0495
60	0.1268	0.0069	-0.0966	-0.0337	0.1460
61	0.0612	-0.0237	0.0226	0.0172	0.0704
62	0.0916	-0.0191	0.0665	0.0037	-0.0350
63	0.1388	-0.0132	0.1132	-0.0543	-0.0821
64	-0.0739	0.0054	-0.2253	-0.0681	-0.0001
65	0.0650	-0.0102	-0.0186	0.0257	-0.0140
66	0.0853	0.0053	0.0156	0.0578	0.0100
67	0.0300	0.0796	0.0196	-0.0360	0.0587
68	0.0497	-0.0516	0.0116	-0.0637	0.0145
69	0.0612	0.0320	-0.0257	0.0839	0.0239
70	-0.0067	-0.0007	0.0550	0.0121	0.0127
71	0.0991	0.0483	-0.0405	-0.0129	-0.0398
72	0.0925	0.0041	0.0246	0.0500	0.0325
73	0.0616	0.0453	0.0474	0.0727	-0.0034
74	0.1086	0.0558	-0.0105	-0.0526	-0.0545
75	0.0135	0.0880	-0.0181	0.0415	-0.0380
76	0.0327	0.0744	-0.0161	0.0047	-0.0063
77	0.0173	0.0532	0.0066	-0.0457	0.0415
78	0.0706	0.0404	0.0004	-0.0015	0.0559
79	0.0531	-0.0011	0.0687	0.0005	0.0153
80	0.0463	0.0008	-0.0077	0.0007	0.0883
81	0.0518	0.0214	-0.0199	0.0049	0.0102
82	0.0284	0.0446	-0.0230	0.0689	0.0189
83	0.1923	0.1269	0.0274	-0.0834	-0.0107
84	0.0850	0.1380	0.0508	-0.0769	0.0479
85	0.0330	0.0212	0.1329	0.0078	0.0188
86	0.0386	0.1129	-0.0775	0.0086	-0.0261
87	0.1060	0.0670	-0.0151	0.0915	-0.0619
88	0.0076	-0.0114	-0.0400	-0.0167	-0.0063
89	0.0293	0.0332	-0.0036	0.0245	-0.0956
90	0.0352	-0.0095	0.0020	0.0147	-0.0137
91	0.0656	0.0091	-0.0208	0.0409	0.1004
92	0.0315	0.0058	0.0470	-0.0568	0.0141
93	0.1015	-0.0451	-0.0067	-0.0179	0.1229
94	-0.0122	-0.0202	0.0798	-0.0328	0.0434
95	-0.0040	-0.0008	0.1575	-0.0352	0.0269
96	-0.0053	-0.0362	0.1191	-0.0541	0.0021
97	0.0517	0.0118	-0.0051	0.0453	0.0613
98	-0.0291	0.0094	0.0795	-0.0329	0.0006
99	0.0382	-0.0073	-0.0151	-0.0070	-0.0108
100	0.0036	0.0234	0.0413	-0.0889	-0.0017

Unit Number in Table 5.1	Communality	FACTORS				
		1	2	3	4	5
101	0.9805	0.4828	0.5173	0.6884	0.0160	0.0479
102	0.9366	0.6625	0.3943	0.5350	-0.0627	-0.0497
103	0.9831	0.7575	0.4501	0.4445	-0.0451	-0.0486
104	0.9631	0.4521	0.4311	0.7477	0.0624	-0.0025
105	0.9707	0.7448	0.5042	0.3913	-0.0420	-0.0158
106	0.9210	0.5465	0.6164	0.4357	-0.0573	0.0383
107	0.9716	0.4922	0.7125	0.4231	-0.0604	0.0610
108	0.9786	0.5134	0.7655	0.3439	0.0071	0.0145
109	0.9805	0.4891	0.7658	0.3592	0.0984	0.0320
110	0.9656	0.3930	0.8296	0.2778	-0.0214	-0.0677
111	0.9583	0.5478	0.7246	0.3270	0.1274	-0.0793
112	0.9450	0.4677	0.7723	0.3349	0.0688	-0.0253
113	0.9718	0.4561	0.7676	0.4032	-0.0400	0.0107
114	0.9743	0.5027	0.6453	0.5129	-0.0552	0.1100
115	0.9770	0.7798	0.5103	0.3105	-0.0606	-0.0279
116	0.9534	0.4961	0.6226	0.5435	-0.0268	0.1301
117	0.9606	0.7522	0.5173	0.3194	-0.0130	0.1031
118	0.9724	0.7356	0.5383	0.3682	0.0360	0.0253
119	0.9774	0.4670	0.7310	0.4531	-0.0684	0.0102
120	0.9601	0.6178	0.6290	0.3951	0.0210	-0.0257
121	0.9749	0.7021	0.5658	0.3734	-0.0263	-0.0853
122	0.9704	0.6744	0.5920	0.3519	-0.0063	0.0134
123	0.9707	0.6222	0.6606	0.3694	0.0628	-0.0192
124	0.9569	0.5032	0.7322	0.3924	0.0874	-0.0058
125	0.9717	0.5498	0.6241	0.4100	0.2775	-0.0434
126	0.9835	0.4472	0.7894	0.3898	0.0412	0.0026
127	0.9627	0.3642	0.8416	0.2999	0.0550	0.0280
128	0.9649	0.4181	0.8247	0.2909	-0.0949	-0.0816
129	0.9793	0.4799	0.7537	0.4031	-0.0207	0.0512
130	0.9535	0.5077	0.7304	0.3746	0.0056	0.1193
131	0.9614	0.7057	0.5864	0.3240	0.0073	0.0516
132	0.9745	0.5468	0.6317	0.5178	0.0672	-0.0202
133	0.9776	0.5540	0.6471	0.4629	0.0817	-0.0473
134	0.9367	0.5246	0.6598	0.4399	-0.0947	-0.0300
135	0.9863	0.5346	0.7092	0.4250	0.0483	0.0201
136	0.9787	0.4700	0.7800	0.3751	-0.0159	-0.0295
137	0.9727	0.5633	0.6834	0.3627	0.1790	0.0574
138	0.9735	0.4701	0.7837	0.3315	0.0061	-0.0092
139	0.9752	0.5482	0.6966	0.3531	0.1894	0.0641
140	0.9486	0.4232	0.8349	0.2518	-0.0199	-0.0494
141	0.9786	0.5400	0.7168	0.3491	0.1984	-0.0302
142	0.9699	0.3931	0.8463	0.2543	-0.0814	0.0998
143	0.9718	0.5216	0.7695	0.2801	-0.0221	-0.0109
144	0.9667	0.4779	0.7918	0.3150	0.0140	-0.0001
145	0.9764	0.4663	0.7655	0.3653	-0.0071	0.0377
146	0.9728	0.4816	0.7515	0.3725	0.0087	0.0495
147	0.9662	0.4918	0.7391	0.3597	0.0041	0.0573
Variance		40.074	34.842	19.425	0.698	0.370
Cumulative variance		40.074	74.915	94.340	95.038	95.408

Unit Number in Table 3.1	FACTORS				
	6	7	8	9	10
101	0.0166	0.0146	0.0221	-0.0482	0.0102
102	0.0530	-0.0174	-0.2088	0.0180	0.0507
103	0.0515	0.0180	-0.0337	0.0076	0.0221
104	0.0162	0.0090	0.0676	-0.0694	0.0070
105	0.0161	0.0168	-0.0211	0.0273	0.0708
106	0.0044	0.0161	-0.0195	0.0130	0.2168
107	0.1035	0.0480	0.0946	-0.1066	0.0441
108	0.0332	0.0845	0.0320	-0.0036	-0.0354
109	0.0318	0.1090	-0.0176	-0.0039	-0.0433
110	-0.0113	0.1471	-0.1307	-0.0405	-0.0162
111	0.0310	0.0014	-0.0178	-0.0478	-0.0111
112	0.0341	0.0212	-0.0437	-0.0018	-0.0931
113	0.0145	0.0677	0.0375	-0.0184	0.0609
114	0.0941	-0.0100	0.0894	-0.0999	-0.0031
115	0.0367	-0.0019	0.0074	0.0674	-0.0411
116	0.0201	0.0447	0.0323	0.0196	0.0524
117	0.0573	-0.0164	0.0678	0.0762	-0.0206
118	0.0304	-0.0230	-0.0049	0.0488	0.0126
119	0.0962	0.0554	0.0147	-0.0481	0.0018
120	0.0631	0.0272	0.0320	0.1406	-0.0045
121	0.0044	-0.0406	-0.0219	0.1099	-0.0114
122	0.0895	-0.0987	0.0641	0.1213	-0.0661
123	-0.0406	-0.0129	0.0343	0.0564	0.0126
124	0.0406	0.0220	0.0442	-0.0403	0.0104
125	-0.0650	-0.0696	0.1347	-0.0587	0.0481
126	-0.0504	0.0536	0.0311	-0.0151	-0.0057
127	-0.0249	0.0975	-0.0394	0.0462	-0.1193
128	0.0084	0.0720	-0.0486	0.0152	0.0433
129	0.0828	-0.0627	-0.0284	-0.0613	0.0004
130	0.0526	-0.0370	0.0474	-0.0266	-0.0240
131	0.0322	-0.0677	-0.0535	0.0411	0.0422
132	0.0218	-0.0278	0.0336	0.0307	0.0132
133	0.0147	-0.0526	0.1327	-0.0021	0.0899
134	0.0018	-0.1413	-0.0131	-0.0377	-0.0354
135	0.0011	-0.0979	0.0586	-0.0084	0.0345
136	-0.0139	-0.0395	0.0227	0.0583	0.0440
137	-0.0136	-0.1401	0.0095	-0.0084	-0.0375
138	-0.0122	-0.0790	-0.0313	0.0269	0.1420
139	-0.0569	-0.1194	0.0353	0.0338	0.0694
140	0.0145	0.0027	0.0687	-0.0201	-0.0305
141	-0.0134	-0.0949	-0.0209	-0.0240	0.0290
142	-0.0792	-0.0196	-0.0641	0.0473	-0.0694
143	0.0103	-0.1591	-0.0175	0.0283	-0.0441
144	-0.0043	-0.0868	0.0440	0.0380	0.0317
145	0.0153	-0.1921	0.0246	-0.0158	0.0098
146	-0.0602	-0.1546	0.0041	-0.0065	0.0851
147	0.0405	-0.2035	-0.0089	-0.0426	0.0160
	0.421	0.323	0.398	0.275	0.287
	95.830	96.153	96.550	96.826	97.113

4 Q-MODE FACTOR ANALYSIS : TABLE OF FACTOR SCORE MATRIX

Variable Number in Table 3.2	FACTOR				
	1	2	3	4	5
1	1.1939	-0.6257	-0.3100	0.1987	-0.9654
2	1.1034	-0.6651	-0.0933	0.1748	-1.0795
3	0.0453	-0.1768	0.7166	-0.0191	-0.1238
4	0.1609	0.0439	0.7145	-0.0343	-0.0619
5	0.1258	-0.0017	0.6019	-0.1221	-0.0531
6	-0.0169	0.0484	1.0249	-0.2809	-0.7452
7	0.3949	0.4138	1.1743	-0.7941	-1.2939
8	1.7171	0.3895	-1.0391	0.4122	-1.1724
9	-0.6272	0.2457	2.0699	-1.2137	-0.7971
10	-0.5453	2.0061	-0.9386	1.7189	-0.8933
11	-0.5219	2.1187	-1.0397	0.5944	-0.4674
12	-0.4436	2.3443	-1.1304	0.5293	-0.6301
13	-0.3195	1.8838	-0.4438	0.8851	0.2766
14	1.8850	-1.2281	1.1203	-0.9637	0.3167
15	1.2234	1.0575	0.8263	0.0667	0.4617
16	1.1927	0.4807	0.5387	-0.6550	-2.0145
17	1.1236	0.5844	0.9067	-0.5897	0.6764
18	0.6415	0.8720	0.3573	0.0612	2.1029
19	0.3204	1.1882	-0.0541	1.7520	0.4521
20	0.7489	1.0050	0.0972	0.9317	-1.6755
21	0.9303	0.9349	0.8017	0.6617	0.2488
22	0.7469	0.2684	0.7986	-0.6210	-0.9998
23	0.9144	0.5087	0.2435	-0.6473	-2.6530
24	0.9876	0.8234	0.0430	-0.3430	-2.1045
25	0.8479	1.0657	-0.4216	1.6815	-0.0098
26	0.9975	1.2894	0.6601	0.2536	0.3110
27	1.4400	-0.0991	0.4758	-0.3444	0.7004
28	1.1903	0.8481	0.7496	0.2483	1.1041
29	0.9094	0.9783	0.4887	-0.4805	-0.4020
30	-0.4357	0.0533	1.5060	-0.6269	-2.0400
31	0.2863	1.0790	0.0270	0.8513	-0.8255
32	1.2219	0.8409	0.8573	-0.1240	0.7693
33	1.2148	0.0065	-0.8217	-1.1773	0.8036
34	0.3830	0.8893	0.1011	1.6948	-0.2806
35	-1.2094	2.3373	-0.2382	-1.7540	0.9593
36	0.6276	0.6762	0.5526	0.1642	0.1053
37	-1.0906	2.3582	-0.5105	-1.4541	0.3528
38	2.2958	-0.5859	-1.4233	-0.9192	0.7026
39	1.2284	-0.8851	0.9980	1.5374	0.4347
40	-0.0826	0.6317	1.6123	0.8157	-0.5758
41	-0.1910	0.1383	0.4202	-0.4326	-1.2362
42	0.9763	0.0891	-0.7505	1.0923	-0.0503
43	0.7899	0.0477	-0.3155	0.4443	-0.5961
44	1.3986	0.4902	0.6567	-0.1880	-0.4769
45	1.6615	-1.0896	1.6754	-0.2297	0.4490
46	0.1841	-0.0150	-0.0229	-0.2401	1.7537
47	0.3586	-0.1369	0.1678	-0.2490	1.6802
48	0.1459	0.2574	-0.1228	-0.1864	1.6783
49	0.3330	1.8085	-0.0643	-1.6987	1.3268
50	1.3081	-0.5947	1.4125	-0.8947	0.6135

Variable Number in Table 3.2	FACTOR				
	6	7	8	9	10
1	-1.1579	0.0568	0.6945	-2.5685	-1.3985
2	-1.3172	0.0213	-0.1162	-2.7531	-1.2119
3	-0.4287	-0.2213	-1.7127	-0.2037	-0.1179
4	-0.2343	-0.1131	-0.9151	0.4678	-0.3175
5	-0.0225	-0.1118	-1.1034	0.4697	-0.2229
6	-0.2889	-0.7760	-0.8808	0.3388	0.4220
7	-0.8707	0.1709	-1.1005	1.2700	-1.3784
8	-2.0623	0.5497	0.6019	0.3211	-2.0887
9	0.2793	-0.1478	-1.7018	1.3131	-0.3114
10	-0.2667	0.4728	-1.1983	0.5339	-0.7711
11	-0.9156	-2.6422	-0.9312	-0.1374	-0.4196
12	-1.0119	-2.8716	-0.3025	0.4392	-0.0616
13	0.0240	-2.7765	-1.2077	0.5841	-0.4406
14	-0.3901	1.6919	0.5721	-1.1294	-0.1380
15	-0.0596	0.1870	-0.0585	-0.1856	0.0670
16	0.4677	0.9119	-0.7123	0.1549	0.4559
17	-0.3478	0.0490	-1.1277	-0.1873	-0.6519
18	0.4457	-0.4288	1.1004	-0.2847	0.1395
19	-0.5159	0.0027	1.5658	-0.0988	0.5615
20	-0.0564	0.6809	0.8005	0.1295	0.8799
21	-0.3294	-0.3509	0.2421	-0.3509	0.1431
22	-0.4498	0.4612	-0.9497	0.8608	-0.7326
23	0.6053	0.9916	-0.0228	1.5612	-0.4864
24	0.7076	1.1610	0.3522	0.2883	1.1771
25	-0.0550	0.2798	1.6133	-0.4926	0.6038
26	0.0289	0.0659	0.5867	-0.1335	0.0765
27	0.0781	0.4845	-1.1805	-0.3434	0.3585
28	-0.2737	-0.0694	-0.1118	0.4623	-1.2166
29	0.3843	0.4916	-0.0788	-0.6603	1.0714
30	0.2441	-1.4648	1.0046	-0.2573	-1.0813
31	-0.1017	-0.1132	2.3712	-0.3579	0.5126
32	-0.2563	0.4957	-0.8470	0.1256	0.0931
33	3.5534	-3.2289	0.0372	-2.4356	-3.2644
34	-0.1148	-0.0726	1.8615	-0.2595	-0.1552
35	1.2346	2.1456	0.0819	-0.7647	-0.2011
36	- 0.1408	0.6524	-0.1291	0.2303	0.3278
37	0.7739	1.8108	0.1325	-0.7634	-0.5712
38	-0.9429	0.3840	2.2386	1.8522	-1.0455
39	0.7071	-0.0363	-2.2459	-0.2996	-0.3014
40	-0.5856	-1.5040	0.1605	-0.6841	1.5618
41	-0.0339	-0.7020	0.0160	0.2872	-0.8687
42	1.0702	-0.7744	-1.0528	-0.0130	4.5162
43	0.1233	0.0577	0.3022	0.3858	1.9716
44	-0.5134	0.2482	-0.6923	0.0032	-0.2360
45	1.0983	-0.3204	0.3901	1.6570	0.2241
46	0.1678	0.1799	-0.2464	0.2775	0.1870
47	0.2799	0.1310	-0.1850	0.4448	0.1990
48	0.0264	0.2345	-0.2696	0.0516	0.1634
49	0.1747	-0.0679	0.3858	0.9530	0.5722
50	-0.2973	-1.0871	1.2705	0.5435	0.7751

Variable Number in Table 3.2	FACTOR				
	1	2	3	4	5
51	0.2355	1.3978	-0.2672	-2.9468	0.6169
52	-0.4727	1.8698	-1.2324	1.9782	-0.3427
53	-0.1983	1.4102	-0.6391	-1.1176	-0.0334
54	0.9602	1.4341	0.3039	-1.2235	0.4985
55	0.4215	-0.4079	0.8123	-0.6896	-0.4328
56	1.4609	0.8164	0.5304	-0.5826	0.5744
57	1.6826	0.6266	0.0200	-0.4134	0.2063
58	1.0173	0.6206	-0.8727	-0.9230	-0.2485
59	1.5261	1.1371	0.5500	0.0194	0.2595
60	-0.3694	-0.3523	2.2513	2.1067	-0.3293
61	2.1340	-0.5375	-0.8462	-0.1247	0.3917
62	0.4799	1.2005	1.2117	-0.3498	0.1252
63	0.6390	1.0972	0.5478	1.0505	0.5144
64	1.0635	0.6637	-0.6521	-0.9234	-2.3720
65	-0.5340	1.0802	1.4069	1.4789	0.5447
66	1.7959	0.3634	-1.3906	-0.0638	-1.9198
67	-0.3566	1.3311	1.4745	0.3501	0.3575
68	-1.3379	1.3861	1.4770	-1.5867	0.8597
69	-0.9340	0.5330	1.9820	-0.0682	-0.4181
70	-0.6682	-0.2730	2.0844	0.0162	-1.3255
71	0.3700	0.1122	1.8769	1.3865	0.5075
72	-1.0530	0.3763	2.1647	-0.1992	-0.4894
73	1.6497	0.1181	-0.3606	1.9937	1.5651
74	0.6351	0.4111	1.4270	1.6366	1.0152

Variable Number in Table 3.2	FACTOR				
	6	7	8	9	10
51	-0.7834	-1.6210	0.2989	1.7631	1.4634
52	0.0528	3.0568	-1.8242	-0.5892	-1.2234
53	-0.6219	0.4699	-0.5567	0.5554	-0.1875
54	-1.7117	0.0910	0.7338	-0.2891	0.4908
55	-0.8629	-0.2818	0.3581	0.1151	-0.0147
56	0.0701	0.3598	-0.2824	-0.2676	0.1165
57	0.0463	0.0410	-0.1911	0.1898	-0.1533
58	1.6036	-0.7518	0.5878	1.2526	-1.0925
59	-0.0264	0.3240	0.2193	-0.0227	-1.1198
60	1.4369	-0.1476	0.4153	1.3561	-1.0135
61	-2.5296	-0.8417	-1.7208	-2.3069	1.1203
62	-1.4521	-0.8109	-1.6208	-1.6422	0.6825
63	-0.5815	0.0278	1.7667	0.4686	-0.4566
64	2.8962	0.0937	-0.5005	-2.1185	1.6234
65	-0.5867	0.1016	1.5015	-0.1004	-0.0461
66	2.5179	-0 .5450	0.6439	0.6769	0.2231
67	0.2094	0.5123	-1.0057	1.2771	-0.7163
68	1.1489	0.7128	0.8091	-2.8239	0.5117
69	-0.0297	-0.0363	0.9293	-1.2543	-0.1312
70	-0.4442	-0.8580	0.7364	-0.4842	0.2010
71	0.7951	-0.0523	-0.4069	-0.0960	0.3070
72	-0.0059	-0.2646	1.0363	-0.7275	-0.1869
73	1.7749	0.2041	-1.2006	0.4332	-0.3858
74	1.5956	-0.0289	-0.2442	-0.1983	-0.4986

APPENDIX C

VARIABLES INCLUDED IN THE CORRELATION ANALYSES

Variable No.	Variable and Source
75	Density per hectare 1967 (Census 1961, Electoral Registers 1961 and 1967).
76	Percentage of persons having changed residence in the year prior to the Census and having moved within same L.A. area (1961 Census 10%)
77	Percentage of persons having changed residence in the year prior to the Census and having moved between L.A. areas (1961 Census 10%)
78	Percentage of those persons having changed residence in the 5 years prior to the Census and moving between L.A. areas who were aged 60 and over (1966 Census).
79	Population potential 1967 (1961 Census, Electoral Registers 1961, 1967)
80	Ratio of 1961 Census population to 1961 Electoral population (1961 Census, Electoral Register 1961)
81	Percentage of 1966 population aged 15 to 59 (1966 Census).
82	Percentage of 1961 population aged 15 and over (1961 Census 10%)
83	Sex Ratio, 1966 (1966 Census).
84	Difference between C.B.R. 1964-5 and C.D.R. 1967-8 (County Health Department Records).
85	Percentage of households with no family (1961 Census 10%)
86	Percentage of households with one family (1961 Census 10%)
87	Percentage of workforce employed in agriculture (1961 Census 10%)
88	Percentage of workforce employed in mining (1961 Census 10%)
89	Percentage of workforce employed in production (1961 Census 10%)
90	Percentage of workforce employed in services (1961 Census 10%)

Appendix C. cont.

Variable No.	Variable and Source
91	Percentage of workforce aged 15-44 (1961 Census 10%)
92	Percentage of sample economically active (1961 Census 10%)
93	Ratio of Theoretical Standard Man Day requirements to estimated actual usage 1963 (M.A.F.F. June Returns 1963)
94	1967 S.M.D. ratio as percentage of that in 1963 (M.A.F.F. June Returns 1963, 1967).
95	S.N.O. per hectare of agricultural land 1963 (M.A.F.F. June Returns 1963).
96	1967 S.N.O. per hectare as percentage of that in 1963 (M.A.F.F. June Returns 1963,1967).
97	S.M.D. requirements per agricultural holding 1967 (M.A.F.F. June Returns 1967).
98	S.M.D. requirements per hectare of agricultural land 1963 (M.A.F.F. June Returns 1963).
99	1967 S.M.D. requirements per hectare of agricultural land as percentage of those in 1963 (M.A.F.F. June Returns 1963,1967).
100	S.M.D. requirements per hectare of agricultural land 1967 (M.A.F.F. June Returns 1967).
101	Percentage of agricultural holdings with less than 2.1 hectares of cropland and improved grassland 1967 (M.A.F.F. June Returns 1967).
102	Percentage of agricultural holdings with 121.4 or more hectares of cropland and improved grassland 1967 (M.A.F.F. June Returns 1967).
103	Percentage of regular whole-time agricultural workers who were aged 20 to 44 1967 (M.A.F.F. June Returns 1967).
104	Percentage of 1966 sample population resident in private households (1966 Census)
105	Percentage of persons inprivate households who were owner-occupiers or families (1966 Census)

Appendix C. cont.

Variable No.	Variable and Source
106	Persons per room in owner occupied dwellings (1966 Census)
107	Percentage of persons in private households in accommodation rented from the Local Authority (1966 Census).
108	Persons per room in Local Authority rented dwellings (1966 Census).
109	Percentage of persons with household access to at least one car (1966 Census).
110	Percentage of economically active and retired males in the professional and managerial S.E.Gs (1,2,3,4 and 13) 1961 (1961 Census 10%)
111	Percentage of economically active and retired males in the professional, managerial and skilled manual S.E.Gs (1,2,3,4,8,9,12,13 and 14) 1961 (1961 Census 10%)
112	Percentage of economically active and retired males in Social Classes 1 and 2 (1966 Census)
113	Percentage of economically active and retired males in Social Class 3 (1966 Census).
114	Percentage of economically active and retired males in Social Classes 4 and 5 (1966 Census).

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