Economic and structural reforms and bank efficiency : a comparative analysis of India and Pakistan 1990-1998

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ECONOMIC AND STRUCTURAL REFORMS AND BANK EFFICIENCY: A COMPARATIVE ANALYSIS OF INDIA AND PAKISTAN 1990-1998

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ABSTRACT

The financial liberalisation programme is a quintessential, and perhaps the most controversial, component of the on-going economic and structural reforms in developing countries like India and Pakistan. A key objective of the financial liberalisation programme in India and Pakistan is to encourage and enable commercial banks to improve their efficiency so that they can augment financial intermediation between savers and borrowers. This study employs non-parametric data envelopment analysis to examine whether the efficiency of commercial banks in India and Pakistan improved between 1990-1998, a period characterised by far-reaching changes brought about by the economic and structural reforms. We find that the banking industry in both India and Pakistan exhibited considerable technical inefficiencies during the period. In the case of India, an average bank could improve its efficiency by at least 11%. In the case of Pakistan, an average bank could improve its efficiency by at least 18%. This improvement in efficiency could lead to a more efficient intermediation as banks would be able to channel more funds from savers to borrowers with their given resources. We find that the efficiency of the banking industry in both the countries improved after the implementation of the financial liberalisation in the early 1990s. In India, the efficiency of all three groups – public, foreign, and domestic private – improved over the years. On the other hand, public sector banks in Pakistan witnessed limited or no improvement in their efficiency. In both the countries, our findings suggest that foreign banks attained the highest improvement in their efficiency after the financial liberalisation. In the case of India, we find a positive relationship between the level of competition and bank efficiency. We also find that governments' fiscal deficits had a negative relationship with the efficiency of banks in both the countries. We propose that high fiscal deficits create an environment in which banks find it difficult to utilise their resources efficiently. In India, a positive relationship between the efficiency and size of banks is found. On the other hand, a negative relationship is found in the case of the Pakistani banking industry. We propose that in Pakistan, public sector banks have become too large and complex to adapt quickly to the changes due to the economic and structural reforms. We argue that, to enable large public sector banks to adapt to the changes due to the reforms, the authorities need to do more to reduce huge non-performing loans in the asset portfolios of these banks.

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Declaration

The material contained in this thesis has not been previously submitted for a degree in this or any other university.

Statement of Copyright

Acknowledgements

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Chapter 1 – The Efficiency of Banks in India and Pakistan: Background, Research Methods, and the Structure of the Study

1.1 – Introduction

During the early 1950s and 1960s, the 'development economists' formulated economic models to explain the causes of underdevelopment, and devised policy prescriptions to foster economic growth in developing countries (see Meier and Stiglitz, 2001). According to these models, capital accumulation was crucial for rapid economic growth (see, for example, Rosenstein-Rodan, 1943; Nurske, 1952; Lewis, 1954; Hirschman, 1958). As markets in developing countries were considered as prone to failure, excessive government intervention in mobilising and allocating scarce resources was advocated. In the case of the financial sector, it was argued that financial institutions in developing countries were exacerbating income inequalities by channelling financial resources to large business groups only (see Caprio et al., 1994). Therefore, strict government controls over the operations of financial institutions were implemented in order to channel financial resources to the so-called priority sectors (agriculture, for instance), which were considered essential for an equitable economic growth.

However, based on the policy prescriptions of the World Bank and the International Monetary Fund, after decades of excessive government regulations and state-determined resource allocation, the implementation of economic and structural reforms (ESRs) endeavours to create a market friendly economic environment in developing countries (Williamson, 2000). These ESRs are based on the belief that the excessive government interventions have failed to enhance economic growth, and have created inefficiencies into almost all sectors of developing countries (see Stiglitz, 2002). These ESRs primarily include: fiscal reforms, investment liberalisation, trade reforms, and financial liberalisation.

The financial liberalisation programme includes: a deregulation of exchange and interest rates controls, reduction in state-determined credit policies, a gradual privatisation of public sector banks, reduced restrictions on the entry and operations of foreign and domestic private financial institutions, reduction in banks' required reserve ratio, and the liberalisation of the capital account (see Caprio et al., 1994). An important objective of the financial liberalisation programme is to enhance the efficiency of financial institutions – especially that of commercial banks – in utilising their resources so that these institutions augment financial intermediation and, therefore, contribute to the process of economic growth (see Shaw, 1973; McKinnon, 1973; Fry, 1995, 1997).

India and Pakistan initiated very similar economic and structural reforms in the late 1980s. These reforms were primarily directed toward four important areas, namely, fiscal policy, investment policy, foreign trade policy, and financial sector policy (see Ahluwalia, 1999a; Zaidi 1999). The main focus of the financial liberalisation programme was to strengthen the commercial banking industry by underpinning prudential regulations, limiting the state-directed credit policies that had been extensively used by the government to finance priority sectors, relaxing the interest rate ceilings on deposits and loans, privatising public sector banks, and allowing the entry of private financial institutions.

Like in other developing countries, an officially-stated objective of the financial liberalisation programme in India and Pakistan is to enhance the efficiency and productivity of commercial banks in order to reduce the costs associated with the intermediation of scarce financial resources between savers and borrowers (see Kumbhakar and Sarkar, 2003; SBP, 2000). The emphasis on the commercial banking industry is due to the fact that in India and Pakistan, as in other developing countries, most of the intermediation between savers and borrowers is conducted by commercial banks; other financial institutions and markets play a relatively insignificant role (see Fry, 1995). Therefore, we submit, it is imperative to examine whether the efficiency of commercial banks has actually improved after the implementation of the financial liberalisation programme. With this in mind, we outline the objectives of the present study.

1.2 – Objectives of the study

Although the ESRs in India and Pakistan were initiated in the early 1990s, little academic research has gone into the empirical investigation of the impact of these reforms on the efficiency of commercial banks. A similar dearth of empirical research exists for other developing countries (see Isik and Hassan, 2003). To the best of the author's knowledge, although a few studies have sought to evaluate the efficiency and productivity of banks in India, the time period examined by most of these studies, as we shall see in chapter 3, is not long enough to shed light on the impact of the liberalisation programme. Similarly, in the case of Pakistan, only one study has measured the inter-temporal variations in the efficiency of banks.

The present study attempts to contribute to the literature on bank efficiency by examining the efficiency and productivity of commercial banks in India and Pakistan during 1990-1998, a period characterised by far-reaching changes brought about by the ESRs. We seek to examine:

1- Are commercial banks in India and Pakistan inefficient in intermediating between borrowers and savers?

2- If yes, what is the extent of inefficiency?

3- Has the efficiency of banks in India and Pakistan improved after the implementation of the ESRs?

4- Is the efficiency of public sector banks lower (higher) than that of private sector banks? In other words, is private ownership more efficient than state ownership?

5- Is the efficiency of foreign banks, which are considered as bringing new technology and managerial skills, higher than that of domestic banks?

6- Do three key elements of the ESRs – fiscal reforms, investment liberalisation, and the financial liberalisation – positively influence the efficiency of banks?

In addition, our comparative analysis attempts to examine whether similar policies implemented in the two countries have similar impacts on the efficiency of the commercial banking industry. The techniques employed to answer these questions are outlined below.

1.3 - Research Methods

In the present study, we employ frontier techniques to measure the efficiency of commercial banks. As outlined in chapter 3, various parametric and non-parametric techniques have been used in the empirical literature to measure the efficiency of financial institutions. Following the studies reviewed in chapter 3, chapter 5 employs non-parametric data envelopment analysis (DEA) to calculate the efficiency of banks in India and Pakistan. Furthermore, we also employ parametric stochastic frontier analysis to check the robustness of our results.

Chapter 6 augments the analysis of chapter 5 by extending the basic DEA model following Bhattacharyya et al.'s (1997) grand-frontier DEA approach. In addition, to examine factors that may explain variations in the efficiency of banks over space and time, we employ the so-called two-step procedure. In the two-step procedure, we regress the efficiency scores obtained from the DEA on various bank-specific factors (e.g. bank size) and external environmental factors (e.g. competition). Two econometric techniques are used in this regard, namely Ordinary Least Squares and Generalised Method of Moments. It should be mentioned at the outset that this study does not claim to advance the theory underlying the techniques used in this study (i.e. data envelopment analysis, stochastic frontier analysis, ordinary least squares, and generalised method of moments). Our objective is purely applied in nature. However, two important contributions of the present study are: (1) to propose various hypotheses regarding a possible relationship between bank efficiency and four environmental variables associated with the ESRs in developing countries; and (2) to use the generalised method of moments to rectify the endogeneity problem in the regression analysis examining the relationship between bank efficiency and various internal bank-specific factor (e.g. size). We shall discuss these issues in some detail in chapter 3 and chapter 6.

1.4 – Data

As we review in chapters 3 and 5, the frontier techniques require data on inputs and outputs of banks. The data for commercial banks in India are obtained from the website of the Reserve Bank of India. The website contains data on all domestic, as well as, foreign banks operating in India during the 1990s. In the case of Pakistan, the data are obtained from the *Banking Statistics of Pakistan* published annually by the State Bank of Pakistan. Data on macroeconomic variables related to fiscal reforms, investment liberalisation, and the financial liberalisation are extracted from World Development Indicators 2003 by the World Bank, Key Indicators 2004 by the Asian Development Bank, and the Indian Economic Survey published by the Indian Ministry of Finance.

1.5 – Structure of the study

Chapter 1 – The efficiency of banks in India and Pakistan – Background, research methods, and structure of the study

Chapter 2 – Financial liberalisation in developing countries – An overview

This chapter provides a very brief overview of the early theoretical and empirical literature on the financial liberalisation in developing countries. This chapter sets the agenda for the next chapters by arguing that most of the early empirical literature on the financial liberalisation attempts to examine the macroeconomic impact of the liberalisation, and only recently researchers have started looking at the impacts of the financial liberalisation on the efficiency of banks in developing countries.

Chapter 3 – Productive efficiency: Meaning, measurement, and empirical evidence on banks in developed and developing countries

What do we mean by the efficiency of a firm? Are firms always efficient? How can we empirically determine whether a firm is efficient or not? To answer these questions, this chapter starts with the traditional neoclassical theory of the firm that ignores the possibility of the internal inefficiency of firms. The transaction costs/property right approach, the behavioural theory of the firm, and the X-efficiency theory of the firm are then briefly discussed. These theories highlight situations where firms may not be able to utilise their resources efficiently. Parametric and non-parametric frontier techniques are reviewed. These techniques enable us to measure the efficiency of a firm relative to other similar firms. Recent empirical literature on the efficiency of banks in developing countries is then reviewed.

Chapter 4 – Economic and structural reforms in India and Pakistan during the 1990s

This chapter describes various components of the ESRs in India and Pakistan during the 1990s. Emphasis is placed on the implementation of the financial liberalisation programme that transformed the commercial banking industry in both the countries. This chapter also measures the performance of the commercial banking industry in terms of deposit mobilisation, credit provision, profitability, competition, asset diversification, and non-frontier based efficiency (i.e. using financial ratios).

Chapter 5 – The efficiency and productivity of banks in India and Pakistan during 1990-1998 using DEA

Some technical details of how the DEA can be used to measure technical efficiency and total factor productivity change are provided. Technical efficiency and total factor productivity change are measured for three groups of commercial banks in India and Pakistan, namely public sector banks, domestic private banks, and foreign banks. Technical efficiency for each year is measured relative to the frontier of that year. As the measurement is sensitive to the input-output specification (see chapter 3), two alternative input-output models are used. The robustness of the calculated efficiency scores is checked by examining their relationship with non-frontier based financial ratios and with efficiency scores obtained from parametric stochastic frontier analysis.

Chapter 6 – Factors explaining the variations in the efficiency of banks in India and Pakistan

This chapter employs the two-step procedure to examine factors that may explain inter-temporal and intra-temporal variations in the efficiency of banks in India and Pakistan. We regress the efficiency scores obtained through the DEA on various bank-specific variables (e.g. size) and external environmental variables (e.g. the level of competition) by using the method of ordinary least squares and generalised method of moments. Another contribution of this chapter is that we present, and test, hypotheses regarding the possibility of a relationship between banks' efficiency and four environmental variables that are associated with the ESRs in India and Pakistan. These variables are: fiscal deficits, investment liberalisation, competition in the banking industry, and the presence of foreign banks.

Chapter 7 – Summary, conclusions and limitations

This chapter summarises and concludes. The main findings of the present study are outlined. Some policy implications are discussed. The limitations of the study are also highlighted.

Chapter 2 – The Financial Liberalisation in Developing Countries: An overview

2.1 – Introduction

After decades of state-directed resource allocation, many developing countries initiated economic and structural reforms (ESRs) in the early 1980s and 1990s[1]. These ESRs are based on the belief that years of interventionist policies invoked by non-benevolent, corrupt, and rent-seeking authorities have created distortions and inefficiencies into almost all sectors of developing countries (see Krueger, 1990; Chaudhri, 1990). Therefore, to make social and economic institutions work for the process of economic development, it is argued, radical reforms are needed in order to make developing countries more market friendly by reducing the role of the state in *mobilising* and *allocating* scarce economic resources.

The financial liberalisation has been a quintessential, and perhaps the most controversial, component of the on-going ESRs in developing countries (see

[1] It is argued that these ESRs are based on the policy prescriptions of the so-called 'Washington Consensus' (see Williamson, 1990). In his original paper, Williamson coined the term 'Washington Consensus' to refer to the lowest common denominator of policy advice being offered by the Washington-based institutions (i.e. the World Bank and the International Monetary Fund). This includes: (1) fiscal discipline; (2) a redirection of public expenditure priorities towards fields offering both high economic returns and potential to improve income distribution, such as primary health care, primary education, and infrastructure; (3) tax reforms; (4) interest rate liberalisation; (5) a competitive exchange rate; (6) trade liberalisation; (7) liberalisation of inflows of foreign direct investment; (8) privatisation of state owned enterprises; (9) deregulation to abolish barriers to entry and exit of private firms; and (10) strengthening rules to protect private property rights. However, as Williamson (2000) contends, in the recent development policy circles the term 'Washington Consensus' has been wrongly used to signify extreme 'neo-liberalism' and 'market fundamentalism' (see, for example, Ito, 1999).

Williamson, 2000). Until the early 1960s and 1970s, a less than the *socially* optimal level of resource allocation was considered as the primary weakness of financial institutions in developing countries[2]. It was argued that financial institutions in developing countries were exacerbating income inequalities by channelling financial resources to large business groups only and were hesitant to finance sectors considered as the drivers of a socially equitable economic growth (e.g. agriculture and small scale industries) (see Sen and Vaidya, 1998; Arun and Turner, 2002). Therefore, in order to mitigate this *perceived* problem[3], governments in developing countries initiated a policy of strict controls over the *direction* and *price* of scarce financial resources mobilised and allocated by financial institutions (especially by the commercial banking industry).

However, with the advent of the 1980s debt crises[4] and the publication of the seminal work of McKinnon (1973) and Shaw (1973), the policy of excessive government interventions in the financial sector – usually known as 'financial repression' – came under attack. The opponents of financial repression argued that excessive government interventions had repressed the domestic financial system in developing countries, and made this sector inefficient in mobilising and allocating scarce financial resources (see McKinnon, 1973 and Shaw, 1973). Therefore, to enhance the efficiency of financial institutions, the financial liberalisation programme was

[2] See Fry (1995, 1997) for discussion.

[3] It should be noted, however, many economists at that time argued that to attain high level of economic development in the long-run, short term inequality was inevitable (see, for example, Papanek, 1967).

[4] The crises began when on August 12, 1982, Mexican minister of finance informed the International Monetary Fund (IMF) that Mexico would be unable to meet its August 16 obligation to service $80 billion debt. For a review factors leading to the debt crisis, see FDIC (1997) and Cline (1995).

proposed. As noted in chapter 1, the financial liberalisation includes: freeing up exchange and interest rates controls, reduction in state-determined credit policies, a gradual privatisation of public sector banks, the entry of new domestic private banks and non-bank financial institutions, reduced restrictions on the entry and operations of foreign banks, reduction in banks' required reserve ratio, and the liberalisation of capital account (see Caprio et al., 1994). The aim of this chapter is to present a brief review of the literature on the emergence of this financial liberalisation paradigm.

Towards this end, the rest of the chapter is structured as follows. Section 2 highlights the literature on the relationship between the financial sector and economic growth, and on the early development economics literature that favoured state-directed resource allocation. Section 3 presents theoretical arguments for and against the financial liberalisation paradigm, and presents some early empirical evidence on the macroeconomic impacts of the liberalisation. Section 4 sets the agenda for the next chapters by arguing that until recently little attention has been paid to the impact of the financial liberalisation, and other components of the ESRs, on the internal productive efficiency of commercial banks in developing countries. Section 5 concludes.

2.2 – From financial repression to financial liberalisation

2.2.1 – Financial institutions and economic growth

The idea of a possible relationship between the operations of financial institutions, especially banks, and the economic activity of a society is not new. For example, as early as 1767, Sir James Steuart suggested that to stimulate 'industriousness' in the economy, authorities would have to either draw metallic money out of its hoards or, even better, rely on the creation of paper money by 'banks'[5]. Other influential social scientists and economists, such as Thorstein Veblen and John Maynard Keynes, also highlighted the role that financial institutions could play in augmenting the level of investment in the economy (see Veblen, 1965; Keynes, 1936).

However, it was Joseph Schumpeter's 'Theory of Economic Development' (1934) that explicitly theorised the importance of the credit-extending role of financial institutions in fostering the process of economic development, and laid down the foundations for future theoretical and empirical research. The main drivers of economic development, according to Schumpeter, are discontinuous changes in the economic environment brought about by random *entrepreneurial innovations* with the help of smooth *credit markets*. Schumpeter's theory views financial intermediaries, bankers in particular, as key economic agents to uphold entrepreneurs' innovatory activities: 'The banker...is essentially a phenomenon of development...He makes possible the carrying out of new combinations, authoritises people, in the name of society as it were, to form them. He is the ephor of the exchange economy' (Schumpeter, 1934, p. 74).

The contemporary theoretical and empirical literature on the impact of financial institutions on the economic growth of developing countries owes much to the seminal work of Gurley and Shaw (1955), McKinnon (1973), and Shaw (1973). These studies suggest that financial institutions in developing countries could enhance economic growth by increasing the rate of capital formation through the 'institutionalisation of savings'. That is, financial institutions in developing countries

[5] Cited in Itoh and Lapavitsas (1999)

could foster economic growth by mobilising savings and then channelling these funds to borrowers for capital formation. More recent studies, based on the theoretical framework of the so-called 'new growth theory'[6], suggest that financial institutions contribute to economic growth by enhancing the efficiency of capital employed in the economy through a reduction in transaction costs associated with the intermediation process and through a reduction in the problems due to pervasive information asymmetries between savers and borrowers (see Levine, 1997)[7].

2.2.2 – The early development economics and the origin of financial repression

The two World Wars played an important role in the dissolution of the European colonial power and the emergence of a large number of politically independent states in Asia, Africa, and Latin America (see Myrdal, 1968, chapter 4). The chronic economic problems – especially high unemployment and poverty – in these newly independent states reinvigorated the debate on the economic well-being of masses. The 'development economists' formulated grand models to explain the causes of

[6] See Aghion and Howitt (1998) for a review of literature on the new growth theory.

[7] These models usually assume that individuals can choose between unproductive assets (e.g. consumer good) and an investment in a firm. The investment is illiquid as it takes time to become productive. However, the expected returns from the investment are higher than the return from an inventory of unproductive asset. In the presence of uncertainty, some individuals could be forced to liquidate or abandon the investment in firms before it become productive (Bencivenga and Smith, 1991). Therefore, individuals may not be willing to hold investment in firms and all their wealth would be held as unproductive assets. This would, in turn, be detrimental for the process of economic growth. In such a situation, financial institutions, particularly banks, enable individuals to hold deposits which banks then invest in currency and capital (i.e. investment in firms). By exploiting the law of large number, banks, unlike individuals, ensure that they never have to liquidate capital prematurely. In addition, financial institutions specialise in pooling funds and acquiring information that enables them to allocate acquired funds to its highest value, so raising the average return to capital. Thus, the presence of financial institutions could lead to higher accumulation and efficiency of capital (see (Bencivenga and Smith 1991; Greenwood and Jovanovic 1990; Greenwood and Smith 1993; King and Levine 1993a, 1993b; Roubini and Sala-i-Martin, 1992).

underdevelopment, and devised policy prescriptions to help developing countries to catch-up with developed countries[8]. These early models envisaged rapid capital accumulation as a necessary and, in many cases, sufficient condition for economic growth (see Rosenstein-Rodan, 1943; Nurske, 1952; Lewis, 1954; Hirschman, 1958).

Many of the early development economists advocated extensive government intervention in allocating scarce economic resources to foster economic growth. Broadly speaking, governments in developing countries were considered as objective and benevolent guardians of their societies. Markets, on the other hand, were considered as prone to failure due to 'structural rigidities'[9]. Therefore, unlike in developed economies, markets in developing countries were assumed to be ill-equipped to promote capital accumulation in socially beneficial sectors[10].

The policy prescriptions of the early development economics models were highly influential in promoting governments' excessively interventionist stance toward the domestic financial sector. It was argued that financial institutions and markets in developing countries had to play a crucial role in fostering equitable economic growth in developing countries, but their main weakness, it was argued, was less than socially optimal levels of capital provisions[11]. Caprio et al. (2001, pp.4-5)

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[8] For review of development economics, see Meier (2001), Cypher and Dietz (1997), Adelman (2001).

[9] Structural rigidities in this context means a lack of responsiveness to price signals and incentives.

[10] These models were also influenced by the success of Keynesian activism in fighting the Great Depression, and the success of the Marshal Plan to rehabilitate the post-war Europe (see Meier, 2001).

[11] The emphasis on socially optimal allocation of credit through government intervention can be traced back to *Marquis de Condorcet* in 18th century. Condorcet argued that to eliminate poverty, it was preferable for authorities to direct credit to poor so that the rich capitalist class could not exploit them (cited in Hunt, 1979).

describe the origin of excessive government interventions in the financial sector – i.e. the financial repression – as follows:

> The fad of financial repression was associated with the rise of populism, nationalism, and statism. Populist opinion thought of interest rate controls as way of redistributing income. Private bank loans to large business houses or foreigners were standard populist or nationalist targets. A desire to avoid excessive concentrations of power in a few private hands, or to ensure that the domestic financial system was not controlled by foreigners who would be insensitive to long-term national goals, were familiar aspects of this type politics. Social goals could, it was thought, be attained more easily if the activities of major financial institutions were not purely profit driven.

Due to these nationalistic views and the alleged structural rigidities of markets in developing countries, governments in many of these countries intervened heavily in their domestic financial sectors[12] by introducing, *inter alia*, high reserve requirements on depository institutions, low interest rate ceilings on loans and deposits, state-directed credit policies to channel funds to 'priority sectors', nationalisation of financial institutions, and restrictions on the entry/operations of foreign financial institutions to restrict the level of competition for nationalised banks (see Fry, 1995). In a nutshell, the official objective of these interventions was to synchronise the functioning of the domestic financial sector with the overall economic planning designed by the government.

[12] This is not to suggest that governments in developed countries do not intervene in their financial sector. However, unlike in developed countries, the objective of financial repressionist policies was to determining the optimal price and direction of financial resources in order to meet governments' investment and growth targets.

It is argued that initially the objective of these government interventions in the financial sector was to engage in 'financial restrictions' rather than financial repression (see Fry, 1995, p.20-22). Financial restrictions encourage financial institutions from which governments can expropriate significant seigniorage. Therefore, governments in developing countries encouraged commercial banks because 'reserve requirements and obligatory holding of government bonds can be imposed to tap this source of savings at zero or low-interest cost to the public sector. Private bond and equity markets are suppressed through transaction taxes, stamp duties, special tax rates on income from capital, and unconducive legal framework, because seigniorage cannot be extracted [.]' (Fry, 1995, p.20-21). However, in many developing countries, while the need for social control of the domestic financial sector provided the rationale for the financial restrictions, the subsequent intensification of these policies was due in great part to finance governments' growing fiscal deficits by borrowing from financial institutions at state-determined low interest rates (Sen and Vaidya, 1998).

2.2.3 – The case for the financial liberalisation

As mentioned above, the early development economists suggested that markets in developing countries were prone to failure, and advocated extensive government interventions. However, although the rationale for government interventions was to resolve market failures, the results were often government failures that created distortions and inefficiencies in almost all sectors of developing countries (see World Bank, 1983; Sirinivasan, 1985; Krueger, 1990). These 'government failures', which became evident with the advent of the debt crisis of 1980s, led to the revival of the mainstream neoclassical approach to economic development that criticised the price distortions – especially in labour markets, financial sector, and foreign exchange rates – due to excessive government interventions, and advocated radical reforms to make developing countries more market-oriented (see Little, 1982). The policy implications were to correct the price distortions by moving away from inward looking state-directed strategies toward a liberalised market-oriented system – the 'Washington Consensus' (see Adelman, 2001).

Based on the Washington Consensus, the recent decades have witnessed the implementation of the multifaceted financial liberalisation programme in many developing countries across the globe (see Cho and Khatkhate, 1989; Caprio et al., 1994, 2001; Fanelli and Medhora, 1998). The proponents of the financial liberalisation programme argue that due to excessive government interventions, the financial system in developing countries has contracted and the efficiency of financial institutions has deteriorated, which, in turn, has led to widespread bank insolvency and poor economic growth.

a – McKinnon and Shaw

The case against government intervention in the financial sector of developing countries was first put forward by Ronald McKinnon (1973) and Edward Shaw (1973). According to McKinnon and Shaw, the liberalisation of the financial sector from government administered interest rate and credit allocation policies accelerates the rate of economic growth in developing countries. The essential feature of the McKinnon-Shaw framework is its emphasis on the role of financial institutions as intermediaries between savers and borrowers. According to McKinnon and Shaw, saving is a positive function of real interest rates on deposits and real rates of growth in output, while the investment function responds negatively to the effective real loan rate of interest and responds positively to the growth rate (McKinnon 1973; Shaw 1973).

When interest rate ceilings are in place, the amount of deposits mobilised for investment is low (i.e. banks' liabilities contract), which, in turn, decelerates the rate of economic growth. Therefore, even when there are investment opportunities, the economic growth of financially repressed developing countries is constrained by the amount of loanable funds (McKinnon 1973: 56-62; Shaw 1973: 78-82). Also, when ceilings on loan interest rate are present, entrepreneurs with low return projects, who were previously deterred from requesting bank loans, enter the market. An increase in interest rates (to the market-clearing level) due to the liberalisation leads to an increase in the amount that people are willing to hold as financial assets by decreasing the holdings of foreign assets and non-financial (unproductive) assets such as cash, gold, commodities, land, etc. This, in turn, augments the resources available for investment. This is further enhanced if the cost of intermediation by banks were kept low by having a competitive banking structure and minimum taxation on financial intermediation. Despite these similarities, however, there are some differences in McKinnon's (1973) and Shaw's (1973) models.

McKinnon's (1973) model hinges upon on two assumptions: (1) all economic agents are confined to self-finance, and (2) investment opportunities are indivisible. Following Keynes' finance motive, McKinnon argues that all potential investors must accumulate money balances prior to their investment. In this case, the lower the opportunity cost of accumulating real money balances or higher the real deposit rate of interest, the greater is the incentive to invest. McKinnon suggests that as the outside financial resources are usually inaccessible in developing countries, interest rate ceilings adversely affect the level of investment and, therefore, the rate of economic growth. McKinnon's model highlights the 'complementarity' between money and physical capital. That is, to accumulate physical capital, investors have to increase their money balances, and to provide incentive for this increase in money balances, deposits rates need to be high enough. Thus, the financial liberalisation creates more incentives to save and invest, which, in turn, fosters economic growth.

Unlike McKinnon, Shaw (1973) allows the possibility of debt financing and discards the 'complementarity' between money and physical capital[13]. Shaw (1973) emphasises the role of 'debt-intermediation and institutionalisation of savings' through financial institutions in improving resource allocation. The financial liberalisation enhances financial intermediation between savers and borrowers by creating more incentives to save and invest. According to Shaw, financial intermediation is repressed and sub-optimal when, in order to subsidise priority sectors, governments in developing countries impose interest rate ceilings. In a liberalised environment, financial intermediaries raise real returns to savers and lower real costs to borrowers by reducing risk through diversification, reaping economies of scale in lending, and increasing operational efficiency. In addition, raising interest rates also deters entrepreneurs from undertaking low-yielding investments.

[13] Molho (1986) argues that models of McKinnon and Shaw need not be viewed as incompatible with one another because most projects are financed partly with own funds (as in McKinnon) and partly with borrowed funds (as in Shaw). Therefore, the two models complement each other.

b – Extensions of the McKinnon-Shaw framework

Since the seminal work of McKinnon and Shaw, a number of formal economic models have been formulated that advocate the financial liberalisation in developing countries. In these models, money demand is a function of the real deposit rate of interest. When deposit rates are fixed by the government, i.e. when financial repressionist policies are in place, a higher inflation rate reduces demand for money in real terms. This decline in demand for money reduces the liabilities of the banking system, and, therefore, dries up the supply of credit for investment in productive capital. Thus, a ceiling on interest rates reduces the accumulation of productive capital, which, in turn, lowers the rate of economic growth (Cho 1988; Kapur, 1992; Fry 1978)[14].

Even if the deposits and loan rates of interest were allowed to be freely determined, excessive reserve requirements create financial repression because banks' ability to augment capital accumulation through credit provision is restricted. Overall, the policy implications of the McKinnon-Shaw school are that 'economic growth can be increased by abolishing institutional interest rate ceilings, by abandoning selective or directed credit programs, by eliminating the reserve requirement tax, and by ensuring that the financial system operates competitively under conditions of free entry (Fry 1995, p. 60)'.

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[14] See Fry (1995: chapter 3) for a comprehensive review of the extensions of McKinnon-Shaw framework.

c – Critics of the financial liberalisation

Various economists, especially the Structuralists, have criticised the policy implication of the financial liberalisation framework (see, for example, Taylor, 1983; van Wijnberegen, 1983; Studart, 1995). According to the Structuralists' models, the financial liberalisation, characterised by an increase in interest rates, leads to a decline in investment (Taylor, 1983; van Wijnbergen, 1983; Buffie, 1984).

The central presumption of these models is that the unofficial market is more efficient in allocating financial resources than the formal financial sector (e.g. commercial banks). The financial liberalisation, which expands the size of the formal financial sector at the expense of the unofficial market, reduces the amount of credit available for investment because of the reserve requirements in the formal financial sector. Such reserve requirements constitute a leakage in the process of financial intermediation through commercial banks. Therefore, the Structuralists suggest that the financial liberalisation is detrimental for economic growth because it reduces the total credit availability in the economy (see Taylor, 1983; Buffie, 1984).

Van Wijnbergen (1983) argues that the benefits of the financial liberalisation are crucially dependent on a hidden assumption that time deposits are a closer substitute to 'unproductive' assets not providing any intermediation, such as gold or cash, than they are to assets providing more rather than less intermediation than the banking system, such as deposits and loans in the unofficial market. If an increase in time deposits due to an increase in interest rate dries up funds in the unofficial market, rather than substituting unproductive assets, then such an increase may not be useful for economic growth.

d – From financial repression to robust financial restriction

More recently, a new strand of literature has emerged that takes a more balanced approach towards the role of government in the financial sector in developing countries. This strand of literature, though criticizing financial repression, advocates robust government restrictions on the domestic financial sector in developing countries. For example, Stiglitz (1993, 1994) and Stiglitz and Honohan (2001) suggest that purely market-based financial intermediation may not always lead to a socially efficient allocation of financial resources due to the presence of asymmetric information, which is a pervasive phenomenon in the financial sector because borrowers inherently know more about their projects than do the lenders of funds.

Stiglitz (1994) suggests that the presence of information asymmetries may lead to market failures because, as lenders face both moral hazard and adverse selection, they may ration credit at less than market clearing prices to reduce their risk. Also, Stiglitz suggests that costly information may lead to suboptimal monitoring because financial institutions may assume that depositors are not monitoring them, and, therefore, have incentives to undertake high-risk projects. In addition, in the event of one bank's failure, depositors may assume, due to costly information, that there is a high risk for other banks to fail. This could lead to large deposit withdrawals, which, in turn, could make banks insolvent. In the presence of such market failures, Stiglitz (1993, 1994) argues, government intervention in the domestic financial system is justified, and some amount of financial repression may be beneficial until advanced stages of the economic development are achieved.

Stiglitz and Honohan (2001) also advocate government interventions in the financial sector. However, they recognise that the objective of these interventions should not be to bend the functioning of the financial sector toward detailed goals of overall economic planning (i.e. like in the era of financial repression when governments decided the direction of financial resources). Rather, the purpose of these interventions should be to 'recognise the externalities involved in bad banking, and informational limitations of regulation' and to 'restrain financial practitioners from generating the type of severe economic damage that has recently been all too evident in inadequately regulated financial system (Stiglitz and Honohan 2001, p. 53)'. To this end, this strand of literature favours restrictions on interest rates on loans and deposits, restrictions on the portfolio selection of banks, and restrictions on the entry of new private sector banks.

2.3 – Does financial liberalisation work?

The multifaceted nature of the financial liberalisation makes the empirical measurement of its impact rather difficult. In addition, the dissimilar pre-reform socio-economic environment of countries that implemented the financial liberalisation policies make the comparison of success or failure of these policies very complicated. Also, as the financial liberalisation is usually accompanied by other socio-economic reform – fiscal reforms, for instance – it is 'virtually impossible to isolate the effect of financial components of the reform package (Fry 1995, p. 179)'. Some researchers, usually the Structuralists and Post-Keynesians, criticize the financial liberalisation programme for generating financial crises in Latin America and East Asia. Others argue that the failure of the financial liberalisation in some regions is due to the years of financial repression that has left the financial system in developing countries poorly prepared for a liberalised regime.

2.3.1 – Some macroeconomic empirical evidence on the impact of the financial liberalisation

Until the late 1990s, most of the empirical evidence on the effects of the financial liberalisation was based on aggregate macroeconomic data. This literature constitutes country case studies as well as cross-country regression analysis[15]. As the empirical literature on macroeconomic impacts of the financial liberalisation is vast, and as the main objective of the present study is to examine the impact of the financial liberalisation on the efficiency of banks, here we provide only a very brief review of the macroeconomic empirical literature.

a – The financial liberalisation and savings

One way of examining the impact of the financial liberalisation is to evaluate the impact of changes in interest rates on the level of savings in the economy. The basic idea is that the financial liberalisation, which leads to higher real interest rates, should stimulate savings in the economy. These increased savings, in turn, provide resources for investment and economic growth (see Bandiera et al., 2000). The first step in measuring the impact of the financial liberalisation through increased saving is to examine the interest elasticity of savings. That is, whether changes in interest rates influence the savings behaviour of individuals. In this regard, the recent reviews by Srinivasan (1993) and Fry (1995, section 8.2) conclude that there is no consensus on the interest elasticity of savings. This disagreement, Fry (1995, p. 158) suggests,

[15] See, for example, the edited volumes by Caprio et al. (1994, 2001), and Fanelli and Medhora (1998).

'springs from different measure of savings and real interest rates, different theoretical models, different econometric techniques, different samples of developing countries, and different time periods'.

In a recent study, Bandiera et al. (2000), using principal components, construct 25-year time series indices of the financial liberalisation in 8 countries, namely Chile, Ghana, Indonesia, Korea, Malaysia, Mexico, Turkey, and Zimbabwe. Bandiera et al. (2000) employ both country-by-country estimation and panel data estimation to examine the impact of the financial liberalisation on savings. They conclude that there is no strong, and reliable, interest-rate effect on savings.

b – The financial liberalisation and investment

Another way of examining the role of the financial liberalisation is to see whether it influences the level of investment in the economy. Like the relationship between savings and the financial liberalisation, there is no consensus on the relationship between the level of investment and the financial liberalisation. For example, Demetriades and Devereux (1992)[16] find a positive, though insignificant, effect of negative real interest rates on investment in a pooled time-series for 63 developing countries over the period 1962-1990. They conclude that financial repression, by lowering the marginal cost of borrowing, stimulates investment. In contrast, Dailami and Giugale (1991) find a positive relationship between real interest rates and private investment ratios in Columbia and India over the period 1965-1985.

[16] Cited in Fry (1995, section 8.3).

c – The financial liberalisation and economic growth

A simple way of examining the impact of the financial liberalisation is to evaluate whether or not it is accompanied by a higher rate of economic growth. However, as mentioned earlier, it should be noted that due to the multifaceted nature of the ESRs, including the financial liberalisation programme, it is virtually impossible to attribute any change in economic growth to any particular components of the reforms process. Various studies try to examine the effect of the financial liberalisation by using a reduced-form equation in which real interest rates are used as a proxy for the financial liberalisation or repression (i.e. positive real interest rate for the financial liberalisation and negative for financial repression).

World Bank (1989) divides 34 developing countries in three groups: the first group exhibit positive real deposit rates, the second moderately negative (less than 0 but greater than –10), and the third group displays highly negative deposit rates (lower than –10). The study finds that economic growth, proxied by GDP growth, in the countries with highly negative real deposit rates is considerably lower than the growth in the countries with positive real deposit rates. Therefore, the World Bank's study suggests that financial repression, which represses the interest rate, is detrimental for economic growth.

Fry (1981) suggest that on average 1 percentage point increase in the real deposit rate (due to the financial liberalisation) on interest towards its competitive free-market equilibrium level is associated with a rise in the rate of economic growth of about half of percentage point. For 53 countries over the period 1960-85, Roubini and Sala-i-Martin (1992) also find some evidence suggesting that countries with real interest rates less than –5% in the 1970s experienced growth rates that averaged 1.4 percentage points less than growth rates in countries with positive real interest rates.

d – The financial liberalisation and financial fragility

In a recent paper, Demirgüç-Kunt and Detragiache (2001) attempt to investigate the connection between the financial liberalisation and financial fragility. Their main argument is that the 'financial liberalisation, by giving banks and other financial intermediaries more freedom of action, can increase the opportunities to take on risk, thereby increasing financial fragility...If prudential regulation and supervision are not effective at controlling bank behaviour and realigning incentives, [the] liberalisation may increase financial fragility well above what is socially desirable'[17] (Demirgüç-Kunt and Detragiache, 2001, p.96).

To identify the impact of the financial liberalisation on financial fragility, Demirgüç-Kunt and Detragiache (2001) estimate the probability of banking crises using a multivariate logit model, and test the hypothesis that a dummy variable capturing whether the financial system is liberalised or not significantly increases the probability of a crises when other factors are controlled for. Demirgüç-Kunt and Detragiache (2001) find that, besides low GDP growth, high inflation, adverse terms of trade, high real interest rates, the probability of banking crises is strongly positively correlated with the financial liberalisation. This may suggest that the financial liberalisation is a significant factor leading to banking sector fragility. In addition, they find that the effect of the financial liberalisation on banking fragility

[17] Some risk is not bad as high risk, high return investments may dominate low risk, low return ventures (Demirgüç-Kunt and Detragiache, 2001, p.96).

does not appear to be characteristic of the immediate aftermath of change in policy, but rather 'it manifests itself only over time' (p.105).

2.3.2 – Prerequisites and sequencing of the financial liberalisation programme

The above brief discussion on the empirical relationship between the financial liberalisation and economic performance suggests that there is no clear evidence on whether the financial liberalisation is beneficial for developing countries. Moreover, some studies even suggest a negative relationship between the financial liberalisation and economic performance. To support the financial liberalisation paradigm in the presence of this controversial empirical evidence, it is argued that:

> '[t]he basic problem lies in the perverse reaction to higher interest rate by insolvent (or non-profit-motivated) economic agents – governments, firms or individuals. By definition, an insolvent agent (one whose liabilities exceed its assets) or 'distress borrower' is unable to repay its loans. Hence, it is not deterred from borrowing by higher cost. It simply continues, if it can, to borrow whatever it needs to finance its losses. These inevitably increase with an increase in the interest rate which drives up the agent's cost of servicing loans (Fry, 1997, p. 758)'.

For example, in a widely cited paper, Diaz-Alejandro's (1985) attempts to examine the failure of the financial liberalisation programme in several Latin American countries, especially in Chile, during the 1960s and 1970s. Diaz-Alejandro (1985) suggests that the key reasons for this failure were, inter alia, transfer of ownership of public sector banks to private owners *without investigating the credentials of these new owners, lack of proper supervision, credibility of government's announced policy of not bailing out the failing financial institutions, and huge capital inflows in* *the presence of appreciating exchange rates.* To avoid such a situation, many recent studies have commented on 'prerequisites' and 'sequencing' of a successful financial liberalisation programme (see Nsouli et al., 2001). Fry (1995, 1997) suggests the following prerequisites for a successful financial liberalisation programme:

1- Adequate prudential regulation and supervision of commercial banks, implying some minimal level of accounting and legal infrastructure.
2- A reasonable degree of price stability.
3- Fiscal discipline taking the form of a sustainable government borrowing requirement that avoids inflationary expansion of reserve money by the central bank either through direct domestic borrowing by the government or through the indirect effect of government borrowing that produces surges of capital inflows requiring large purchase of foreign exchange by the central bank to prevent exchange rate appreciation.
4- Profit-maximising, competitive behaviour by the commercial banks.
5- A tax system that does not impose discriminatory explicit or implicit taxes on financial intermediation.

Besides these prerequisites, appropriate *sequencing* of the overall economic and structural reforms is essential to achieve the underlying objectives of the financial liberalisation, as well as the other elements of the reforms. The sequencing of reforms refers to the order in which either macroeconomic policy actions or specific reforms are introduced. Sequencing involves the order in which reforms are undertaken *across* sectors (for example, whether fiscal adjustment or stabilisation should be prerequisites for introducing current account liberalisation or decontrolling prices) and the order in which reforms are undertaken *within* sectors (for example, whether in the case of capital account liberalisation, foreign direct investment or short-term capital flows should be liberalised first) (see Nsouli et al., 2001). In the case of developing countries, many papers suggest that the financial liberalisation should precede capital account liberalisation (especially short-term capital) and follow fiscal and monetary stabilisation (see McKinnon, 1991; Edwards, 1990). This recent strand of literature on the prerequisites and sequencing of the financial liberalisation suggests that there is no question that financial repression inhibits growth, the debate in economics should concentrate on how to devise a programme that can help a transition from financial repression towards the financial liberalisation.

2.4 – The financial liberalisation and the efficiency of commercial banks in developing countries

As noted in chapter 1, a key stylised fact of the financial sector in almost all developing countries is that most of the intermediation between savers and borrowers is carried out by commercial banks. The size of other financial institutions and market is insignificant relative to that of the commercial banking industry (Fry, 1995). Given the importance of commercial banks in developing countries, it is imperative to examine how efficient these intermediaries are in performing their functions.

The early theoretical and empirical literature on banks in developing countries emphasised their 'allocative efficiency', and endeavoured to examine whether the financial liberalisation process has enhanced this efficiency (see, for example, Schiantarelli et al., 1994). This literature emphasises the inherent information asymmetries in financial markets, i.e. borrowers have more information on their investment in comparison with lenders[18]. The empirical studies, therefore, attempt to examine whether financial intermediaries could minimise these information asymmetries through information gathering and monitoring. In this context, Jaramillo et al. (1992), using a panel of 420 Ecuadorian firms, examine the allocative efficiency of banks before and after the implementation of the financial liberalisation. They find that, ceteris paribus, the flow of funds to technically more efficient firms increased after the liberalisation. Therefore, they argue that the financial liberalisation enhanced banks' allocative efficiency as banks become more efficient in differentiating between good and bad borrowers.

Starting in the late 1990s, following the empirical literature on financial institutions in developed countries, a new strand of literature has emerged that attempts to examine the 'productive' efficiency of banks in developing countries. The productive efficiency of a firm refers to its ability to 'determine optimal mix of inputs' (price/allocative efficiency), and 'optimally utilise the determined inputs' (technical efficiency)[19]. One key function of commercial banks in developing countries is intermediation between savers and borrowers, i.e. mobilising funds and lending the acquired funds to borrowers (see Fry, 1995, p.294). Therefore, productive efficiency, in the context of banking firms, refers to their ability to intermediate with given

[18] The information asymmetries could lead to 'adverse selection' and 'moral hazard' problem. Adverse selection is the problem that occurs before a loan is negotiated. While moral hazard problem arises after the loan is advanced (see Stigliz and Weiss, 1981).

[19] These concepts, and parametric and non-parametric frontier techniques to measure them, will be discussed in detail in the following chapter. It should be noted that unlike the early empirical literature that referred to the 'allocative efficiency' of financial institution as their ability to lend to projects with highest returns, the use of the term 'allocative efficiency' in this recent literature is related to the production process of banks. In rest of this thesis, we will use the term 'allocative efficiency' to refer to determination of the optimal set of inputs.

resources. Given the importance of commercial banks in developing countries, it is important for policy makers, academics, and bank managers to examine the productive efficiency of these intermediaries because:

> "Greater [productive] efficiency might be expected to lead to improved financial products and services, a higher volume of funds intermediated, greater and more appropriate innovations, a generally more responsive financial system, and improved risk-taking capabilities if efficiency gains are channelled into improved capital adequacy position" (Gardener, 1995, p.7).

The examination of the productive efficiency of commercial banks is especially germane to those developing countries that initiated the economic and structural reforms to eliminate the alleged distortions and inefficiencies created by the decades of state-interventionist policies. Also, Fry (1995, p. 322) suggests that the failure of the financial liberalisation programme in many developing countries is due to high intermediation cost that banks in these countries incur. The high intermediation cost, we submit, could be due to low productive efficiency of banks in determining the optimal set of inputs and optimal utilisation of these inputs to carry out their intermediation function. Therefore, it is important to measure the efficiency of banks in developing countries, and to examine whether the financial liberalisation process has enabled and encouraged banks to improve their resource utilisation.

However, until the late 1990s, little empirical research had gone into the measurement of the productive efficiency of banks in developing countries before and after the implementation of the financial liberalisation. At least two reasons could be forwarded for this lack of research. *First*, as reviewed in the previous sections, the main emphasis of early empirical studies on the financial liberalisation in developing countries was 'macroeconomic' impacts of the financial liberalisation. That is, the early empirical studies endeavoured to examine how the financial liberalisation influenced the level of savings, investment, domestic private credit, or economic growth in developing countries. *Second*, as recent studies have noted, the empirical literature on the efficiency of financial institutions has been largely directed towards the financial institutions in developed countries, especially in the US (Berger and Humphrey 1997, Isik and Hassan 2003). In addition, the unavailability of microeconomic data on the annual accounts of banks, which are required to employ the contemporary frontier techniques to measure banks' efficiency, could have contributed to this lack of empirical investigation.

Following the empirical studies on the impact of financial deregulation in the United States and Europe, a handful of recent studies have measured the productive efficiency of banks in developing countries, and some of these studies have sought to examine whether the financial liberalisation has had any impact on the measured efficiency. This strand of literature suggests that the financial liberalisation can influence the productive efficiency of banks by altering the market structure of the banking industry and by changing the regulatory framework under which banks operate. Market structure consists of the degree of competition, concentration, and demand for services provided by banks. Changes in the regulatory framework refer to deregulation of interest rates and priority sector lending, reduction in reserve requirements, and so forth. We will review these recent empirical studies in some detail in the next chapter after reviewing the frontier techniques that they employ to measure the productive efficiency of banks. In addition, we will review the transaction costs/property rights approach, the behavioural theory of the firm, and the X-efficiency theory to understand why firms might not be able to utilise their resource efficiently.

2.5 – Summary and conclusion

The economic and structural reforms in developing countries primarily include fiscal reforms to curtail governments' budget deficits, reductions in tariffs on international trade, dismantling of barriers on private (domestic and foreign) investment, privatisation of state-owned-enterprises, and the financial liberalisation. This chapter presented a very brief review of the theoretical and early empirical literature on the financial liberalisation in developing countries.

Prior to the financial liberalisation, governments decided the *direction* and *price* of financial resources. However, with the seminal work of McKinnon and Shaw, these policies of heavy government interventions confronted strong criticism: it was argued that the governments' interventions had repressed the domestic financial system in the developing countries, and made this sector inefficient in mobilising and allocating scarce financial resources. To enhance the efficiency of the domestic financial sector in mobilising and allocating financial resources, the financial liberalisation was proposed.

We argued that until the late 1990s, the empirical literature on the financial liberalisation largely concentrated on evaluating the macroeconomic impacts of the liberalisation, and little attention was paid to the empirical investigation of the impact of the financial liberalisation programme on the productive efficiency of individual financial institutions operating in these countries. The reason for this, we argue, was that the early literature – empirical as well as theoretical – implicitly considered financial institutions as 'rational profit maximising agents' that respond objectively to the changes in environment (e.g. increased competition) brought about by the financial liberalisation process, and exert maximum effort to utilise their resources. Starting in the late 1990s, some empirical studies have empirically investigated whether the financial liberalisation influences the productive efficiency of financial institutions operating in developing countries. In the next chapter, we turn to this more recent literature.

Chapter 3 – Productive Efficiency: Meaning, Measurement, and Empirical Evidence on Banks in Developed and Developing Countries

3.1 – Introduction

The previous chapter briefly reviewed the early theoretical and empirical literature on the financial liberalisation programme in developing countries. It was argued that most of the early empirical literature was primarily concerned with macroeconomic changes – changes in the level of savings and investments, for instance – brought about by the liberalisation programme. Starting in the late 1990s, a new strand of literature has emerged that, following the empirical literature on the efficiency of banks in the US and Europe, attempts to examine the impact of the liberalisation on the internal productive efficiency of banks in developing countries. This recent literature hypothesises that the implementation of the financial liberalisation programme encourages and enables banks to improve their resource utilisation by reducing government interventions and by creating a flexible and competitive environment in which banks have more control over their inputs and outputs. This chapter reviews this recent empirical literature.

Before reviewing this literature, however, we briefly discuss various theories of the firm. The aim of this discussion is to highlight the fact that the traditional neoclassical theory of the firm, which views the firm as a unified rational economic agent, ignores the issue of the internal efficiency of the firm. We briefly discuss the transaction costs/property rights approach, the X-efficiency theory of the firm, and the behavioural theory of the firm, which enable us to understand why firms may not be able to utilise their resources optimally. We then discuss frontier techniques that enable one to determine empirically whether a firm is efficient relative to other similar firms.

The rest of the chapter is structured as follows. Section 3.2 reviews the theories of the firm and highlights why firms may not be able to utilise their resources efficiently. Section 3.3 reviews five frontier techniques used to measure the efficiency of firms, and outlines various approaches used to specify inputs and outputs to measure the efficiency of banks using these frontier techniques. Section 3.4 reviews the empirical literature on the efficiency of banks in developing countries. Section 3.5 concludes.

3.2 – Internal productive efficiency and the theory of the firm

3.2.1 – The concept of efficiency in economics

Since the late nineteenth century, the Business and Management literature has paid considerable attention to the efficient utilisation of resources by firms (see Witzel, 2002). For example, leading figures of the Scientific Management literature, such as Frederick Winslow Taylor, emphasised measuring and improving the efficiency of firms by breaking down their operations into component parts, and then studying each component and looking for areas where improvements (i.e. reduction in inputs and/or increase in outputs) could be made (Taylor, 1911). In contrast, economics has traditionally endeavoured to expound the 'allocative efficiency' of *markets*. That is, how efficiently markets allocate scarce resources using the price mechanism; the internal productive efficiency of firms was traditionally considered as an issue for engineers rather than economists (see Henderson and Quandt, 1980)[1].

However, starting with the seminal theoretical work of Koopmans[2] (1949, 1951) and Debreu (1951), and the empirical work of Farrell (1957), a plethora of economic research endeavours to explain the internal productive efficiency of firms. Within this contemporary economics literature, the efficiency of a firm is usually decomposed into the firm's ability to (1) 'determine *optimal* mix of inputs according to their marginal productivity given the prices of their inputs', and (2) 'utilise the determined mix of inputs to produce the *optimal* level of outputs' (see, Farrell, 1957). The former is known as 'allocative/price efficiency', while the latter is known as the 'technical efficiency' of the firm[3].

It should be noted that the contemporary empirical literature considers efficiency as a relative, rather than absolute, phenomenon as it measures the ability of the firm to *determine* and *utilise* inputs relative to an estimated/calculated optimal standard of performance[4]. Also, it should be noted that to establish whether the firm is efficient relative to any specified standard of performance, one needs to specify, in advance, the inputs and outputs of the firm. This may be easy for manufacturing firms that

[1] As Pigou stated '...it is not the business of economists to teach woollen manufacturers how to make and sell wool, or brewers how to make and sell beer' (quoted in Koopmans' Noble Prize lecture).

[2] Tjalling Koopmans' influential work on optimal utilisation of resources won him the Nobel Prize in economics in 1975.

[3] The allocative efficiency in this context refers to allocation of resources within firm rather than allocation of resources by markets using the price mechanism.

[4] In section 3.3, we will review the Frontier Techniques that measure relative efficiency of firms by constructing a 'benchmark' production frontier obtained through either econometric estimation of cost/profit/production function or piece-wise linear combination of input-output ordered *n-tuples* of homogenous firms in a given sample.

employ a standard measurable input, say machine hours, to produce a standard measurable output. However, there are cases when a precise definition of firms' inputs and outputs is not available. This issue, as we shall see in section 3.4.4, is particularly relevant to the measurement of the efficiency of banking firms.

3.2.2 – The traditional neoclassical theory of the firm

The standard neoclassical theory views the firm as a 'rational economic entity' striving to maximise a well-defined objective function, usually profit maximisation (see Henderson and Quandt, 1980; Cyert and March, 1992). Towards this end, the firm transforms input(s) into output(s) in the face of a technologically-determined 'production function' or the 'state of the art'. The production function in this context is a *known* relation between factors of production and their corresponding outputs. Assuming that the firm is operating in a perfectly competitive market, maximisation of profit (i.e. the equilibrium position) is achieved by determining the optimal mix of inputs by equating the marginal product and marginal cost of the factors of production, and output is determined by equating marginal cost with marginal revenue (where marginal revenue in perfect competition is given by a perfectly elastic demand curve).

Other characteristics of this traditional neoclassical theory of the firm are (see De Alessi, 1983, p. 65): (1) transaction costs are zero (e.g. the costs of obtaining information about alternatives and of negotiating, monitoring, and enforcing contracts are zero); (2) adjustment is instantaneous (i.e. the firm is assumed to make quick costless adjustments to any changes in its external environment); (3) all resources are fully allocated and privately held (i.e. the issue of agency between owner and manager is assumed away); (4) owners allocate resources to productive purposes purely in response to pecuniary incentives; and (5) any shirking by owners and employees (including managers) is ruled out. This representation of firms reveals little curiosity regarding the internal productive efficiency because firms, by assumption, always exhibit allocative efficiency as they determine the optimal mix of inputs according to the marginal cost and marginal product of their inputs, and exhibit technical efficiency as they optimally utilise the determined mix of inputs according to a known production function[5].

3.2.3 – Extensions of the traditional theory of the firm

One key reason for the lack of emphasis on the internal operations of firms within the traditional theory is the implied asymmetry between the demand side of the microeconomics theory, which lays emphasis on individual consumers as the ultimate building block of consumer theory, and the supply side of the theory, which lays emphasis on the firm as the ultimate building block of production theory and not the individuals associated with the firm (see De Alessi, 1983; Ricketts, 2002). The firm in this tradition, as discussed above, is a mere production function converting inputs into outputs. However, starting in the 1950s, dissatisfaction with this simplistic view of the firm grew. It was argued that, unlike the neoclassical theory's representation of the firm as a unified rational entity,

[5] This theory of firm under perfectly competitive environment has been elaborated by taking into account different market conditions, such as imperfect competition. These elaborations, while consider various market conditions, retain the basic framework and decision-making process within firms. That is, firms are considered as rational economic entities constantly equating all costs and benefits in a changing external environment.

> '[t]he modern "representative firm" is a large, complex organisation. Its major functions are performed by different divisions more or less coordinated by set of control procedures. It ordinarily produces many products, buys and sells in many different markets. Within the firm, information is generated and processed, decisions are made, results are evaluated, and procedures are changed. The external environment of the firm consists, in part, of other firms with comparable characteristics. *If the market completely determined the firm's economic behaviour, these internal attributes would be little more than irrelevant artefacts. But the market is neither so pervasive nor so straightforward.*' (Cyert and March, 1992, p.2; *emphasis added*).

Therefore, to take into account this complex nature of the firm, economists have extended the simplistic view by recognising the firm as a nexus of contracts among various 'opportunistic' individuals. The most influential amongst these extensions are: the transaction costs/property rights approach, the behavioural theory of the firm, and the X-efficiency theory (see Cyert and March, 1963; Leibenstein, 1979; Alchian and Demsetz, 1972; Williamson, 1975). The first two approaches endeavour to explain various organisational phenomena (such as, why do firms exist? what are the benefits of different organisational structures? What are the impacts of various patterns of property rights?). The third approach, however, only concentrates on the presence of the so-called X-inefficiency (i.e. less than optimal utilisation of resources) in firms. As the literature on these theories is vast, here we only present a very brief overview that will enable us to see why firms may not always be able to utilise their resource efficiently.

a – The behavioural theory of the firm

The behavioural theory by the Carnegie School endeavours to explain how firms make economic decisions regarding inputs, outputs, prices, investments, and so forth (see March and Simon, 1958; Cyert and March, 1992). Unlike the traditional neoclassical theory of the firm, which views the firm as a unified rational agent striving to maximise its profits, the behavioural theory views the firm as a coalition of various participants such as owners, managers, employees, investors, customers, and so forth (see Douma and Schreuder, 1998, chap. 6). Basic to the idea of the coalition is the expectation that individual participants may have substantially different preference orderings (i.e. goals). These participants receive payments from the firm and, in return, contribute to the operations of the firm. The payments to and demands of the participants are in the form of a variety of money payments, perquisites, policies, personal treatments, and private commitments.

As we noted earlier, in the neoclassical theory of the firm, the firm is assumed to have a single well-defined objective, usually profit maximisation. In the behavioural theory, as the firm is viewed as a coalition of individuals with conflicting goals, this standard neoclassical approach of defining the firm's goal breaks down. One key feature of the behavioural theory is its emphasis on the formation of the goals of the firm through *a bargaining process among the individual participants.* The bargaining power of each participant depends on his/her contributions towards the coalition. Therefore, unlike in the neoclassical theory, the firm in the behavioural theory may not have a single clearly defined objective.

This way of looking at the firm's goals is particularly relevant to our study of the efficiency of banks in the context of developing countries because banks in developing countries sometimes seem to follow multiple, and often conflicting, goals. For example, on the one hand, banks in developing countries provide services (e.g. loans and deposits) to earn profits. On the other hand, governments in developing countries usually require banks to channel their mobilised fund to the so-called priority sector at low interest rates. Towards this end, governments influence banks' objectives either directly (i.e. through nationalisation) or indirectly (i.e. through various policy directives). In both the cases, governments are influential in determining the asset portfolio of banks in developing countries and, hence, the goal of banks.

The effort of individuals working within a bank to achieve one goal may not result in the accomplishment of the other goal. For example, if, on government's directions, banks try to maximise the amount of loans to priority sectors at low interest rates, their earnings may decline. Therefore, even if banks are efficient in generating earning assets (including loans to priority sectors), they may not be efficient in generating revenues from these assets. In this context, we submit, the implementation of the financial liberalisation programme could play a key role in reducing governments' influence on the objectives of banks through (1) a gradual privatisation of public sector banks, and (2) a gradual elimination of directed credit schemes and interest rate ceilings. In chapter 5 and 6, we will see how the efficiency of banks varies when two different input-output models are considered: one based on banks' income-based objective and other based on loan-based objective. Furthermore, we will examine whether the efficiency of banks from the two models has converged during the post-financial liberalisation era.

Another relevant feature of the behavioural theory is the presence of 'organisational slack'. Within the behavioural theory, the coalition among various participants is viable only if the payments made to these participants are adequate to keep them in the firm (i.e. according to their *aspiration level*). If resources exist to meet all the demands of these participants, and those resources are distributed so as to meet the demands, the coalition survives. The coalition's demands are analogous to the factor prices in the traditional theory of firm. However, in the behavioural theory, Cyert and March (1992) suggest, as the information on *actual* factor prices is hard to obtain, easily misinterpreted, and often unreliable, there is usually a disparity between the resources available to the organisation and the payments required to maintain the coalition. This difference between total resources and total necessary payments is called the *organisational slack*. In conventional economic theory slack is zero (i.e. an input is employed if and only if its marginal product exceeds its marginal cost, assuming that marginal product and marginal cost is known). This is not the case in the behavioural theory. Furthermore, Cyert and March (1992) suggest that when the environment becomes less favourable for the coalition (e.g. due to increased competition), resource scarcity brings on a renewed bargaining and tends to cut heavily into the excess payments that existed earlier. However, this 'does not necessarily mean [that] slack is deliberately created for such stabilising' because slack arises from the bargaining and decision process within the firm 'without conscious intent on the part of the coalition members to provide stability to the organisation' (Cyert and March, 1992, p. 41-44).

This feature of the behavioural theory could be relevant to this study when we compare the efficiency of public sector banks and private sector banks before and after the initiation of the financial liberalisation programme in India and Pakistan. Prior to the liberalisation, public sector banks were required to extend their branch network to rural and sub-urban areas. Also, as public sector banks hired on the basis of political affiliation of applicants, their staff grew rapidly prior to the liberalisation. The higher expenses of public sector banks due to these factors could be considered as the organisational slack i.e. excessive expenses that could be reduced without hampering banks' operations. Prior to the liberalisation, public sector banks had a guaranteed market because of the lack of competition due to governments' restrictions on the operations of private sector banks (domestic and foreign). Therefore, the slack continued to persist. However, after the initiation of the financial liberalisation, public sector banks in India and Pakistan, as well as in many other developing countries, are expected to rationalise their resource use to survive the competition from private sector banks. Therefore, it could be argued that with increasing competition, the organisation slack in public sector banks would decline.

Another feature of the behavioural theory that is relevant to the internal productive efficiency of the firm is that of 'organisational choice'. According to the traditional neoclassical theory, the firm 'maximises', i.e. it decides after a careful calculation of the costs and benefits of all available alternatives. This is based on two assumptions: (1) the firm knows about all the available alternatives, and (2) the firm is able to compare the costs and benefits of these alternatives. According to the behavioural theory, the firm has to make decisions under the conditions of partial ignorance (see March and Simon, 1958; Douma and Schreuder, 1998). Instead of maximising, the firm in the behavioural theory is engaged in 'satisficing', i.e. doing the best to survive comfortably instead of exploring all the alternatives (see Simon, 1955). Also, in contrast to the traditional theory, individuals (i.e. the participants in the coalition) in the behavioural theory exhibit 'bounded rationality' (Simon, 1955). This means that, due to cognitive limitations, the participants may not be able to evaluate the costs and benefits of all the available alternatives. The presence of bounded rationality and satisficing behaviour could also be one cause of relative productive inefficiency of firms.

b – The transaction costs/property rights approach

The property rights approach extends the traditional neoclassical theory of the firm in at least three important ways (see Furubotn and Pejovich, 1972; De Alessi, 1983; Douma and Schreuder, 1998; Ricketts, 2002). First, instead of a unified rational entity, the firm is viewed as a coalition of opportunistic individuals, who are assumed to maximise their utility subject to the limits established by the existing organisational structure. The objectives of individuals working inside the firms may be different from the profit maximising objective of the firm. The assumption of opportunism suggests that some economic actors are "self-interest seeking with guile" (Williamson, 1975, p. 26)

Second, unlike the neoclassical theory, transaction costs are recognised as being greater than zero. That is, it is recognised that, due to adverse selection and moral hazard, the costs of obtaining information about various alternatives and of negotiating, monitoring, and enforcing contracts are not zero.

Third, this strand of literature takes into account the effects of various patterns of property rights on the decision-making behaviour of individuals associated with the firm. This, in turn, influences the resource allocation and utilisation within the firm. The pattern of property rights is important because

> '[t]he value of any good exchanged depends, *ceteris paribus*, on the bundle of property rights that is conveyed in the transaction. For example, the worth of a house to an individual will be relatively greater if the bundle of property rights acquired contains the right to exclude gasoline stations, chemical plants, etc. from the immediate vicinity of the house. It follows that the set of various property rights held over resources enters into the utility function of the decision maker. Consequently, *a change in the general system of property relations must affect the way people behave and, through this effect on behaviour, property rights assignments affect the allocation of resources, composition of output, distribution of income*, etc.' (Furubotn and Pejovich, 1972, p. 1139; *emphasis added*).

This extension of the theory of the firm by recognising the firm as a coalition of opportunistic individuals, and by taking into account positive transaction costs and the impact of different patterns of property rights can enable us to understand why firms may exhibit productive inefficiency. For example, Oliver Williamson (1963) highlights the possible effects of *managerial discretion* on the resource allocation decisions within firms. In Williamson's framework, managers of the firm, instead of maximising profits of the firm, maximise their own utility, which depends on salary, security, power, status, prestige, professional excellence, and so forth. Williamson then introduces the concept of 'expense preference' according to which, managers are not neutral towards different kinds of costs, i.e. some types of expenses are preferred over others. In particular, 'staff expenses, expenditures for emoluments, and funds available for discretionary investment have value additional to that which derives from their productivity' (Williamson, 1963, p. 1034). This utility maximisation by the firm's managers through their expense preference may augment the firm's costs without increasing outputs, which, in turn, impede the firm's ability to allocate and utilise resource in an efficient manner.

In their influential paper, Alchian and Demsetz (1972) suggest that the essence of the firm is that it permits people to work as a team. They suggest that, in an organisation (i.e. firm) a failure to reward without regard to the productive effort of individuals will distort the incentive to engage in any productive effort. The organisation, therefore, is required to 'meter input productivity' and 'meter rewards'[6]. If organisation meters poorly, with rewards and productivity only loosely correlated, then productivity will be smaller. In the traditional neoclassical theory, Alchian and Demsetz (1972) argue, rewards of inputs are allocated, without any costs, according to their marginal productivity. However, 'team production' makes metering costly because '[i]n team production, marginal products of cooperative team members are not so directly and separably (i.e. cheaply) observable' (p. 780). That is, within a team, 'production is not a sequence of identifiable stages by which a series of intermediate products are gradually transformed into final output. Rather, the final output is the joint result of the combined efforts of all the inputs working at the same time' (Ricketts, 2002, p. 98-99).

Within the firm, if it were costless to detect the behaviour/productive effort of individual members of the team, nobody would have an incentive to shirk, because

[6] By metering, Alchian and Demsetz refer to measurements and control.

nobody could impose cost of his/her shirking on the other member of his/her team. The shirking by one member of the team may affect the productivity of the other member of the team. However, 'since costs must be incurred to monitor each other, each input owner will have more incentive to shirk when he works as part of a team, than if his performance could be monitored easily or if he did not work as a team (Alchian and Demsetz, 1972, p. 780). In the presence of metering costs (i.e. monitoring, detecting, and policing costs) each individual has more incentive to shirk and to take more leisure (one argument of his/her utility function) rather than engaging in the productive effort. Therefore, the presence of opportunistic behaviour and transaction costs may hinder the optimal resource utilisation that is otherwise attainable.

If shirking is to be checked, someone must have both the right to monitor the performance of team members and sufficient incentive not to shirk himself. To this end, he must possess specific property rights including: (1) the right to receive the residual after all other inputs have been rewarded, (2) the right to terminate and revise the membership of the team, and (3) the right to sell these two rights (see Furubotn and Pejovich, 1972). This bundle of property rights defines ownership of the classical capitalist firm. Alchian and Demsetz then discuss, by considering how the attenuation of the basic property rights affects the actions of decision makers, metering costs in different organisational forms, such as profit-sharing firms, corporations, and non-profit firms. This emphasis on the private property rights could be useful in explaining differences in the efficiency, if any, of public sector and private sector banks.

c – The X-efficiency theory of the firm

In a series of papers, Leibenstein suggested that firms might not always engage in optimal utilisation of their inputs. Leibenstein called this under-utilisation of inputs the 'X-inefficiency', where *X* represents an unknown factor responsible for a non-allocative type of inefficiency within firms (see Frantz, 1997). Leibenstein (1966, 1979) argued that the traditional neoclassical theory of the firm, which considered firms as a mere mathematical relationship between inputs and outputs, did not explain why firms might under-utilise their outputs. To explain this so-called X-inefficiency of firms, Leibenstein formulated his X-efficiency theory.

According to Leibenstein, X-efficiency differs from, and contributes to, the traditional theory of the firm in five ways (see Table 3.1). First, unlike the traditional theory, Leibenstein's X-efficiency theory focuses on individuals working in the firm rather than considering the firm as a unified entity striving to maximise profits. Second, Leibenstein assumes that individuals exhibit 'selective rationality'. According to the 'selective rationality' assumption, individuals, on the one hand, want to adhere to standards and strive to be attentive and calculating to attain the maximum. Leibenstein refers to this aspect of individuals' personality as the 'superego function (i.e. the part of the mind that acts as a self-critical conscience, reflecting social standards)'. On the other hand, sometime individuals *select* to engage in a decision-making behaviour that is not calculative and attentive. Leibenstein refers to this aspect as the 'id function (i.e. the part of the mind in which innate instinctive impulses and primary processes are manifest)'. The X-efficiency theory postulates that, on average, each individual is influenced by both the functions in a way that leads to a compromise between the two.

Third, the X-efficiency theory assumes that labour contracts are incomplete. That is, the payment side of a labour contract is clearly specified but the effort side is not. Consequently, due to this incomplete labour contract, workers have discretion over how much effort they want to put into their work (Frantz, 1997). Fourth, Leibenstein assumes that functional relations are surrounded by inert areas within which changes in certain values of independent variables do not result in changes in dependent variables. Finally, Leibenstein assumes that, within the firm, there is a conflict of interest between agents and principals (e.g. managers and employees).

With these five elements, Leibenstein attempted to explain that firms might not always utilise their resources efficiently because firms' managers are not 'completely in command of the full spectrum of the decision-making process. Management must cope with each worker's motivation preference, and in some instances the latter are so complex, even at points contradictory, that a 'best' outcome is not more than management's collective (but no less subjective) conclusion that it has done as much as it can, and whatever that was it was good enough to keep the firm economically afloat' (Dean and Perlman, 1998).

Within the X-efficiency theory, the utilisation of resources depends primarily on the level of effort of individuals within the firm. The level of effort depends on internal pressure (i.e. pressure from peers or managers) and external pressure (e.g. pressure due to increasing competition). In the context of our study, it could be argued that the increase in the level of competition in the commercial banking industry brought about by the entry of new private (domestic and foreign) banks, as well as the entry of non-bank financial institutions, could enhance the level of pressure on individuals operating within banks. This, in turn, could influence the level of internal efficiency (i.e. X-inefficiency) of banks in India and Pakistan.

Table 3.1 – A comparison of the X-efficiency theory and the neoclassical theory

Components	X-efficiency Theory	Neoclassical theory
Units	Individuals	Households and firms
Psychology	Selective rationality	Maximisation or minimisation
Contracts	Incomplete	Complete
Effort	Discretionary variable	Assumed given
Inert areas	Important variable	None
Agent-principal	Differential interest	Identity of interests

Reproduced from Leibenstein (1979, p.3)

3.3 – The measurement of efficiency using frontier techniques

The previous section suggests that the traditional theory of the firm does not explain why firms may not be able to utilise their resources efficiently. We then reviewed the property rights/transaction costs approach, the behavioural theory of the firm, and the X-efficiency theory of the firm. These theories highlight some situations when the firm may deviate from the optimal resource utilisation. However, whether the firm is efficient or inefficient in reality is an empirical question because it requires a comparison between the actual operations of the firm and some best practice benchmark. In this section, we review the frontier techniques that enable one to evaluate the efficiency of firms relative to an estimated/calculated production frontier using actual data on the inputs and outputs of firms in a sample.

3.3.1 – Frontier techniques to measure efficiency

The contemporary empirical literature on the measurement of efficiency builds on the seminal paper of Farrell (1957). As highlighted earlier, according to Farrell (1957), the efficiency of a firm is composed of 'technical efficiency' and 'price/allocative efficiency' (see, Färe, Grosskopf, and Lovell 1994; Lovell, 1993; Coelli et al., 1998). Allocative/price efficiency refers to the firm's ability to determine the optimal mix of inputs given the prices of inputs that minimises (maximises) their cost (profit). The technical efficiency of the firm, on the other hand, refers to managers' ability to utilise the determined set of inputs. That is, to be technically efficient a firm must minimise (maximise) its inputs (outputs) given outputs (inputs). Following Farrell (1957), we use Figure 3.1 to explain the distinction between the two efficiency concepts (see Coelli et al., 1998).

Assume an industry in which firms use two inputs, x_1 and x_2, to produce a single output, y. Furthermore, assume that constant returns to scale hold. The assumption of constant returns to scale allows the production technology to be represented using the unit isoquant, i.e. input(s) per one unit of output ($x_1/y = X1$ and $x_2/y = X2$). Later on, we will relax this assumption to explain the difference between pure technical efficiency and scale efficiency. The curve *AA`* represents the *given* 'technology' or 'state of the art' that shows the technical relationship between inputs and outputs (i.e. an isoquant). All the firms in the industry that produce according to this given state of the art (i.e. firms that are on the isoquant) are technically efficient. Now, assume that given this isoquant that represents optimal utilisation of inputs, we want to evaluate the efficiency of a firm that operates at point *R*. The technical efficiency of this firm can be measured by evaluating the distance between point *R* and the isoquant representing the fully efficient firms. That is, the distance DR, which denotes the amount by which the two inputs can be proportionally reduced without affecting the level of output, represents the technical efficiency of the firm. Mathematically, the technical efficiency (TE) is given by:

$$TE = OD/OR$$

This TE takes a value between 0 and 1, where 1 represents the optimal utilisation. Clearly, the firm operating at point R is technically inefficient as it could reduce the amount of inputs to produce one unit of output.

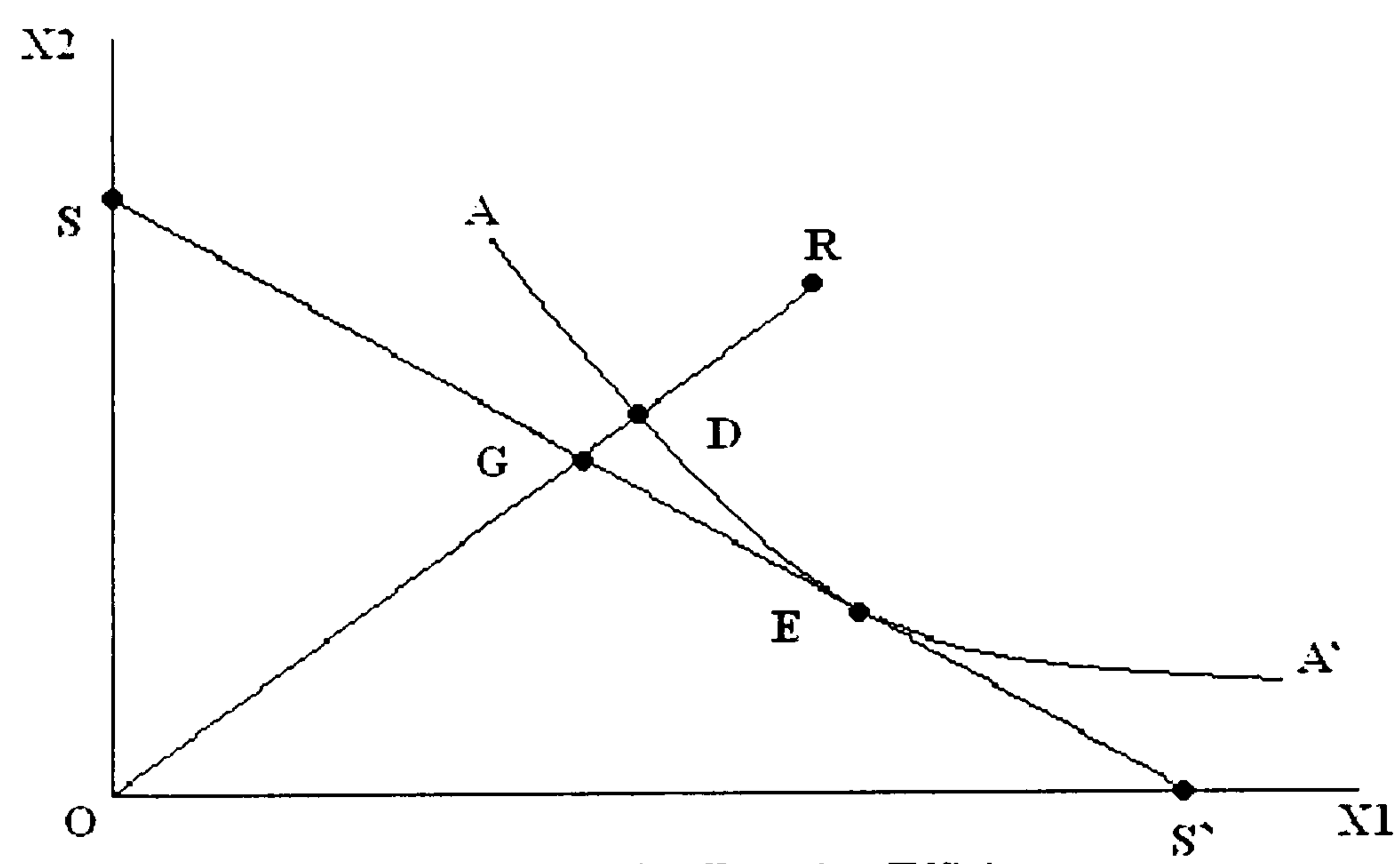

Figure 3.1 Technical & Allocative Efficiency

In the economics literature, technical efficiency refers to the ability of management to organise, manage, and coordinate its inputs in a way that maximum output can be obtained. If 'we were to observe two identical firms with same scale of operation, using the same technology and same combination of inputs to produce a homogenous product, then difference in output produced could only be explained by difference in the way the two firms were operated, i.e. managed and organised' (Mayes et al., 1994, p. 14).

The concept of technical efficiency does not consider the prices of inputs and, therefore, does not consider whether firms in an industry are allocating their inputs in the optimal proportion. Allocative efficiency considers the prices of inputs, and assumes that firms are profit maximising or cost minimising rational agents. Allocative efficiency 'involves selecting that mix of inputs (e.g., labour and capital) which produce a given quantity of output at minimum cost' (Coelli et al., 1998, p.5). In Figure 3.1, assuming that the prices of the two inputs are known, the line SS` denotes the isocost line. The allocative efficiency (AE) of the firm operating at point *R* involves measuring the distance between G and D as this distance represents the reduction in the production cost of the firm. Mathematically, AE is given by the ratio:

$$AE = OG/OD$$

The combination of technical efficiency and allocative efficiency is known as overall 'economic efficiency'. Thus, technical efficiency only requires input-output data, but economic efficiency also requires price data.

Technical efficiency can be decomposed into two components: pure technical efficiency and scale efficiency (see Thanassoulis, 2001; Coelli et al., 1998). This decomposition of technical efficiency into pure technical efficiency and scale efficiency rests on the economic concept of economies and diseconomies of scale[7]. A scale efficient firm produces at a point where constant returns to scale hold. The decomposition of technical efficiency into scale efficiency and pure technical efficiency can be illustrated using Figure 3.2 (see Coelli et al., 1998, p.4).

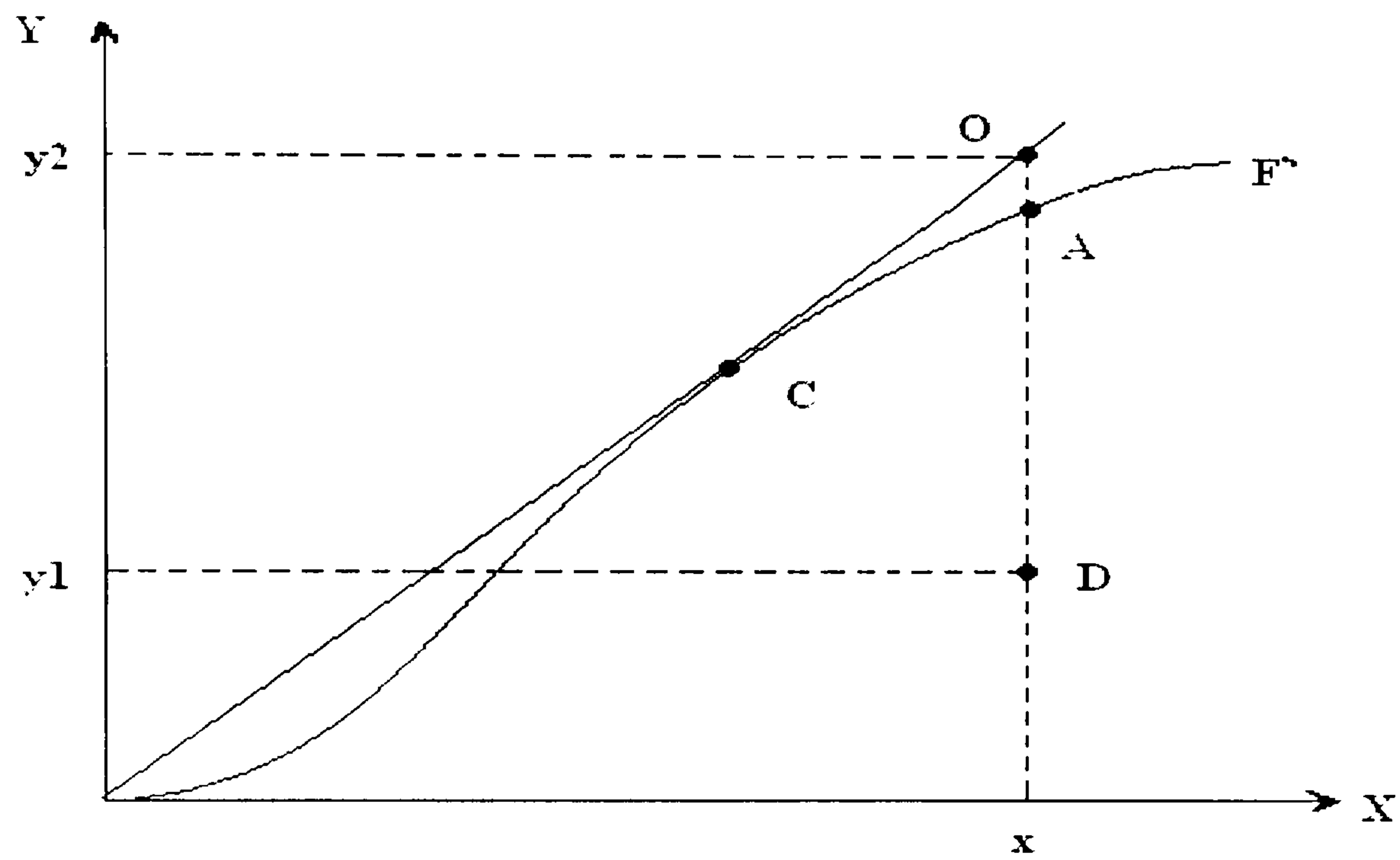

Figure 3.2: Pure technical efficiency and scale efficiency

Figure 3.2 assumes that one input, *X,* is used to produce one output, *Y.* The production frontier is represented by the curve F`. Unlike in the Figure 3.1, the assumption of constant returns to scale is not imposed on the production frontier F`. The production frontier exhibits increasing returns to scale (economies of scale) until the point C, constant return to scale at point C, and decreasing returns to scale (diseconomies of scale) beyond C. A firm producing at point D produces output y_1 using input x. This firm is technically inefficient due to two reasons. First, it exhibits

[7] A production function exhibits constant returns to scale if proportionate increase in all inputs causes output to increase in the same proportion. A production function is subject to increasing return to scale (or economies of scale) if a proportionate increase in all inputs results in a more than proportionate increase in output. A production function exhibits decreasing returns to scale (or diseconomies of scale) when a proportionate increase in all inputs results in a less than proportionate increase in output (see Waldman and Jensen, 2001).

pure technical inefficiency as it is not utilising its given inputs efficiently by not producing *at* the production frontier F`. If input x is fully utilised, the firm should produce at the point A. Second, at point D, the firm is scale inefficient as it is not producing at the constant returns to scale represented by the 45° line. At point A, although the firm operates at the efficient production frontier, it exhibits decreasing returns to scale. That is, at point A, the firm is pure technically efficient, but it is scale inefficient.

As apparent from this brief discussion, the empirical investigation of whether a firm is efficient or not hinges upon (1) the knowledge of the 'production frontier' representing the optimal utilisation of resources, and (2) the measurement of deviation from the best practice frontier. The frontier techniques discussed below enable one to achieve these two tasks. Based on the assumptions made about the shape of the best practice frontier, the treatment of random error in the estimation process, and the distributions assumed for inefficiency and random error, the frontier techniques employed in the literature can be classified into two groups: parametric techniques and non-parametric techniques[8]. Some technical details of the two techniques applied in this study (i.e. parametric stochastic frontier analysis and non-parametric data envelopment analysis) will be provided in chapter 5 and 6. Here, we present a brief overview of the frequently used parametric and non-parametric techniques.

[8] The following sub-sections draw on some of the many reviews of the parametric and non-parametric approaches, especially Berger and Humphrey (1997), Bauer et al . (1998), Coelli et al. (1998), Kumbhakar and Lovell (2000), and Murillo-Zamarano (2004). However, the examples of studies using various techniques cited herein are from the author's own literature review.

a – Parametric approaches

The parametric approach to measure the efficiency of firms requires the selection of economic concepts (for example, profit function or cost function), a pre-specified functional form for the function (for example, translog functional form or Fourier flexible functional form) [9], and distributional assumption for the error term of the estimated frontier (see Bauer et al., 1998). The methodology is stochastic as the error term is assumed to consist of an inefficiency component and random noise. Efficiency is measured by separating the inefficiency component from the composite error term (see Berger et al., 1993; Berger and Humphrey, 1997; Bauer et al., 1998). Three parametric approaches have been used in the empirical literature to calculate the efficiency of financial institutions. These approaches are: Stochastic Frontier Approach (SFA), Distribution Free Approach (DFA), and Thick Frontier Approach (TFA). These parametric approaches differ from each other in determining how best to separate random error term from the inefficiency of firms in a given sample.

I – Stochastic frontier approach (SFA)

In SFA, a functional form for a cost, profit, or production relationship among inputs, outputs, and environmental factors is specified and estimated using econometric techniques, usually maximum likelihood estimation procedure (see Kumbhakar and Lovell, 2000). The SFA posits a composed error model where the inefficiency term is assumed to follow an asymmetric distribution, usually half-normal, while random errors are assumed to follow a symmetric distribution, usually the standard normal (Berger and Mester 1997; Bauer et al., 1998, p.93; Coelli et al., 1998, and Kumbhakar and Lovell, 2000). That is, the error term 'ε' from the estimated frontier

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[9] See, for example, Altunbas et al. (2001).

is assumed to be composed of two terms, i.e. $\varepsilon = \mu + \nu$, where μ represents inefficiency and follows a half-normal distribution or truncated normal distribution, and ν represents random error that is assumed to be normally distributed[10]. Both the inefficiency term and the random error term are assumed to be orthogonal to inputs, outputs, or exogenous variables used in the pre-specified production function (Ferrier and Lovell, 1990). Examples of studies that have employed SFA are: Williams and Gardner (2003), Altunbas et al. (2001), Carbo, Gardner, and Williams (2002), Hao et al (2001), Bauer et al. (1998), Abd-Karim (2001), Berger and DeYoung (1997), and Mester (1996).

II – Thick Frontier Approach

Like SFA, the Thick Frontier Approach (TFA) also specifies a functional form for the cost function. The cost function is estimated for the firms in the lowest average cost quartile. This estimated frontier is considered as a 'thick frontier', and it is assumed that the firms forming this frontier are of greater than average efficiency. A cost function is also estimated for the highest average cost quartile and it is assumed that the firms forming it are of less than average efficiency. 'The difference between

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[10] Greene (1990) suggests that other distributions for inefficiency may be more appropriate than half normal. The imposition of different distributional assumption has influenced the estimation of efficiencies of financial institutions (see, Yuengert, 1993; Mester, 1996; Berger and DeYoung, 1997). Green (1990) proposes a Gamma distribution for the inefficiency term. Lee (1983) proposed a four-parameter Pearson distribution. However, Bauer et al. (1998, p. 94) argue that any distributional assumption simply imposed could lead to significant error in estimating individual firm efficiencies. For example, half-normal assumption on the inefficiencies imposes that most of the firms are clustered near full efficiency, but there is no theoretical reason why inefficiencies could not be more evenly distributed of distributed close to symmetrically, like the assumed distribution of the random error. Although more flexible distributions have been proposed, the two original single parameter distributions remain the distributions of choice for the empirical research on efficiency (Kumbhakar and Lovell, 2000, p. 9)

the two estimated cost function are separated into 'market factors', which are explained by differences in the available exogenous variables, and an 'inefficiency residual', which cannot be explained' (Berger and Humphrey, 1991, p. 121). The deviations from predicted performance values within the highest and lowest performance quartiles of observations are assumed to be due to random error. This approach of measuring inefficiency does not provide exact point estimates for the efficiencies of the individuals firms constituting the sample but is intended instead to provide an estimate of the general level of overall efficiency (see Berger and Humphrey, 1997). Some examples of the studies using the TFA are: Berger and Humphrey (1991), Shaffer (1993), Pantalone and Plait (1997), and Yuengert (1993).

III – Distribution Free Approach

If panel data on the inputs and outputs of firms are available, the Distribution Free Approach (DFA) enables one to relax the distributional assumptions of the SFA because this approach 'does not impose a specific shape on the distribution of efficiency (as does SFA) nor does it impose that the deviations within one group of firms are all random error and deviations between groups are all inefficiencies (as does TFA). Instead, the DFA assumes that there is a core efficiency or average efficiency for each firm which is constant over time, while random error tends to average out over time' (Berger and Mester, 1997, p. 95). The main contribution of the DFA is the identification of the persistent part of unexplained costs (profits), which is considered as an important firm-specific characteristic, from the transitory part, which is considered as random noise. This is carried out by comparing many observations of observed and predicted costs for each firm in the sample and inferring that the average difference is a good indicator of the unobserved inefficiency parameter. More specifically, if the cost function is given by: $\ln C = f(\mathbf{w}, \mathbf{Y}, \mathbf{Z}) + \ln u_i + \varepsilon$, where the cost, C, is a function of prices, w, outputs, Y, and environmental variables, Z. u_i represents unobservable firm-specific cost inefficiency, and ε_i denotes random error. To estimate the unobserved cost inefficiency for firms in a sample, the DFA estimates separate cross-section regressions for the cost function (as panel data are available) for each of period t in the sample. Under the assumption that the random errors average to zero over time for firms in the sample, a simple average of the t regression residuals approximates the unobserved firm-specific cost inefficiency term. Examples of studies that have employed the DFA are: Hunter and Timme (1995), Berger and Mester (1997), Hardi and Patti (2001), Bauer et al. (1998), and Rime and Stiroh (2003).

b – Non-parametric Approaches

Unlike the parametric approaches, the non-parametric approaches do not require specification of functional form of the frontier. Two widely used non-parametric approaches are: Data Envelopment Analysis (DEA) and Free Disposal Hull (FDH) method.

I – Data envelopment analysis

Data envelopment analysis (DEA) is a linear programming technique to construct the best-practice production frontier and to calculate the efficiency of firms relative to the constructed frontier (see Thanassoulis, 2001). Unlike the parametric approaches discussed above, the best-practice production frontier within the DEA is not determined by some specific functional form but is generated from a piecewise linear combination of the input-output correspondence data on firms included in a sample.

This piecewise linear combination yields a convex production possibility set that envelops all the firms in the sample. The efficiency of each firm in the sample is calculated by measuring the distance between the calculated frontier and the input-output correspondence of the firm. Firms that form the production frontier are considered as (100%) efficient relative to the other firms in the sample. Examples of studies that have employed the DEA are: Casu and Molyneux (2003), Bauer et al. (1998), Bhattacharyya et al. (1997), Strum and Williams (2004), Gilbert and Wilson (1998), and Leightner and Lovell (1998).

II – Free Disposal Hull

Free Disposal Hull (FDH) technique was proposed by Deprins et al. (1984) as a special case of the DEA where the points on lines connecting the DEA vertices are not included in the frontier. Instead, in the FDH approach, the production possibility set is composed only of the DEA vertices and the free disposal hull points interior to these vertices. As Berger and Humphrey (1997, p. 5) note, 'because the FDH frontier is either congruent with or interior to the DEA frontier, the FDH will typically generate larger estimates of average efficiency than [the] DEA'.

3.3.2 – Which technique is best?

As discussed above, the extensions of the traditional neoclassical theory of the firm – transactions cost/property rights approach, and the behavioural theory of firm, for instance – suggest that firms may not always be able to optimally utilise their resource due to individuals within firms pursuing their own objectives rather than striving to maximise firms' profits. However, to investigate whether such inefficiency exists in reality requires methods that could empirically determine what the optimal utilisation of resource (i.e. the best practice frontier) is and whether firms are producing according to the frontier. We have briefly reviewed parametric and non-parametric frontier techniques that enable one to determine the efficiency of a given sample of homogenous firms, provided that the data on inputs and outputs of the firms in the sample is given. Now, given the differences between the various frontier-techniques discussed above, which technique is the best?

Although a lot of research has gone into the measurement of efficiency of firms (financial, as well as, non-financial firms) using both parametric and non-parametric approaches, to date there is no consensus in the literature regarding the best frontier technique with some researchers preferring the parametric (e.g. Berger, 1993, Kumbhakar and Lovell, 2000) and others the non-parametric (e.g. Seiford and Thrall, 1990, Thanassoulis, 2001) approach. On the empirical front, a consensus is difficult to achieve because the true (absolute) efficiency of firms is not known with which the estimates from various techniques could be compared (Berger and Humphrey, 1997). On the theoretical level, the consensus is difficult to make as both parametric and non-parametric techniques have their relative strengths and weaknesses.

The main disadvantage of the parametric approaches is that these techniques impose a particular functional form that presupposes the shape of the best practice frontier. Consequently, the measurement of efficiency using parametric techniques could face a misspecification problem. Therefore, as contended by the proponents of non-parametric approaches, non-parametric approaches are preferable because these approaches do not impose any restrictions on the shape of the frontier. In this regard, the proponents of the parametric approaches have specified more general functional form, such as the Fourier flexible functional form, which adds Fourier trigonometric terms to a translog functional form, to lower the risk of misspecification error (see, for example, Berger and Mester, 1997, Altunbas et al., 2001).

Another criticism against the parametric approaches, particularly against the SFA, is that it assumes, rather arbitrarily, a particular probability distribution for the composed error term (half-normal, truncated, or, more recently, Gamma distribution) (see Greene, 1990; Bauer et al., 1998).

The key disadvantage of the non-parametric approaches is their deterministic nature. That is, the measurement error and statistical noise are assumed to be nonexistent in the non-parametric techniques. Therefore, any deviation from the calculated frontier would be considered as inefficiency. Parametric techniques, on the other hand, are more robust in the sense that they consider random error as a source of deviation from the best-practice frontier.

Given these advantages and disadvantages, Bauer et al. (1998) suggest that it is not necessary to have consensus on which is the single best technique to measure efficiency. Instead, Bauer et al. (1998) propose a set of consistency conditions that the efficiency measures derived from various approaches should meet so as to be useful for regulators and other decision makers. Bauer et al. (1998, p. 87) argue that 'the efficiency estimate derived from the different approaches should be consistent in their efficiency levels, ranking, and identification of best and worst firms, consistent over time and with competitive conditions in the market, and consistent with standard non-frontier measure of performance'. More specifically, Bauer et al. (1998) propose following consistency conditions:

1- The efficiency scores generated by the different approaches should have comparable means, standard deviations, and other distributional properties.
2- The different approaches should rank the institutions in approximately the same order.
3- The different approaches should identify mostly the same institutions as 'best-practice' and as 'worst-practice'.
4- All of the useful approaches should demonstrate reasonable stability over time, i.e. tend to consistently identify the same institutions as relatively efficient or inefficient in different years, rather than varying markedly from one year to the next.
5- The efficiency scores generated by the different approaches should be reasonably consistent with competitive conditions in the market.
6- The measured efficiencies from all of the useful approaches should be reasonably consistent with standard non-frontier performance measures, such as return on assets or the cost/revenue ratio.

The first three conditions might be considered as measuring the degree to which the different techniques are consistent with each other, while the last three conditions might be considered as measuring the degree to which the efficiency scores generated by different approaches are consistent with reality or are believable.

This study employs two of the most widely used techniques to measure the efficiency of banks in India and Pakistan during the 1990s, namely data envelopment analysis and stochastic frontier analysis. In chapter 5, we employ the non-parametric DEA to measure technical efficiency and to decompose technical efficiency into pure technical efficiency and scale efficiency. This measurement will be carried out using annual frontiers for each year in the sample. We then employ parametric stochastic frontier analysis to check the robustness of our results. In addition, we use the DEA to construct the Malmquist total factor productivity indices for the banking industry in both the countries[11]. In chapter 6 we augment the analysis of chapter 5 in two ways. First, following Bhattacharyya et al. (1997), we employ the DEA to measure the pure technical efficiency of banks relative to a single grand-frontier constructed using pooled input-output data for 1992-1998. Second, we highlight how various components of the economic and structural reforms in India and Pakistan (see Chapter 4) may explain inter-temporal variations, if any, in the efficiency of banks. Towards this end, besides various internal bank-specific factors highlighted by the existing empirical literature, we regress the efficiency scores of banks on external macroeconomic factors to examine the impact of four elements of the economic and structural reforms on the efficiency of banks during the post-ESRs period.

3.3.3 – Bank efficiency and inputs–output specification

As evident from the above discussion, to measure the efficiency using frontier techniques, one first needs to specify inputs and outputs of firms under consideration. Contemporary literature on banking views banks as providers of four key services (see Freixas and Rochet, 1997, p. 14-16): (1) offering access to a payment system, (2) transforming assets, (3) managing risk, and (4) processing information and monitoring borrowers. For empirical purposes, it is difficult to define precisely what inputs banks use and what outputs they produce (see Berger and Humphrey, 1992). This difficulty arises due to the dual nature of some of the services (resources) that banks provide (use). For example, bank deposits can be regarded as banks' inputs as

[11] We will discuss the construction of the Malmquist total factor productivity index using the DEA in chapter 5.

they are the main ingredients for loan production. On the other hand, high value added deposits products, like integrated saving and checking accounts, can be regarded as services (outputs) that banks produce. Broadly speaking, the existing frontier analysis based empirical studies utilise two approaches to specify banks' inputs and outputs, namely the 'production approach' and the 'intermediation approach'.

Within the ***production approach***, banks are viewed as the providers of loan and deposit accounts (see Isik and Hassan, 2003). To provide these outputs, banks use capital and labour. The outputs are measured by the *numbers* of deposits and loans, while inputs are defined as operating expenses. The main weakness of this approach is that it does not take into account the interest expenses that banks incur. Another difficulty with this approach is that it is usually hard to obtain data for the number of transactions (i.e. number of loans and deposits accounts) for a given period of time. This approach, however, is useful in evaluating the efficiencies of different branches of financial institutions because branches usually process customer documents for the institution as a whole and branch managers typically have little influence over bank funding and investment decisions that influence their interest expense. (Berger and Humphrey, 1997). Examples of studies that use this approach are: Sherman and Gold (1985), Oral and Yolalan (1990), and Berger and DeYoung (1997).

The ***intermediation approach*** considers banks as intermediators of financial resources from savers to borrowers (see Sealy and Lindley, 1977). That is, banks use capital and labour to transform deposits into loans and other earning assets. Within this approach, outputs are measured as the value of loans and other earning assets (e.g. investments), while deposits and other liability funds, along with labour and capital, are considered as banks' inputs. Total costs in this approach, due to inclusion of deposits, include both operating expenses as well as interest expenses.

Three variants of the intermediation approach are: (1) the asset approach, (2) the value-added approach, and (3) the user cost approach (see Berger and Humphrey, 1992). The *assets approach* considers banks as financial intermediaries between liability holders (e.g. depositors) and those who receive funds in the form of banks' earning assets (e.g. loans and investments). So, outputs are defined as assets for which banks have advantage over other financial institutions, while deposits and other liabilities are considered as banks' inputs. According to the *value-added approach*, most items on the assets and liability sides of the balance sheets could be regarded as both inputs and outputs according to whether they create or add value to the operations of banks. Items that create value are usually loans, investments, and time and savings deposits. Other items on the balance sheets are considered as intermediate products or inputs (see Berger and Humphrey, 1992). The *user-cost approach* specifies inputs and outputs depending on each item's net contribution to banks' revenues. If the financial returns on an asset exceed the opportunity cost of funds or if the financial cost of a liability is less then opportunity cost of funds, than the item is considered as an output. As Berger and Humphrey (1997) notes, neither of these approaches fully capture the dual role of banking firms in providing transaction/documents processing services and being financial intermediaries that transfer funds from savers to investors.

3.3.4 – Correlates of bank efficiency

As Berger and Mester (1997) point out, once the efficiency of banks is measured using frontier techniques, it is imperative to determine potential correlates of the measured efficiency, i.e. bank, market, and regulatory characteristics that are at least partially exogenous and may explain some of the variations in the efficiency over time and space. This is particularly relevant to our study as we endeavour to examine the impact of changes brought about by the economic and structural reforms, particularly the financial liberalisation programme, on the efficiency of banks in India and Pakistan during the 1990s.

In the context of banks in developed countries, substantial research has gone into the empirical investigation of factors that may explain the variations in the efficiency (see, for example, Mester, 1996; Berger and Mester, 1997; Altunbas et al., 2001; Dietsch and Lozano-Vivas, 2000; Casu and Molyneux, 2003; Akhigbe and McNulty, 2003; Girardone et al., 2004). Broadly speaking, the internal bank-specific variables include, *inter alia*, size of banks, ownership/organisation structure, asset/liability structure, age, and cost/profitability ratios. External factors that have been found to be significantly related to the banks' efficiency include the level of competition in the banking industry, growth in demand for financial services provided by banks, and inter-regional and intra-regional variations in governments' regulations.

The existing empirical studies use the following approaches to asses the impact of various environmental factors – including the financial liberalisation – on bank efficiency (see, for example, Leightner and Lovell, 1998; Berger and Mester, 1997; Coelli et al. 1998, chapter 7; Casu and Molyneux, 2003):

(1) *Single-stage analysis*: This approach can be further subdivided into two groups. First, there are studies that use the non-parametric DEA to calculate efficiency over a period before and after the implementation of a particular policy (e.g. the financial liberalisation). Any improvement (deterioration) in the measured efficiency is then attributed to the success (failure) of the policy. As evident from our review of the empirical studies on banks in developing countries, most of the empirical studies on the impact of financial liberalisation on the efficiency of banks in developing countries fall into this category (see, for example, Gilbert and Wilson, 1998, Leightner and Lovell, 1998). Second, in the case of parametric approaches, costs or profits are regressed on environmental variables, along with the specified inputs and outputs.

(2) *Two-stage analysis:* This approach involves estimating efficiency scores of banks using parametric and non-parametric techniques in the first stage. In the second stage, the calculated efficiency scores are considered as data and are regressed on various bank-specific variables – e.g. operating expenses, size – as well as the proxies for market and regulatory factors such as the financial liberalisation. Studies following this approach include Casu and Molyneux (2003), Berger and Mester (1997), Hao et al. (2001). Berger and Mester (1997) note that the factors used in the second stage could be endogenous; therefore, they call them the correlates of bank efficiency rather than the determinants of bank efficiency (see also Kumbhakar and Lovell, 2000, p. 264). As outlined in chapter 6, to rectify the problem of endogeneity, we will employ generalised method of moments. The empirical

studies usually employ the two-stage analysis because of following advantages of this approach (see Coelli et al., 1998, p.171):

- It can accommodate more than one potential correlate;
- It can accommodate both continuous and categorical variables;
- It does not make prior assumptions regarding the direction of the influence of the categorical variables;
- It enables us to test hypotheses regarding the relationship between the variations in the efficiency and the potential correlates; and
- It is easy to calculate.

In chapter 6 of the present study, we will employ two-stage analysis to examine the impact of the financial liberalisation on the variations in bank efficiency. In the first stage, we will employ the DEA to measure the efficiency of banks. In the second stage, we will employ Ordinary Least Squares and Generalised Method of Moments to examine factors that may explain inter-temporal and intra-temporal variations in the efficiency of banks in India and Pakistan. The Generalised Method of Moments will be particularly useful to rectify the endogenity problem mentioned above (see Chapter 6).

3.4 – Frontier techniques and bank efficiency in developing countries: Empirical evidence

This section reviews the empirical studies that seek to examine the efficiency and productivity of banks in developing countries, especially those which implemented the financial liberalisation programme. However, first a brief discussion of some studies on the efficiency of banks in developed countries, especially those that seek to examine the impact of financial deregulation or other regulatory changes, is in order (for detailed review of empirical studies on developed countries, see Berger and Humphrey, 1997).

3.4.1 – Bank efficiency in developed countries using frontier techniques

It is argued that the deregulation of the US banking industry, which started in the early 1980s, endeavoured to free the banking industry from excessive government regulations introduced after the Great Depression (see Mukherjee et al., 2001, DeYoung et al., 2004). Various studies have tried to examine the impact of this deregulation on the efficiency and productivity of banks in the US using both parametric and non-parametric approaches (see Hunter and Timme, 1991, Bauer et al. 1993, Wheelock and Wilson, 1999, and Mukherjee et al. 2001). By estimating an alternative profit function for banks in the US, Humphrey and Pulley (1997) endeavour to separate statistically the internal, bank-initiated adjustments to deregulation from the external, contemporaneous changes in banks' business environment. Their results suggest that between 1977-1980 and 1981-1984, large banks (those with assets over $500 million) adjusted deposits and loan input prices and their use of labour and capital inputs to minimise the negative impacts on profits from the deregulation-induced rise in their funding costs, i.e. due to deregulation of interest rates. In contrast, Humphrey and Pulley (1997) find, smaller banks (with assets between $100 and $500 million) apparently initiated few adjustments in response to deregulation and instead relied on an improved business environment to stabilise profitability. Humphrey (1993) and Hunter and Timme (1991) estimate cost functions to measure technical change in the US commercial banking industry and find little or no technological change during 1977-88.

Wheelock and Wilson (1999) employ non-parametric technique to calculate Malmquist total factor productivity index for US banks during 1984-1993. Wheelock and Wilson (1999) find that during 1984-1993, banks of all sizes experienced decline in technical efficiency. However, during the same period, banks witnessed technological progress. They suggest that though productivity also declined over the sample period, the extent was less than the decline in efficiency. Wheelock and Wilson conclude that only a few firms might be able to adapt to the changes in economic environment, such as those brought about by the deregulation in the banking sector. The relatively large technological gains of larger-sized banks since 1984 suggest that on average they have been favoured more by the changed environment than small banks. However, they add, many banks of all sizes lagged behind the few leaders in catching up and utilising the benefits of technological progress.

Mukherjee et al. (2001) examine the productivity growth for 201 large US commercial banks during 1984-1990. They employ the DEA to construct Malmquist productivity index (discussed in chapter 5) and isolate the contributions of technical change, technical efficiency change, and scale change to productivity growth. Their results suggest an overall productivity growth at the rate of around 4.5% per year on average. However, they find that productivity declined by 7.61% between 1984 and 1985 and by 0.33% between 1988 and 1989. Mukherjee et al. (2001) also employ second stage analysis in which they use feasible Generalised Least Squares method to regress productivity growth on various bank-specific and market specific variables. They find that larger asset size and specialisation of product mix is associated with higher productivity growth while higher equity to assets is associated with lower productivity growth[12].

Casu and Molyneux (2003) examine whether there has been an improvement in and convergence of productive efficiency across five European banking markets – namely, France, Germany, Italy, Spain, and the United Kingdom – since the creation of the Single Internal Market during the early 1990s. Their analysis is based on the two-stage procedure outlined above. In the first stage, Casu and Molyneux (2003) employ the DEA to calculate technical efficiency. Following the intermediation approach, Casu and Molyneux specify two outputs – namely, loans and other earning assets – and two inputs – namely, total costs and total deposits. Their DEA results show relatively low average efficiency levels, and show a slight improvement in the average efficiency scores over the period of analysis for almost all banking systems in the sample, with the exception of Italy. However, the results show that the efficiency gap among countries grew even wider over the period 1993–1997. In the second stage, using efficiency measures derived from the DEA calculations, the determinants of European bank efficiency are evaluated using the Tobit regression model approach. Following Simar (1992), in order to minimise the bias arising from the inherent dependency problem of the efficiency scores calculated through the DEA, Casu and Molyneux also substitute the conventional estimators of the Tobit regression coefficient estimates with the bootstrap estimators to calculate the standard errors of these estimates. Their bootstrap regression results indicate that

[12] Other influential empirical studies on the US banking industry include Elyasiani and Mehdian (1995), Mester (1996), Berger and Mester (1997), and Bauer et al. (1998).

geographic location influences bank efficiency, while little evidence was found to suggest that the average capital ratio and the return on average equity explain variations in bank efficiency levels. They find that these results contrast with the positive relationship between both returns and capital ratios and efficiency levels found in some of the non-bootstrapped estimates. Casu and Molyneux conclude that this contrasting result suggests that inference on the determinants of bank efficiency drawn from non-bootstrapped regression analysis may be biased.

On the recommendation of the Campbell Committee, the deregulation of the Australian banking industry started in the mid 1980s (see Wright, 2002). One of the most important features of this deregulation was the entry of foreign banks into the Australian banking industry, which was previously dominated by four large Australian banks. Strum and Williams (2004) evaluate the efficiency and productivity of the Australian banking industry during the post-deregulation period. Their primary focus is to examine the impact of the entry of foreign banks on the efficiency and productivity of the Australian banking industry. Strum and Williams (2004) employ the non-parametric DEA and Malmquist Indices to examine the efficiency and productivity of both foreign and domestic banks and the dynamics of efficiency changes in Australia during 1988-1994. Stochastic Frontier Analysis is then used as a robustness check on the results obtained from the DEA. To specify inputs and outputs of banks, Strum and Williams utilise the intermediation approach, viewing banks as financial intermediaries employing inputs such as labour, capital and deposits to produce outputs such as loans and off-balance sheet items. Strum and Williams find that scale inefficiency dominates technical inefficiency in the Australian banking industry. They argue that the four largest Australian banks used size as a barrier to entry via mergers before the entry of the foreign banks and increased spending upon branch networks during the post-deregulation period. Their DEA results suggest that foreign banks experienced superior scale efficiency, which resulted in increased efficiency, on average, compared to the big four Australian banks or the other domestic banks. They argue that these results tend to support the 'limited form of the global advantage hypothesis' proposed by Berger et al. (2000). According to this hypothesis, foreign banks from a particular set of nations are more efficient than domestic banks because they are able to master the disadvantages presented by the liability of foreignness (see Ataullah and Le, 2004). This nation-specific advantage could be sourced from factors such as home market structure and regulation. Avkiran (2000) also examines the productivity of ten domestic Australian banks from 1986 to 1995, and finds that total productivity increased during the post deregulation period, but this increase was mainly due to technological progress rather than technical efficiency improvement.

Grifell-Tatje and Lovell (1996) examine the impact of the liberalisation of the Spanish banking industry on the efficiency and productivity of savings banks during 1986-1991. The Spanish banking industry prior to 1969, Grifell-Tatje and Lovell note, was highly regulated and closed to foreign competition. The pace of liberalisation was fostered in the mid-1980s. Two consequences of this deregulation are a rapid growth in branching activity and a burst of merger activity. To examine the influence of the liberalisation, Grifell-Tatje and Lovell (1996) employ the DEA to measure technical efficiency and to construct Malmquist total factor productivity index for Spanish saving banks. Their findings suggest that, though deregulation has generated service growth in the Spanish banking industry during the sample period, even higher growth in resource use has led to lack of improvement in the productivity of banks, i.e. productivity declined during the sample period. Their results suggest that the decline in the productivity of less efficient savings banks was lower than that in the best practice banks. This, in turn, led to catching up of the less efficient banks over the years. They also find little evidence to suggest a positive impact of mergers and acquisition on banks' productivity.

Norway initiated bank deregulation in the mid-1980s (see Ongena et al., 2003 for a brief overview of bank deregulation in Norway and subsequent crises). Like in developing countries, prior to the deregulation, the Norwegian authorities limited both the quantity and rates at which Norwegian banks could lend. In addition, banks faced restrictive reserve requirements, and regulations required banks to invest in government bonds, and direct controls on lending by state-owned banks facilitated the rationing of credit at artificially low loan rates. In 1984, authorities relaxed reserve requirements, allowed subordinated debt to be counted as bank capital, and opened Norway to competition from both foreign and newly established Norwegian banks. Berg et al. (1992) examine productivity growth during the deregulation of the Norwegian banking industry during 1984-1989 by employing the DEA, the period after the deregulation but prior to the 1990s Norwegian banking crisis. Their DEA results suggest productivity regress at the average bank prior to the deregulation, but rapid growth when deregulation took place. In addition, they suggest that deregulation led to less dispersion of productivity levels within the industry.

3.4.2 – Bank efficiency in emerging, transition, and developing economies

Using the non-parametric DEA, Zaim (1995) evaluates the technical efficiency of banks in Turkey for the years 1981 and 1990, where the year 1981 represents the pre-financial liberalisation period and the year 1990 represents the post-financial liberalisation period. Zaim (1995) specifies four outputs, i.e. total balance of demand deposits, total balance of time deposits, total balance of short-term loans, and total balance of long-term loans, and four inputs, i.e. total number of employees, total interest expenses, depreciation expenditures, and expenditures on materials. Zaim finds that on average the efficiency of Turkish banks improved by 10% after the implementation of financial liberalisation. The main source of technical inefficiency in the Turkish banking industry, according to Zaim's findings, was low pure technical efficiency.

Yildirim (2002) also employs the DEA to measure the technical efficiency of Turkish banks between 1988 and 1999, a period characterized by increasing macroeconomic instability in the country. She postulates that banks in Turkey produce three outputs, i.e. total loans, interest income and non-interest income, by employing four inputs, i.e. total demand deposits, total time deposits, total interest expense and total non-interest expense (total interest expense contains interest on deposits, interest on non-deposit funds and other interest expenses). Yildirim (2002) finds that over the sample period, the two components of technical efficiency, i.e. pure technical efficiency and scale efficiency, show high inter-temporal and intra-temporal variations. In addition, she finds little evidence to suggest a sustained efficiency gain. The trend in the performance levels over the period suggests that unstable macroeconomic conditions had a profound influence on the efficiency measures. In contrast to Zaim's findings, the lack of improvement in technical efficiency is found to be due mainly to high scale inefficiency, which, in turn, is due to decreasing returns to scale. Yildirim's results suggest that, during the sample period, public sector banks outperformed private sector banks. In addition, Yildirim examines the relationship between size and bank efficiency. Yildirim proposes that size may proxy banks' flexibility in the financial market and their ability to diversify credit risk. A positive relationship between size and pure technical efficiency and scale efficiency is found.

Isik and Hassan (2003) also employ the DEA to examine the impact of the financial liberalisation on the total factor productivity of Turkish banks during 1981-1990 (see also, Isik and Hassan, 2002). They calculate Malmquist total factor productivity index that allows decomposing total factor productivity change into its two components, technical change and efficiency change. Isik and Hassan specify four outputs, i.e. short-term loans, long-term loans, risk-adjusted off-balance sheet item (e.g. letters of guarantee, bank acceptance, letters of credit), and other earning assets, and three inputs, i.e. labour, capital, and loanable funds. Their results indicate that the efficiency of banks improved after the implementation of the financial liberalisation: average input waste in banking has declined strikingly from about 50% in 1981 to about 24% in 1990. The results also suggest that the source of total technical inefficiency in the initial phase of liberalization was mostly scale-related for foreign banks as they were new and too small initially to optimally exploit scale economies. However, Isik and Hassan argue that, over the years, as foreign banks became larger by expanding their business into the domestic market, their scale has become almost fully optimal in terms of cost saving. With respect to 1981, Isik and

Hassan (2003) find that Turkish banks registered neither productivity growth (except in 1982, 1989 and 1990) nor technological progress (except in 1982). However, they note, negative productivity growth has become increasingly less negative over time and turned to a positive growth after 1988. In addition, their results indicate that the source of the productivity growth was an efficiency increase rather than progress in technology. As the reforms began to show their impact, the performance difference between the best- and worst-practice banks narrowed, i.e., inefficient banks began to catch-up with efficient banks. Despite the financial reforms and banks' heavy investment in technology, lack of technological progress is attributed to the long-term nature of banks' investment (Isik and Hassan, 2003, p. 1477-1478).

Greece fostered its liberalization programme during the late 1980s and early 1990s to prepare the domestic financial system for new challenges brought about by the EMU membership. Tsionas et al. (2003) employ the DEA to measure technical and allocative efficiency and total factor productivity change for Greek banks during 1993-1998. Following the intermediation approach, they postulate that banks produce loans, investments, and liquid assets (outputs) by using labour, physical capital, and deposits (inputs). Tsionas et al. (2003) suggest that the majority of the Greek banks operate close to the best market practices, while allocative inefficiency costs seem to be more important than technical inefficiency costs. Using a Malmquist productivity index approach, they find a positive but not substantial technical efficiency change over the sample period (approximately. 2.3% on average). Their results also indicate that most of the increase in technical efficiency comes mainly from medium-sized banks. Also, Tsionas et al. (2003) find, total factor productivity changes are mainly attributed to the technical change improvement of larger banks.

Gilbert and Wilson (1998) evaluate the impact of the financial liberalisation on the productivity of banks in the context of the Korean banking industry by constructing a Malmquist total factor productivity index. They postulate that banks produce demand deposits, loans in domestic currency, and loans in foreign currency, by employing labour, capital, and purchased funds. Gilbert and Wilson find some evidence that banks in Korea witnessed improvement in total factor productivity after the initiation of the financial liberalisation programme. This improvement in total factor productivity was due to improvement in both technology and efficiency. Criticising the excessive government regulations and restrictions prior to the financial liberalisation, they conclude that '[w]hatever positive effects government control of the financial system may have had on growth of the Korean economy in the 1960s and 1970s must be weighed against the negative effects on the productivity of Korean banks' (p. 153).

Leightner and Lovell (1998) examine the impact of the financial liberalisation in Thailand on the productivity of Thai banks by constructing the Malmquist total factor productivity index during 1989-1994. Their sample includes both foreign and domestic banks. Recognising the fact that governments in developing countries actively influence banks' objectives, Leightner and Lovell (1998) specify two input-output models to measure changes in total factor productivity. First, they assume that banks seek to maximise their profits arising from their financial activities. To capture this objective, Leightner and Lovell postulate that banks produce interest and non-interest income using personnel expenses, premises and equipment expenses, and provisions for possible loan loss. Second, Leightner and Lovell assume that central banks in developing countries (the Bank of Thailand in case of Thailand) regulate banks' behaviour in order to facilitate economic growth by providing financial resources to domestic enterprises. Toward this end, Leightner and Lovell postulate, banks produce two outputs, i.e. credit granted and investments in securities, by employing three inputs, i.e. personnel expenses, premises and equipment expenses, and provisions for possible loan loss. They suggest that large Thai banks were more successful than small Thai and foreign banks. In addition, their findings suggest that three banks classes, i.e. Thai large, Thai medium, and foreign small, performed well in the pursuit of profit maximising objective. Only two bank classes, i.e. Thai large and Thai medium, performed well in the pursuit of resource providing objective of the Bank of Thailand. Overall, Leightner and Lovell suggest that if their results were evaluated outside the context of the 1997 Asian Crises, which some blame on financial liberalisation, one would conclude that the financial liberalisation was a huge success. They argue that four factors contributed to the positive impact of the financial liberalisation on the productivity of banks (see Leightner and Lovell, 1998, p. 128). First, Thailand liberalised its financial system at a time when the economy was booming, which made the adaptation process for banks rather easy. Second, the financial system was oligopolistic at the onset of the liberalisation, which gave Thai banks a window of opportunity to adapt before increased competition reduced their profits. Third, many Thai banks had the international expertise needed to capitalise on the simultaneous liberalisation of foreign exchange markets. Fourth, many of the foreign banks brought with them the necessary international expertise.

Using Stochastic Cost Frontier approach, Abd-Karim (2001) examines the efficiency of banks in four Asian economies, namely Indonesia, Malaysia, the Philippines, and

Thailand, during 1989-1996. Banks' outputs in his study include commercial and industrial loans, other loans, time deposits, and demand deposits, while inputs are the sum of expenses on wages and salaries, land, buildings, and interest on deposits. His results indicate that there were considerable differences in average bank efficiency across the four countries during the sample period, with Thai banks being the least inefficient, followed by the Malaysian banks, the Indonesian banks, and finally the Philippines banks. Abd Karim's findings also suggest that cost inefficiency in the four countries increased over the years preceding the Asian crises in 1997, suggesting that the problem of bank failures may have had contributed to the crises. In addition, the results suggest that privately owned banks are more cost efficient than state-owned banks, hence supporting the argument in favour of the financial liberalisation that includes privatisation.

Chen (2002) employs the DEA to measure the technical efficiency of banks in Taiwan during 1988-1997. Chen's results show that the efficiency of banks improved over the sample period. Chen attributes these improvements to the changes in the economic environment brought about by the deregulation and privatisation policy adopted during the period.

Using stochastic cost frontier methodology and data for 1994 and 1995, Kraft and Tirtiroglu (1998) examine the technical efficiency of state and private banks in Croatia, which initiated liberalisation in the early 1990s. Their results suggest that new banks in Croatia are neither as efficient as old banks nor do they operate at the efficient scale. However, they argue, that the observation that new private banks are not yet as efficient as older banks does not mean that their entry has had no effect on competition in the Croatian banking industry. They propose that the relatively satisfactory efficiency performance of old banks may be the result of measures taken by them to survive the anticipated competitive threat posed by both new banks and restructuring and privatizing old banks. They also suggest that Croatia has not benefited from another possible competitive factor, i.e., the entry of foreign banks, in large part because of the war situation prevailing through the signing of the Dayton Accords in 1995.

Following entry into the European Community in 1986, Portugal initiated the financial liberalisation that included the entry of foreign banks, the granting of new banking licenses, and privatisation of existing banks. Canhoto and Dermine (2003) seek to determine the impact of this liberalisation policy on the efficiency of banks during 1990-1995. To this end, Canhoto and Dermine use the DEA to measure technical efficiency, i.e. scale and pure technical, and to construct the Malmquist total factor productivity index. Their output vector includes loans, deposits, inter-bank assets/liabilities, and number of branches. The input vector includes the number of employees and physical capital. Capital is approximated by the book value of fixed assets. Their results suggest around 59% improvement in the efficiency of banks over the years 1990–1995. The new banks, which were allowed to operate in the liberalised era, dominate the old ones in terms of efficiency with an average efficiency score of 77% compared to 62%. Moreover, the Malmquist productivity index indicates that the new banks consolidate their relative efficiency advantage over time.

Hungary started the financial liberalisation after decades of dominance of the National Bank of Hungary and the National Saving Bank (Hasan and Marton, 2003). Like other transition economies, the key elements of this liberalisation were privatisation and entry of new domestic and foreign banks. Hasan and Marton (2003) employ Stochastic Frontier Analysis (SFA) to estimate cost and profit efficiency of banks in Hungary in order to explore the role of foreign banks as competitors and partners of domestic banks in shaping the new environment of Hungarian banking market during 1993-1998. They use Translog functional form for the cost and profit function. Their primary finding is that a liberal privatisation policy and easy terms and conditions may have caused some immediate loss of maximum possible benefits; however, the competition and associations from more skilled and experienced foreign banking institutions have resulted in a positive influence on the efficiency of the banking sector. Their results suggest that banks with foreign involvement were significantly less inefficient than their domestic counterparts, and among the foreign-involved institutions, a higher share of foreign ownership was associated with lower inefficiency.

In addition to measuring the efficiency of banks, Hasan and Marton (2003) also apply second stage analysis to determine the correlates of banks' efficiency by regressing the measured efficiency scores on a number of bank-specific and regulatory variables using Ordinary Least Squares (OLS) method (see Hasan and Marton, 2003, p. 2262). Their results suggest that banks involved in acquisition in the new banking environment benefited from such experience and are associated with lower inefficiency. Among other bank-specific variables, concentration in liquid assets is found to have a positive relationship with profit inefficiency, but a negative relationship with cost inefficiency. In addition, equity ratio showed consistent positive correlation with inefficiency suggesting that risk-averse banks with relatively lower earning assets outstanding were less likely to be associated with increased efficiency. Logarithm of banks' assets, a proxy for banks' size, showed inverse relationship with the inefficiency of banks. They argue that this negative relationship reflects that bigger banks were relatively more efficient during the sample period. Following DeYoung and Nolle (1998), they propose that the positive relationship between size and efficiency reflects larger banks' capability to attract and retain better managers who are able to optimally utilise banks' resources.

Weill (2003) seeks to analyse the impact of an increasing share of foreign owned banks on the performance of the banking industry in Czech Republic and Poland. Towards this end, Weill conducts a comparative analysis of the performance of foreign-owned and domestic-owned banks by employing the stochastic frontier approach to compute cost efficiency scores. Weill's main finding is that on average foreign-owned banks are more efficient than domestic-owned banks. However, Weill (2003) suggests, this advantage does not result from differences in the scale of operations or the structure of activities.

3.4.3 – Bank efficiency in India and Pakistan

Sathye (2003) measures the productive efficiency of banks in India for the year 1997-98. The measurement of efficiency is done using data envelopment analysis. The calculation of bank efficiency is based on two input-output models. In the first model, outputs are non-interest income and net interest income and the inputs are interest expenses and non-interest expenses. In the second model, net loans and non-interest income are outputs, while deposits and staff number are used as inputs.

Based on the ownership structure, the Indian banking industry is divided into three groups: publicly owned, privately owned and foreign owned. Sathye finds the efficiency of private sector commercial banks as a group is lower than that of public sector banks and foreign banks in India. Sathye then recommends that the existing policy of reducing non-performing assets and rationalization of staff and branches may be continued to obtain efficiency gains and make the Indian banks internationally competitive which is a declared objective of the financial liberalisation programme of the Government of India. Given that Sathye's study only examines the efficiency for one year, his conclusion regarding the liberalisation programme is not well supported.

Saha and Ravisankar (2000) employ the DEA to examine the efficiency of 25 public sector banks in India during 1992-1995. They exclude both private domestic and foreign banks. They conclude that, with a few exceptions, public sector banks improved their efficiency during 1992-1995. They also find that the public sector banks that successfully tapped capital markets during the recent privatisation drive attained consistently high efficiency scores.

Bhattacharyya et al. (1997) attempt to examine the impact of the financial liberalisation on the efficiency of banks in India during 1986-1991 using the two-step procedure. In the first step, Bhattacharyya et al. (1997) employ the DEA to measure the pure technical efficiency of banks, and in the second step, they employ SFA to determine factors that may explain variations in the measured efficiency. Instead of measuring annual frontiers, they pool data for all the years in the sample, i.e. from 1986 to 1991, to construct a single grand frontier against which the efficiency of each bank in the sample is then measured for each of the sample years. To measure the efficiency of banks using the DEA, Bhattacharyya et al. (1997) postulate that banks produce three outputs, i.e. advances, investments, and deposits, using two inputs, i.e. interest expenses and non-interest expenses. Their sample includes an un-balanced panel of more than seventy banks, including public sector banks, foreign banks, and domestic private banks. They find that public sector banks achieved the highest average efficiency, and the smallest average variation in efficiency, during the sample period. Overall average performance, they suggest, improved marginally after 1987: Public sector banks showed a significant decline in average efficiency, private Indian banks showed almost no change, and foreign-owned banks showed a remarkable increase in their efficiency during the sample period. In addition, foreign-owned banks exhibited below average performance through 1990, and improved dramatically to above average performance in the last year of the sample period, when they were nearly as efficient as the public sector banks.

After measuring efficiency using the DEA, Bhattacharyya et al. (1997) use SFA to examine factors explaining variations in the measured efficiency. They find that relative to the base year 1986, and controlling for ownership form and the environmental variables, performance declined significantly between 1988 and 1991: over the entire period the Baltagi-Griffin performance index declined at an average annual rate of 2.23%. They conclude that this declining trend presumably reflects a cautious adjustment of banks to rapid policy changes in a relatively unstable political environment. They also examine the impact of branching restriction policy and find no evidence to suggest that geographic restrictions on branch network expansion had any perceptible impact on the performance of publicly-owned banks, but find negative impact on the performance of private banks. Bhattacharyya et al. (1997) also find that the capital adequacy variable has a statistically insignificant impact on the performance of public sector banks, but for foreign-owned banks and private Indian banks it has a statistically significant adverse effect on performance. This suggests that the conservative behaviour of the latter two groups accounts for their lower efficiency scores, implying a risk-return trade-off in the industry. It should be noted that the time period used in their study might not be able to capture the impacts on the liberalisation that started in 1991-92.

Kumbhakar and Sarkar (2003) investigate the impact of financial liberalisation by calculating growth in the total factor productivity (TFP) of 23 public sector banks and 27 private domestic banks during 1985-1996 (their study excludes foreign banks). To date, this is the only study on the efficiency of Indian banks that uses a time period long enough to shed some light on the impact of the financial liberalisation. Kumbhakar and Sarkar (2003) measure TFP growth by estimating a translog cost function, and decompose TFP growth into a technological change, a scale, and a miscellaneous component. To estimate the cost function, they specify banks inputs and outputs according to the value-added approach. The banks' outputs vector includes quantities (Indian Rupee value in 1980–81 prices) of fixed deposits, savings deposits, current deposits, investments, and loans and advances. Apart from these, they also include the number of branches, disaggregated into rural branches, urban and semi-urban branches, and metropolitan branches as additional outputs. Labour and capital are used as two variables inputs, while equity is assumed as a quasi-fixed input. In addition, in Kumbhakar and Sarkar's study, prices of inputs are determined as follows: The price of labour is obtained by dividing total expenses on labour by total number of employees, and the price of capital is obtained dividing the difference between total operating cost and total expenses on labour by total fixed assets.

Kumbhakar and Sarkar's results indicate the presence of significant distortion in input prices due to regulation, which resulted in over-employment of labour relative to capital throughout the entire study period. The extent of distortion is observed to have declined over the years, but the rate of decline is very slow. TFP growth is found to be moderate over the entire study period, with a slowdown around 1990. A reversal of the downward trend is observed in the years following deregulation, but no significant improvement in TFP growth compared with the pre-deregulation period is observed in the post-deregulation period. Kumbhakar and Sarkar suggest that public sector banks in India have become too dominant to feel the impact of changes in the economic environment brought about by financial liberalisation. In the case of private banks, Kumbhakar and Sarkar find significant over-employment of labour relative to capital in the pre-deregulation years. The extent of distortion is found to have been progressively reduced in the post-deregulation period and completely eliminated by 1996, the terminal year of their study period. The TFP growth of private sector banks is found to be slightly higher than that of public sector banks for the entire study period.

Finally, to date, only one study has examined the efficiency of banks in Pakistan (see Hardy and De Patti, 2001). Hardy and De Patti (2001) employ parametric Distribution Free Approach to examine the impact of the financial liberalisation on revenue and cost efficiency of 33 banks. Their sample includes seven state-owned banks, two of which were privatised in 1991-92, twenty two foreign banks, and four wholly private domestic banks, for which data begin in 1993. They exclude specialised credit institutions, as these institutions are subjected different regulations. Like in this study, Hardy and De Patti (2001) corrected a number of typographical errors; data were obtained from various issues of the Money and Banking Statistics published by the State Bank of Pakistan. In order to evaluate the impact of financial liberalisation that started in 1991-92, Hardy and De Patti divide the whole sample period, i.e. 1981 to 1998, into two sub-periods: the first sub-period (1981 to 1992) represents the period before and during the liberalisation, and the second sub-period (1993 to 1998) denotes post-liberalisation period. After dividing the data into two sub-periods, Hardy and De Patti specify costs, revenue, and profit functions for each bank, where revenues are defined as total interest and fee receipts, total variable costs are the sum of interest costs and fees, and other wage and non-wage operating expenses, and profits are defined as the difference between theses revenue and the total costs. All bank-specific variables, except prices, are divided by total assets in order to normalise for difference in size between institutions. The translog functional form is used for estimation. The outputs specified for the cost, profit and revenue function are total earning assets, which comprise loans and advances, holding of government securities and bills purchased and discounted, cash balances with other banks, and investments. The unit price of banks' output is defined as total income from interest receipts and fees, divided by earning assets. The unit price of borrowed funds is defined as total interest expenses and fees divided by payable liabilities, namely deposits and amount due to other banks, which are specified as banks' inputs. Hardy and De Patti find that financial liberalisation has led to an increase in both revenue and costs of banks during the post-liberalisation period. They conclude that benefits of the liberalisation were passed to the consumers of bank outputs (such as borrowers and those needing transaction services, who received more and better products) and those supplying banks inputs (such as depositors). They also find no evidence of improvement in profit efficiency, which, they suggest, was held down by a combination of rising deposits rates and intensified competition.

3.5 – Summary and conclusion

The paucity in the scale and scope of the empirical studies on the efficiency of banks in developing countries is obvious from our review (see also Table 3.2). To date, very few studies have sought to measure the variations in the efficiency of banks in developing countries. One possible reason for this could be the lack of reliable data on the inputs and outputs of banks. It is also evident that most of the empirical studies use single-stage procedure to examine the impact of the implementation of the financial liberalisation programme. Furthermore, the impact of other components of the economic and structural reforms on the efficiency of banks has not been investigated. In the following chapters, we review the main components of economic and structural reforms in India and Pakistan, and attempt to examine the impact of these components, particularly that of the financial liberalisation, on the efficiency of commercial banks during the 1990s using non-frontier based ratio analysis and frontier based data envelopment analysis and stochastic frontier analysis.

Table 3.2 – A review of empirical studies on the efficiency of banks in emerging and developing countries

Author/ Year	Sample	Technique(s)	Input(s)	Output(s)	Main findings
Zaim (1995)	42 Turkish commercial banks in 1981 and 56 banks in 1990	- Non-parametric DEA	- Number of employees - Interest expenses - Depreciation expenditures - Expenditures on materials	- Demand deposits - Time deposits - Short-term loans - Long-term loans	- Efficiency improved by 10% after the implementation of the financial liberalisation - State banks are more efficient than private banks - Banks are successful in achieving optimal scale - Low pure technical efficiency is the main source of technical inefficiency
Yildirim (2002)	Turkish banks (1988-1999)	- Non-parametric DEA	- Demand deposits - Interest expense - Non-interest expense	- Loans - Interest income - Non-interest income	- Great variation in both pure technical and scale efficiency measures - No sustained efficiency gains due to unstable macroeconomic conditions and high scale inefficiency, which in turn, is due to decreasing returns to scale - Differences in the efficiency performance with different ownership status - Efficient banks are more profitable - Pure technical efficiency and scale inefficiency are positively related to size
Isik and Hassan (2002)	Turkish banks (1988-1996)	- Non-parametric DEA - Spearman and Pearson correlation coefficients	- Labour - Capital - Loanable funds - Deposit - Non-deposit funds	- Short-term loans - Long-term loans - Risk-adjusted off-balance sheet items - Other earning assets	- The heterogeneous characteristics of banks have significant impact on their efficiency - Cost and profit efficiencies have exacerbated over time - The dominant source of inefficiency is due to technical inefficiency - Strong negative relationship between bank size and efficiency - Strong association between X-efficiency and management-team structure

Isik and Hassan (2003)	Turkish banks (1981-1990)	- Malmquist TFP index	- Labour - Capital - Loanable funds	- Short-term loans - Long-term loans - Risk-adjusted off-balance sheet items - Other earning assets	- Banks' performance improved significantly after the implementation of financial liberalisation - Productivity gains were driven mostly by efficiency increases rather than by technical progress - Efficiency increases were mostly owing to improved resource management practices rather than improved scales - Private banks began to close their performance gap with public banks in the new environment
Gilbert and Wilson (1998)	Korean banks (1980-1994)	- Malmquist TFP index	- Labour - Capital - Purchased funds	- Demand deposits - Loans in domestic currency - Loans in foreign currency	- Improvement in TFP after the initiation of financial liberalisation programme due to improvement in both technology and efficiency - Korean banks responded to privatisation and deregulation by altering mix of inputs and outputs
Hao et al. (2001)	19 Korean private banks (1985-1995)	- Stochastic cost frontier	- Labour costs - Physical capital expenses - Allocated interest expenses	- Loans - Deposits	- Banks with higher rates of asset growth, fewer employees per million won of assets, larger amounts of core deposits, and lower expense ratios were more efficient - Banks which branched nationwide were more efficient - The 1991 financial deregulation had little or no significant effect on bank efficiency

Leightner and Lovell (1998)	Thai banks (1989-1994)	- Malmquist TFP index	- First Model (bank objectives) - Personnel expenses - Premise and equipment expenses - Provisions for possible loan loss - Second model - Personnel expenses - Premise and equipment expenses - Provisions for possible loan loss	- Second Model (Bank of Thailand objectives) - Interest income - Non-interest income - - - - Second model - Credits - Investments in securities	- When bank objectives were used the average bank experienced rapid growth in production and in TFP - When Bank of Thailand objectives were used similar growth in production were found but TFP declined for Thai banks and increased for foreign banks - Outside the context of the 1997 Asian Crises, financial liberalisation had positive impact on bank efficiency due to: (1) the booming economy; (2) the oligopolistic financial system at the onset of liberalisation; (3) international expertise of many Thai banks; and (4) international expertise of foreign banks
Chen and Yeh (2000)	34 Taiwanese commercial banks (1995-1996)	- Non-parametric DEA - Malmquist TFP index	- Deposits	- Provision of loan services - Portfolio investment - Non-interest income	- Lower technical efficiency in publicly-owned banks than in privately-owned banks due to pure technical efficiency - Slight increase in the productivity of banks
Huang (2000)	22 domestic Taiwanese banks (1981-1995)	- Parametric translog profit function - Nonlinear iterative seemingly unrelated regression (NISUR) technique	- Deposits and borrowed money - Labour	- Investments - Loans	- More than half of all potential profits are lost due to economic inefficiency - Most inefficiency come from devoid output revenues - Technical inefficiency is relatively more important compared with allocative inefficiency - Larger banks tend to be more technically efficient than smaller ones - Public banks are technically much more efficient than private banks, and the latter are only moderately more allocatively efficient than the former

Abd Karim (2001)	82 Indonesian, 31 Malaysian, 27 Philippine, and 15 Thai banks (1989-1996)	- Stochastic cost frontier	- Expenses on wages and salaries, land, buildings and equipment - Interest on deposits	- Commercial and industrial loans - Other loans - Time deposits - Demand deposits - Securities and investment	- Increase in return to scale - Differences in bank efficiency across the four countries - Cost inefficiency increase over the years before the 1997 crises - Large banks have lower cost inefficiency - Privately owned banks are more cost efficient that state-owned banks
Kwan (2003)	Banks in Hong Kong, Indonesia, Malaysia, the Philippines, Singapore, South Korea and Thailand (1992 to 1999)	- Time series analysis -	-	-	- Improvement in operating performance over time - Systematic differences in bank operating efficiency across Asian countries - Banks using relatively more labour in a particular country is due to the labour force productivity, rather than labour being cheap
Zenios et al. (1999)	144 branches of the Bank of Cyprus	- Non-parametric DEA	- Managerial personnel - Clerical personnel - Computer terminals - Space - Number of accounts	- Time spent on each transaction	- Branch resource underutilisation - Branches in rural and tourist areas have lower efficiencies than urban branches
Tsionas et al. (2003)	19 Greek banks (1993-1998)	- Non-parametric DEA - Malmquist TFP index	- Labour - Physical capital - Deposits	- Loans - Investments - Liquid assets	- Majority of banks operate close to best market practices - Allocative inefficiency costs seem to be more important than technical inefficiency costs - A positive but not substantial technical efficiency change (2.3%) is associated to efficiency improvement for the medium-sized banks and to technical change improvement for larger institutions

Halkos and Slamouris (2004)	Greek banks (1997-1999)	- Non-parametric DEA using ratios as output measures	-	- Financial ratios	- The higher the size of total assets the higher the efficiency - Wide variation in performance - Increase in efficiency is accompanied with a reduction in the number of small banks due to mergers and acquisitions - Non-systematic relationship between transfer of ownership and last period's performance
Canhoto and Dermine (2003)	20 Portugese banks (1990-1995)	- Non-parametric DEA - Malmquist TFP index	- Number of employees - Physical capital (book value of fixed assets)	- Loans - Deposits - Inter-bank assets/liabilities - Number of branches	- Improvement in efficiency of 59% over the years 1990–1995 - New banks, which were allowed to operate in the liberalised era, dominate the old ones in terms of efficiency
Mertens and Urga (2003)	79 Ukrainian banks in 1998	- Stochastic frontier approach - Thick frontier approach	- Deposits - Purchased funds - Labour	- Interbank loans - Clients' loans - Investment in securities	- Small banks are more efficiently in cost terms but less efficient in profit terms - Substantial difference in scale economies between small and large banks - Large banks show significant diseconomies of scale while small ones show significant scale economies
Nikiel and Opiela (2002)	43 Polish banks (1997-2000)	- Parametric frontier analysis - Distribution-free approach	- Interest expenses on funds - Labour price	- Household loans - Business loans - Securities	- Foreign banks servicing foreign and business customers are more cost-efficient and less profit-efficient than other banks - Evidence of cost economies and profit diseconomies of scale
Hasan and Marton (2003)	Hungarian banks (1993-1998)	- Stochastic frontier analysis - OLS	- Borrowed funds - Labour - Related expenses	- Loans - Investments - Non-interest or fee-related income - Interest bearing borrowed funds	- Early reorganization initiatives, flexible approaches to privatisation and liberal policies towards foreign banks' involvement with the domestic institutions helped to build a relatively stable and increasingly efficient banking system - Foreign banks and banks with higher foreign bank ownership involvement were associated with lower inefficiency

Kraft and Tirtiroglu (1998)	43 Croatian banks (1994-1995)	- Stochastic cost frontier	- Wages - Capital - Funds	- Loans - Deposits	- New banks are neither as efficient as the old banks nor do they operate at efficient scale - Negative, but only weakly statistically significant relationship between profitability and X-efficiency due to free-riding opportunities created by distressed borrowers, limited competition, and start-up difficulties at the new banks.

Chapter 4 – The Economic and Structural Reforms and the Evolution of the Banking Industry in India and Pakistan

4.1 – Introduction

As highlighted in chapter 1, India and Pakistan launched a programme of Economic and Structural Reforms (ESRs) in the early 1990s in areas including industry, trade, exchange rates, foreign investment, tax policy, government expenditures, and the financial sector (see Sachs et al., 1999; Panagariya, 2004; Zaidi, 1999; Husain, 1999). The key objective of the ESRs was to reduce pervasive state-directed resource allocation and to make the economy more market friendly.

This chapter reviews the key elements of the ESRs in India and Pakistan. In the context of the present study, emphasis will be placed on the financial liberalisation programme. This review highlights the changes brought about by the ESRs in the economic environment in which commercial banks in India and Pakistan operate. In addition, we examine trends in the banking industry in both the countries, before and after the implementation of the ESRs. Our aim is to examine whether the ESRs, particularly the financial liberalisation programme, resulted in any change in the banking industry in terms of deposits mobilisation, credit provision, asset diversification, profitability, and efficiency. It should be noted that unlike in the following chapters that employ frontier techniques (DEA and SFA) to evaluate bank efficiency, the analysis in this chapter is based on traditional financial ratios.

The rest of the chapter is structured as follows. Sections 4.2 and 4.3 discuss the key elements of the ESRs in India and Pakistan, respectively, and examine trends in deposits mobilisation, credit provision, competition and profitability, and financial ratios-based efficiency of banks. Section 4.4 summarises and concludes.

4.2 – The ESRs and the banking industry in India during the 1990s

4.2.1 – Key elements of the ESRs and macroeconomic performance during the 1990s

After its independence in 1947, India pursued a policy of state-controlled resource allocation until the early 1980s when a liberalisation programme was initiated. The scope of the early 1980s' liberalisation programme, however, was limited because of the dominance of the leftist ideology in India that emphasised an equitable allocation of resources by the state. Therefore, it is argued that the liberalisation of the early 1980s was introduced quietly and without much content (usually referred to as 'liberalisation by stealth') (see Panagariya, 2004). In contrast, the ESRs initiated in the early 1990s, when India was facing a severe fiscal and balance of payment crisis, were a combination of short-term stabilisation and long-term structural adjustments that sought to gradually reduce government's role in mobilising and directing economic resources in the economy.

Key elements of the ESRs included controlling fiscal deficits and inflation, improving the external payments position, liberalising import rules and cutting import duties, encouraging exports and foreign investment, removing controls on private investment, and reforming the financial sector by lowering excessive government regulations and restrictions (Srinivasan, 2000).

Table 4.1 shows key macroeconomic indicators of India from 1980 to 2001, reflecting the economic performance in areas targeted by the ESRs[1]. In 1991 fiscal deficits of the central and local government reached 10% of GDP, the rate of inflation was nearly 14%, and real GDP grew at the rate of less than 1%. The current account deficit reached 3.2% of GDP in 1990, compared with 1.79% and 2.34% in the first and second half of the 1980s, respectively. The foreign currency reserves fell to US$ 1.5 billion in 1990 and, thus, for the first time in its modern history India was faced with the prospect of defaulting on its external commitments.

Table 4.1 suggests that the GDP growth rates were much higher during the 1980s than in the 1990s. It is argued that high, albeit volatile, average GDP growth rates during the 1980s (i.e. prior to the ESRs) were achieved through an unsustainable fiscal expansion financed by external and internal borrowings (Joshi and Little, 1994). There was a jump in the GDP growth rate during 1977–79, a massive decline in 1979–80, a jump again in 1980–82, a moderate growth during 1982–88 except 1983–84, a climb up again in 1988–91, and a crisis in 1991–92 (see Panagariya, 2004). On the other hand, growth rates during the 1990s were more robust and far less volatile. From 1992 to 1993 GDP growth rates improved significantly, and again during 1994-1996 GDP grew impressively at the rate of more than 7%. From 1997 until 2001, the GDP growth rate ranged between 3.95% and 6.5%.

During the 1980s fiscal deficits were large and growing. Fiscal deficits as a percentage of GDP in the first and second half of the 1980s were around 6%. This, however, deteriorated to 7.9% during the late 1980s (see Table 4.1). At the same

[1] In this chapter, unless stated otherwise, the statistics are calculated by the author. For details on the sources of data see Appendix 4.1.

time, government expenditure increased significantly from 24.5% of GDP in 1981-1982 to 30.5% in 1986-1987, and 36.6% in 1990-1991 (see Bajpai and Sachs, 1999). It could be argued that these figures understate the extent of the fiscal deficits because during this period the interest rates at which the Government of India appropriated a large share of the loanable funds of the commercial banking industry, through the Statutory Liquidity Ratio (around 38.5%) and the Cash Reserve Ratio (around 15%), were administratively set below what would have been the market clearing level (see Srinivasan, 2000, pp32-36)[2]. Although high government expenditure maintained high and volatile growth rates, the growing fiscal deficits and government expenditure were identified as one of the root causes of the 1991 crisis. Therefore, reducing fiscal deficits was considered as the primary objective of the ESRs in the early 1990s.

Nevertheless, as Table 4.1 shows, tackling high fiscal deficits was a rather disappointing aspect of India's ESRs (see, Ahluwalia, 1999a). In the post-ESRs period fiscal deficits as a percentage of GDP declined to less than 6% in 1991 and 1992, increased again to 7% in 1993 and decreased thereafter, ranging between 4.7% and 5.5% (see Table 4.1). However, this ratio remained well above the target of 3% set by the Indian Ministry of Finance in 1993. It is argued that the lack of improvement on the fiscal front was due to high central and state government

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[2] This argument will become the basis of our hypothesis regarding the possibility of a negative relationship between bank efficiency and fiscal deficits in chapter 6.

expenditures, rising interest rates that made debt servicing more expensive, and the lack of improvement in tax structure (see Bajpai and Sachs, pp 81-118)[3].

Table 4.1 – Macroeconomic Performance Indicators of India (1980 – 2001)

	GDP Growth[1]	Fiscal Deficits[2]	Inflation[3]	C/A Balance[4]	Reserves[5]	Exports Growth[6]	Imports Growth[7]	FDI[8]	GDI[9]
1980/4[10]	5.58	-6.06	9.16	-1.79	5346.3	3.98	7.04	53.6	20.80
1985/9[11]	6.21	-7.93	7.96	-2.34	5605.52	6.63	6.85	155.9	23.26
1990	5.81	-7.64	10.55	-3.20	1521	9.10	3.69	236.7	24.06
1991	0.91	-5.49	13.82	-0.61	3626.6	10.80	-12.21	73.5	21.93
1992	5.27	-5.33	8.85	-1.59	5757.1	6.92	19.18	276.5	23.78
1993	4.87	-7.04	9.48	-0.56	10199	14.41	11.13	550.4	21.25
1994	7.59	-5.60	9.55	-1.17	19698	7.96	17.55	973.3	23.38
1995	7.68	-5.04	8.94	-1.76	17922	32.93	14.48	2143.6	26.53
1996	7.23	-4.89	7.40	-1.30	20170	7.05	10.12	2426.1	22.13
1997	4.45	-4.87	6.53	-1.44	24688	6.23	11.78	3577.3	22.93
1998	6.50	-5.27	7.37	-1.05	27341	12.53	-2.51	2634.7	21.36
1999	6.10	-5.50	4.47	-1.14	32667	16.68	12.73	2168.6	23.59
2000	3.95	-5.21	4.09	-0.64	37902	20.86	10.62	2315.1	22.90
2001	5.40	-4.74	3.50	0.27	45870	9.01	4.86	3403	22.50

[1] Real in %. [2] Overall budget balance of the central government, including grants as % of GDP. [3] Consumer Price Index in %. [4] Current Account Balance as % of GDP. [5] Net International Reserves, excluding gold, in current million US$. [6] and [7] in %. [8] Net inflows of FDI in current million US$. [9] Gross Domestic Investments as % of GDP. [10] and [11] Annual Average.
Source: ***World Development Indicators 2003***

Opening the economy to foreign trade and foreign investment was considered as an important step to reap potential benefits from a greater integration with the world economy (Sachs et al., 1999). Reforms in trade policy included: dismantling quantitative restrictions, reducing tariffs, and introducing a flexible exchange rate regime. These policies led to some improvements in the external payment position (see Table 4.1). The current account deficit decreased substantially in the post-ESRs

[3] Another factor contributing to the presence of high fiscal deficits is the presence of various explicit and implicit subsidies of government (estimated to be around 14.4% of GDP in 1994-1995) (see Srinivasan, 2000, p. 40).

period. For example, in 1990 the current account deficit was 3.2% of GDP, while between 1992 and 2001 it ranged between 0.56% and 1.76%, which was well below the ratio in 1990 and during the pre-ESRs period. Foreign direct investment inflows improved considerably during the post-ESRs period.

Foreign currency reserves increased from US$ 1.5 billion in 1990 to US$ 5.7 billion in 1992, which was equal to the average level of the 1980s. From 1993 to 2001 the reserves increased steadily and reached US$ 45.8 billion in 2001. Exports grew significantly after the reforms though there was some slowdown, which is partly attributed to slower growth in world trade (Ahluwalia, 1999a). Imports during the post-ESRs period also grew at much higher growth rates than during the pre-ESRs period. The import-weighted customs duty rates of the whole economy, decreased from 87% in 1990 to 30% in 1999 (Ahluwalia, 1999a).

Another key element of the ESRs was a gradual removal of controls on private investment in order to create a more competitive industrial environment. The 'Statement of Industrial Policy' in 1991, usually known as the New Industrial Policy, sought to remove the complex licensing policy of the 1980s. By reducing the number of industries reserved for the public sector, and by initiating a policy of automatic approval for foreign direct investment (FDI) up to 51 percent, the New Policy ended the public sector's monopoly in many industries that prevailed in the pre-ESRs period (see Panagariya, 2004, p. 22). Investment by both the private corporate sector and households increased after the New Industrial Policy was implemented. For example, investment by the private corporate sector as a percentage of GDP increased from 3.5% in the 1980s to around 6% between 1992 and 1994 and 8%

between 1995 and 1997. The increase in private investment was, however, offset by a decline in public sector investment (Ahluwalia, 1999a), and, therefore, the ratios of gross domestic investment over GDP in the post-reforms period were not much different from those in the 1980s. During the late 1980s, average annual inflow was around 155 million dollars. FDI inflows to the country increased rapidly in the 1990s after an abrupt drop in 1991. By 2001 the FDI inflows were US$ 3.4 billion, compared with US$ 53 million and US$ 155 million in the first and second half of the 1980s, respectively (see Table 4.1).

4.2.2 – Reforms in the financial sector

The objective of the financial liberalisation programme, a key element of the ESRs, was to enhance the efficiency of financial institutions, particularly that of commercial banks, and capital markets to mobilise and allocate scarce financial resources (Hanson and Kathuria, 1999, Sen and Vaidya, 1998). Towards this end, in August 1991, the Government of India appointed a high level Committee (the Narasimham Committee) to look into all aspects of the financial system, and make comprehensive recommendations for reforms. The Committee made a number of recommendations for reforms in the banking industry and in the capital market (Ahluwalia, 1999b). With the acceptance of the government, the financial liberalisation programme was set in motion in 1991-1992[4].

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[4] The website of the Reserve Bank of India, www.rbi.org.in, is a rich source of information about the financial sector reforms, especially the reforms in the commercial banking industry, in India. Documents that are extensively used for this review are Trend and Progress of Banking in India (various issues)

In the banking industry, as discussed below in more detail, measures were introduced to promote flexibility and competition. Interest rates were liberalised, allowing banks to vary rates charged to borrowers according to their costs of funds and the creditworthiness of their borrowers (RBI, various issues, Ahluwalia, 1999b). Competition was promoted within the banking industry and between banks and non-bank financial institutions (NBFIs), development finance institutions (DFIs), and capital markets (Ahluwalia, 1999b). According to an official from the Reserve Bank of India, the competition from other institutions and markets spurred by the financial liberalisation compelled commercial banks to gradually adopt modern technology to maintain their market share (Talwar, 2001). In the following chapter, using a Malmquist total factor productivity index, we will examine this claim.

Regarding the stock markets, as Sen and Vaidya (1998) state, 'compared with other developing countries, India has had fairly well-developed stock markets...In 1993 India ranked 22 in the world in terms of market capitalisation, 24 in terms of value traded and 2 in terms of listed domestic securities' (p. 79). The financial liberalisation programme endeavoured to enhance the role of capital markets in mobilising and channelling financial resources. Before 1991 India's capital market did not have a statutory regulatory framework (Hanson and Kathuria, 1999). The Securities and Exchange Board of India was given statutory powers in 1992. It laid down a structure of regulations governing participants in the capital market, including rules for insider trading, takeovers and management of mutual funds, regulation of new issues and information requirements for listed shares. The focus of the new regulations was to better govern the stock exchanges and ensure investor protection through transparency and full disclosures. A new exchange, the National

Stock Exchange, was created in 1992. Another important policy in the reforms was the opening of the capital market to foreign institutional investors, and allowing Indian companies to raise capital abroad by issuing equity in the form of global depository receipts. As a result of these measures, market capitalisation as a ratio of GDP increased from around 5% in the 1980s to above 50% by the mid 1990s (see Sen and Vaidya, 1998).

4.2.3 – Reforms in the commercial banking industry

Reforms in the Indian commercial banking industry were initiated in 1992 with the acceptance of the key recommendations of the Narasimham Committee. The reforms aimed at increasing the profitability and efficiency of banks, especially that of public sector banks (PSBs), and improving their safety and soundness through improvement in prudential norms and standards, reducing the cash reserve ratio (CRR) and statutory liquidity ratio (SLR), liberalising branching policy, interest rate deregulation, increasing competition in the banking sector, eliminating quantitative restrictions on credit allocation by banks, and strengthening supervision.

The financial liberalisation programme gradually changed the economic environment faced by the commercial banking industry. The interest rate liberalisation, which gradually deregulated deposit rates and lending rates, was aimed at giving banks opportunity to offer borrowers more attractive interest rates (Ahluwalia, 1999b). At the same time, the elimination of quantitative restrictions on credit allocation (e.g. state-directed credit allocation to priority sectors) gave banks more operational freedom to determine their asset portfolio and to strengthen their methods of assessing the working capital requirements of borrowers. This, however, was allowed within the prudential guidelines and exposure norms prescribed by the Reserve Bank of India. Prior to the liberalisation, to finance growing fiscal deficits, the Government of India kept the interest rates on government securities below the market-clearing rate. The liberalisation allowed the interest rate on government securities to be determined by the market on the basis of periodic auctions (see RBI, various issues).

To allow banks to have more control on their asset portfolios, the financial liberalisation programme lowered the existing high reserve requirements and mandatory requirements for investment by banks in low-interest government securities. Towards this end, average CRR fell from 15% in the 1990-1991 to around 5% by the end of the 1990s, and SLR was gradually reduced from above to 35% in the early 1990s to around 25% in the late 1990s (see RBI, various issues).

Prior to the liberalisation, the entry of foreign banks (FBs) and domestic private banks (DBs) was restricted. To increase the level of competition in the commercial banking industry, new private sector banks were given licenses and FBs were allowed to expand much more liberally than in the past. Banks were also exposed to increased competition from the non-bank sector, including NBFIs, DFIs and the capital market (RBI, various issues; Ahluwalia, 1999b; Hanson and Kathuria, 1999). In addition, the liberalisation programme allowed PSBs to raise capital from domestic equity markets in order to allow gradual privatisation of these banks.

The focus of the statutory regulation of commercial banks in India until the early 1990s was mainly on licensing, administration of minimum capital requirements, pricing of services including administration of interest rates on deposits and credit, and reserves and liquid asset requirements (see Venkitaramanan, 1999). The regulatory and supervisory frameworks for banks in India also underwent significant changes after the liberalisation. Prior to 1993, the supervision and regulation of commercial banks was handled by the Department of Banking Operations and Development (DBOD). In December 1993 the Department of Supervision was carved out of the DBOD with the objective of segregating the supervisory role from the regulatory functions of RBI. The aim was to align supervisory and regulatory standards with international best practices by keeping in view the socio-economic conditions of the country, the business practices, the payment systems prevalent in the country and the predominantly agrarian nature of the economy. Prudential norms and standards relating to capital adequacy, income recognition, asset classification and provisioning were upgraded and brought into a closer alignment with the Basle Committee's recommendations. External supervision of banks was strengthened to monitor and evaluate banks' performance on the basis of the new prudential standards (RBI, 2000).

The major instrument of supervision of the financial sector is inspection. Areas relating to internal control, credit management, overseas branch operations, profitability, compliance with prudential regulations, developmental aspects, proper valuation of assets/liabilities, portfolio investment, and the bank's role in social lending are covered in the course of the inspection (RBI, 2000).

The entire supervisory mechanism was realigned in 1994 under the directions of a newly constituted Board for Financial Supervision (BFS), which functioned under the aegis of the Reserve Bank of India. Off-site and on-site surveillance and new institutions for supervision and monitoring were introduced. The Off-site Monitoring and Surveillance System (OSMOS) was introduced in 1995 as an additional tool for supervision of commercial banks to supplement the on-site examinations[5]. All commercial banks were introduced to concurrent audit in 1993 by using external auditors and required to set up audit committees to follow up on the reports of the statutory auditors and inspection by the RBI. It is argued that higher prudential standards forced banks to seek quality borrowers in order to improve their asset quality (Talwar, 1999) and strengthening external supervision made the financial condition of banks more transparent (Ahluwalia, 1999b).

In the 1990s, the Indian commercial banking industry was also exposed to major changes brought about by other elements of the overall economic reforms initiated in 1991 such as controlling fiscal deficits and government expenditure, removing controls on private investment and encouraging foreign direct investment. For example, fiscal reforms enabled government to reduce its reliance on funds mobilised by the commercial banking industry, while the liberalisation of investment provided more opportunities to extend loans and advances (more on this in chapter 6). In the following sections the trends and performance of the Indian commercial banking industry in the 1990s are evaluated on the basis of deposit mobilisation and

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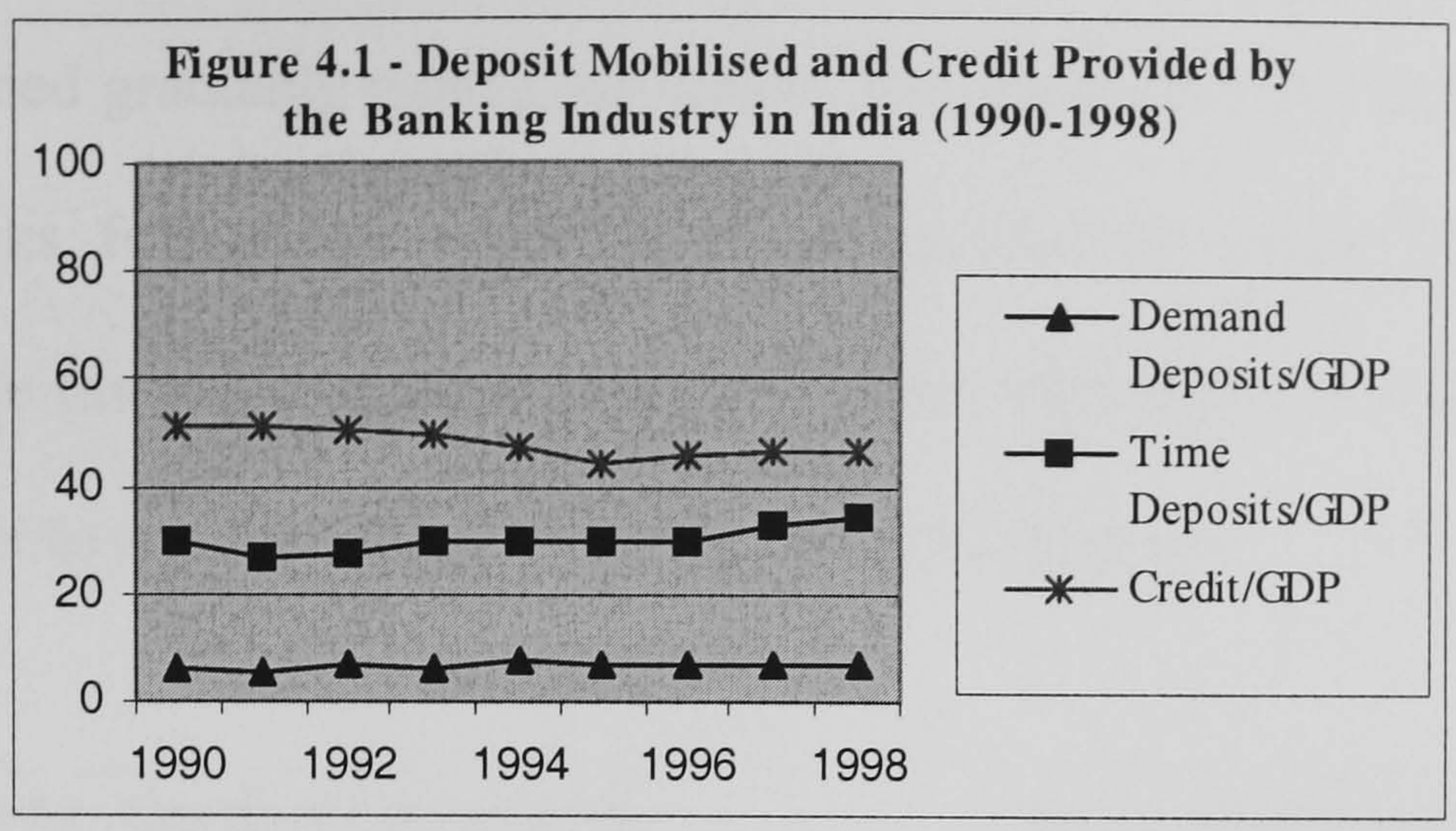
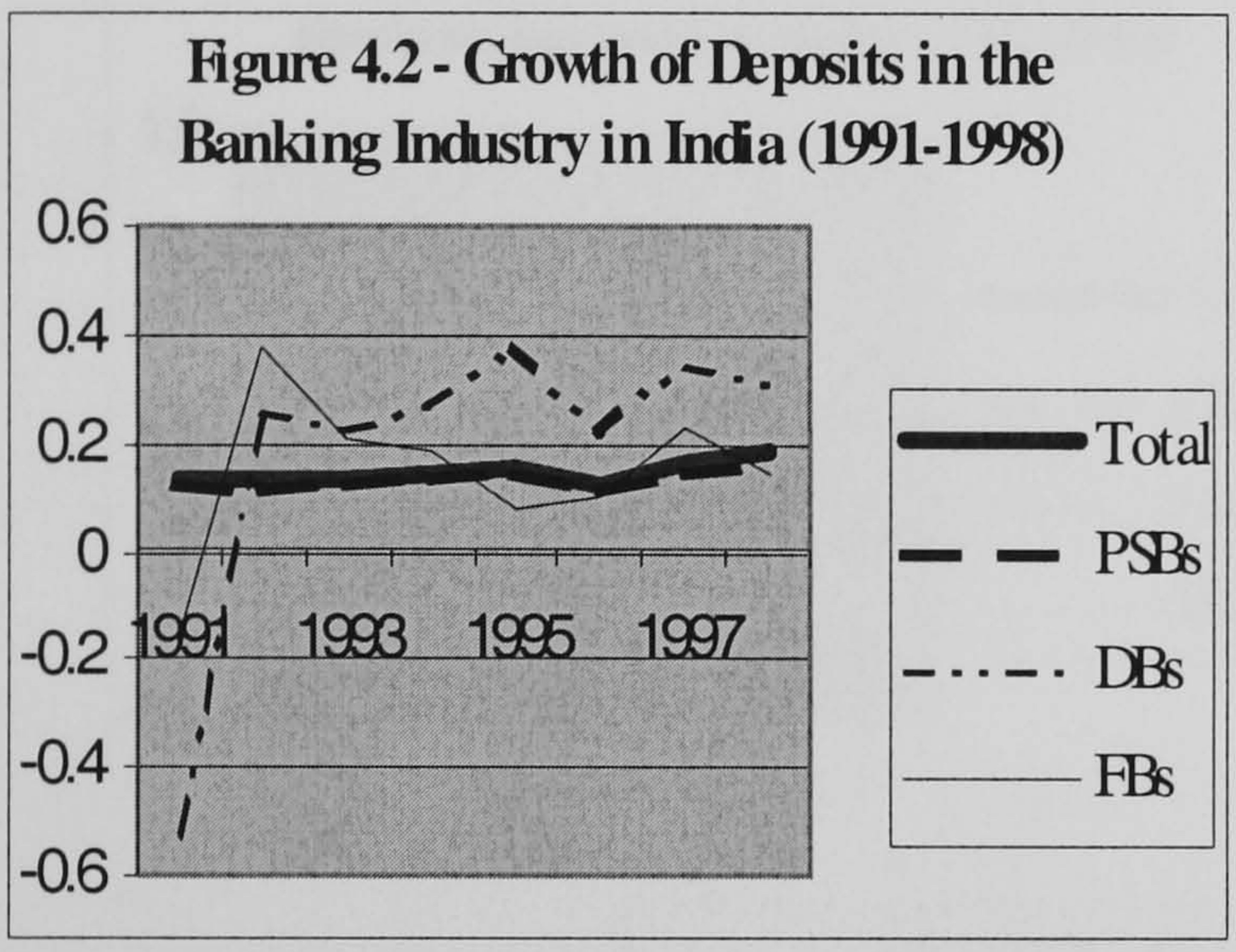
[5] On-site inspection of banks is based on the CAMELS model (Capital adequacy, Asset quality, Management, Earnings appraisal, Liquidity and Systems & controls). A rating system for domestic and FBs based on the international CAMELS model combining financial management and systems and control elements was introduced for the inspection cycle commencing from July 1998. Off-site monitoring system for surveillance over banks was put in place in RBI in March 1996. This requires quarterly reporting on assets, liabilities and off balance-sheet exposures, operating results for the quarter, asset quality and large credit exposures in respect of domestic operations by all banks in India (RBI, 2000).

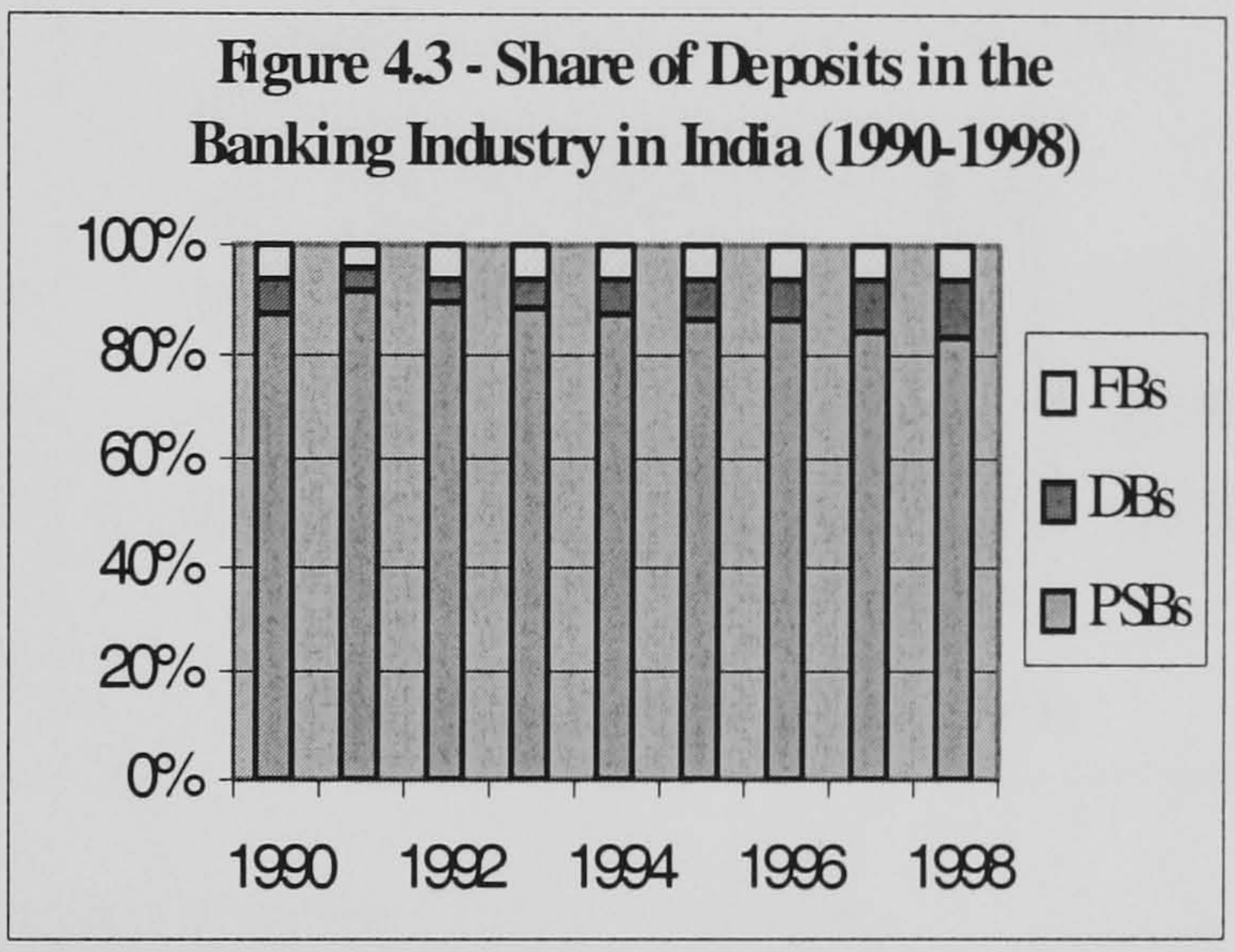
credit provision, asset diversification, competition, profitability, and ratio-based efficiency.

a – Deposit mobilisation and credit provision

There were some achievements in the 1990s in terms of deposit mobilisation and credit provided to the economy by the Indian commercial banking industry. Figure 4.1 shows that time deposits as a percentage of GDP increased steadily in the 1990s. From 29% in 1990 this ratio briefly decreased to 26% and 27% during the time of crisis, i.e. 1991 and 1992, but increased after 1992. By 1998, this ratio increased to 34.2%. Meanwhile demand deposits as a percentage of GDP stayed almost unchanged at around 6.7% after a decrease to 5.6% in 1992. A similar trend can be seen in banks' credit provision. Figure 4.1 also shows that shortly after the initiation of the liberalisation, credit provided by the commercial banking industry as a ratio of GDP decreased from 51% in 1990 to 44% in 1995. However, from 1995 to 1998 this ratio increased gradually and reached 47% in 1998.



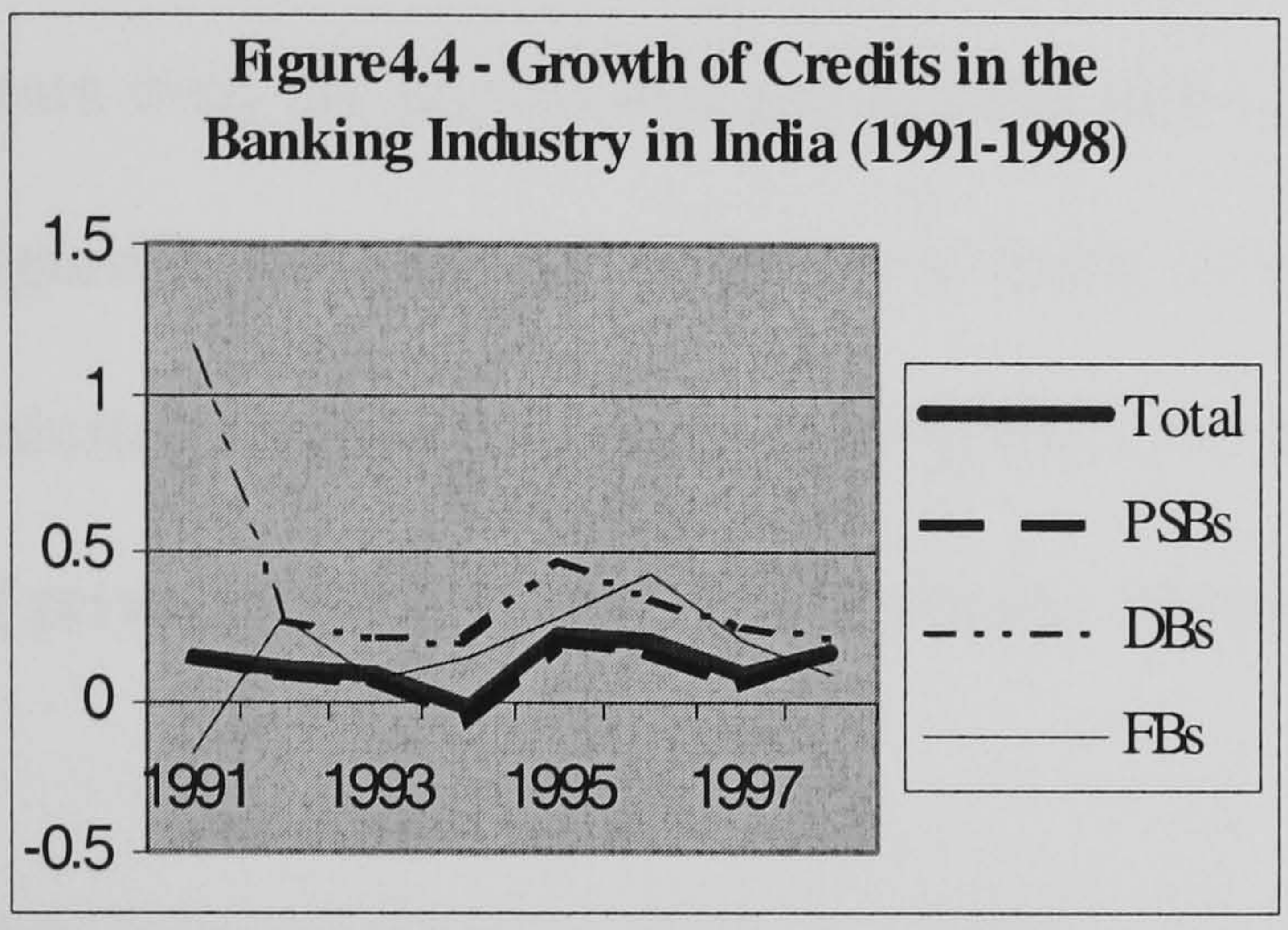


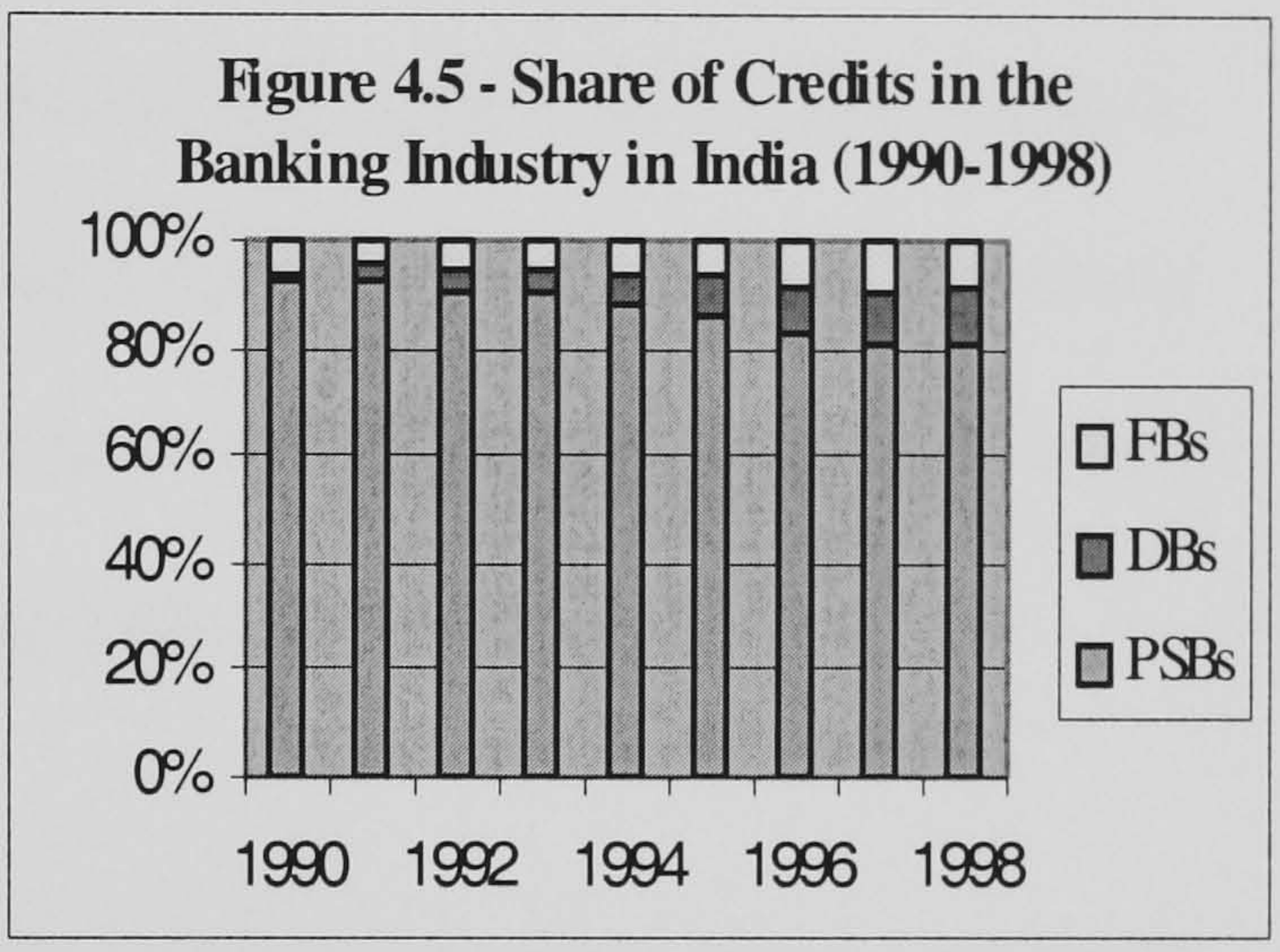


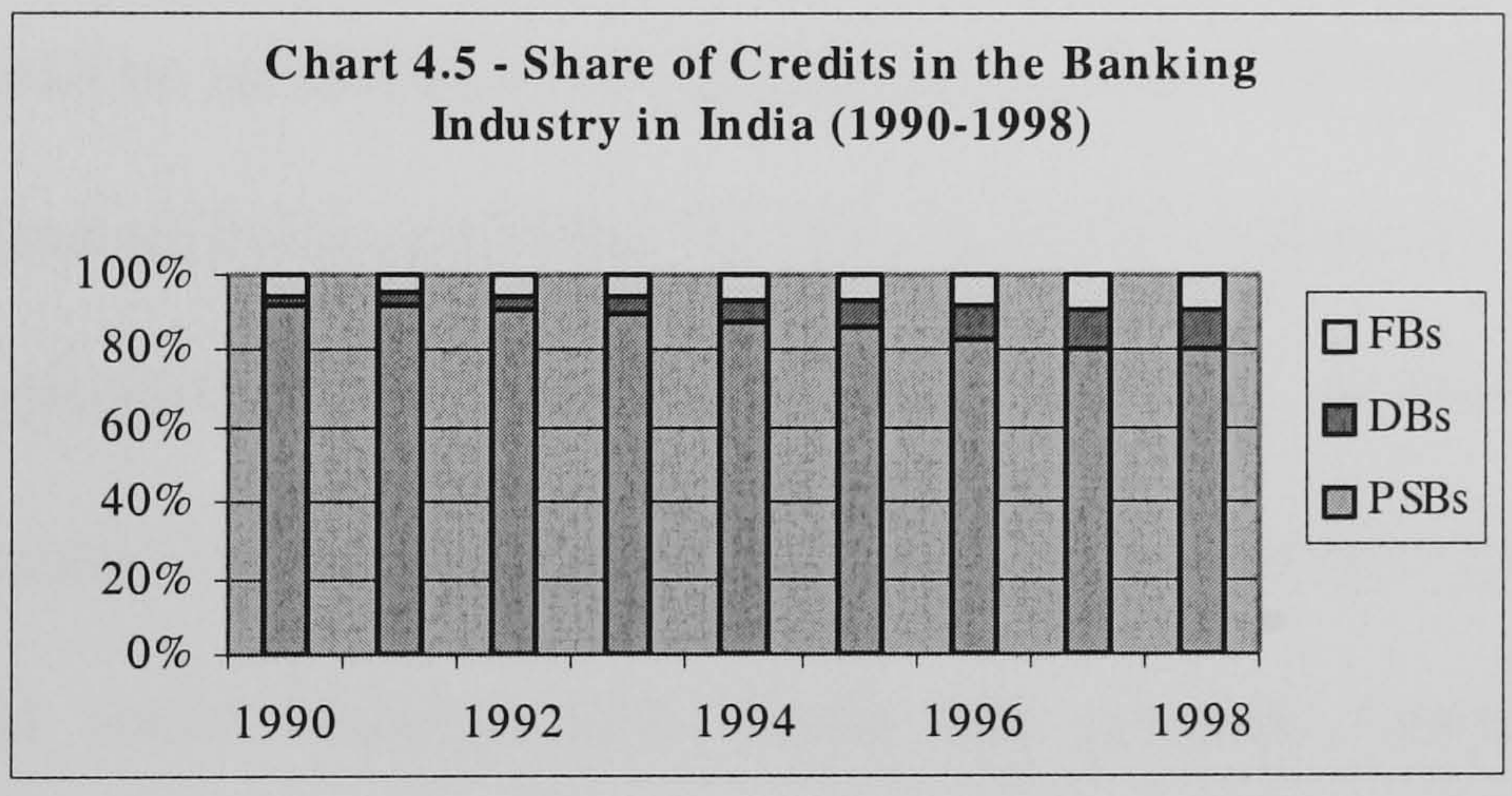
FBs= Foreign Banks; DBs=Domestic Private Banks; PSBs=Public Sector Banks

Figure 4.2 shows that the growth rates of deposits mobilised by the commercial banking industry were impressive during 1991 and 1998. The average growth rate of the whole industry was around 14.4%, which was close to the average rates of PSBs and FBs but lower than the average rate of DBs at 18.4%. In the 1990s the growth rates of deposit mobilised by PSBs were rather stable, ranging between 11.2% and 18%. Meanwhile the growth rates of deposits mobilised by the FBs were fluctuating, –16% in 1991 and ranging between 7% and 37% between 1992 and 1998. DBs had the highest growth rates of deposit mobilisation in most years. Except in 1991, where the growth rate in this sector was –52%, between 1992 and 1998, the growth rates ranged between 21.6% and 37.1%.

Figure 4.3 shows that in terms of share of total deposits, concentration in the banking industry declined gradually during the 1990s. The share of PSBs declined while that of private banks, foreign and domestic, increased over the years. This may suggest that PSBs were finding it difficult to maintain their dominance that prevailed during the period prior to the initiation of the financial liberalisation.







FBs= Foreign Banks; DBs=Domestic Private Banks; PSBs=Public Sector Banks

As mentioned above, the interest rate liberalisation gave banks more flexibility to offer borrowers more attractive interest rates. At the same time the competition for lending within the commercial banking industry and from the non-bank industry, including NBFCs, DFIs and the capital market, intensified. Meanwhile, other elements of the reform such as opening the economy to trade and foreign investment and removing controls on private investment might have had some positive impacts on demand for funding. Under these circumstances credit provided by the banking industry increased at the average rate of 11.9% in the 1990s.

Figure 4.4 shows that the growth rates of credit provided by the three groups exhibited similar trends. Credit provided by PSBs and FBs increased at the average rate of 10% and 16%, respectively. DBs had the highest growth rate of credit in most years with the annual average growth rate of 38.6%. As in the case of total deposits, Figure 4.5 shows that in terms of share of total credit, concentration in the banking industry declined gradually during the 1990s. The share of PSBs decreased while that of private banks, foreign and domestic, increased over the years.

This improvement in deposit mobilisation and credit provision by the commercial banking industry could be attributed to several elements of the 1991 reforms. Before 1991 the Reserve Bank of India controlled the rates payable on deposits and also the rates that could be charged for bank loans (Ahluwalia, 1999b). As the interest rate deregulation gave banks flexibility to offer borrowers and depositors more attractive interest rates, banks could mobilise more funds and generate more loans. The availability of funds was also improved due to reduction in CRR and SLR.

b – Asset diversification

This section evaluates asset diversification in the Indian commercial banking industry during the 1990s. In India, as credit and investment are the two major sources of income for banks on the asset side of their balance sheet, the level of diversification depends largely on the choice between these two assets, which in turn depends on their relative risk and return. Investments primarily include government securities. According to Sarkar (1999) with the deregulation of lending interest rates and gradual reduction in CRR and SLR, one would expect Indian banks to alter their asset portfolios in favour of credit. Nevertheless Figure 4.6 shows that this did not occur in the Indian commercial banking industry. The share of credit in total assets of the industry fluctuated without any clear trend. Meanwhile the share of investment increased from 23.7% in 1990 to 34.2% in 1998. This increasing share of investment in total assets was due to an increase in the proportion of investment in government securities (Sarkar, 1999).

Figures 4.6 to 4.9 show that the trends of asset diversification in PSBs, DBs and FBs resembled that of the whole industry, especially in PSBs. For DBs and FBs the gap between shares of credit and investment in total assets was much wider in the mid 1990s and became smaller toward the end of the decade.

Figure 4.6 - Asset diversification in the Banking Industry in India

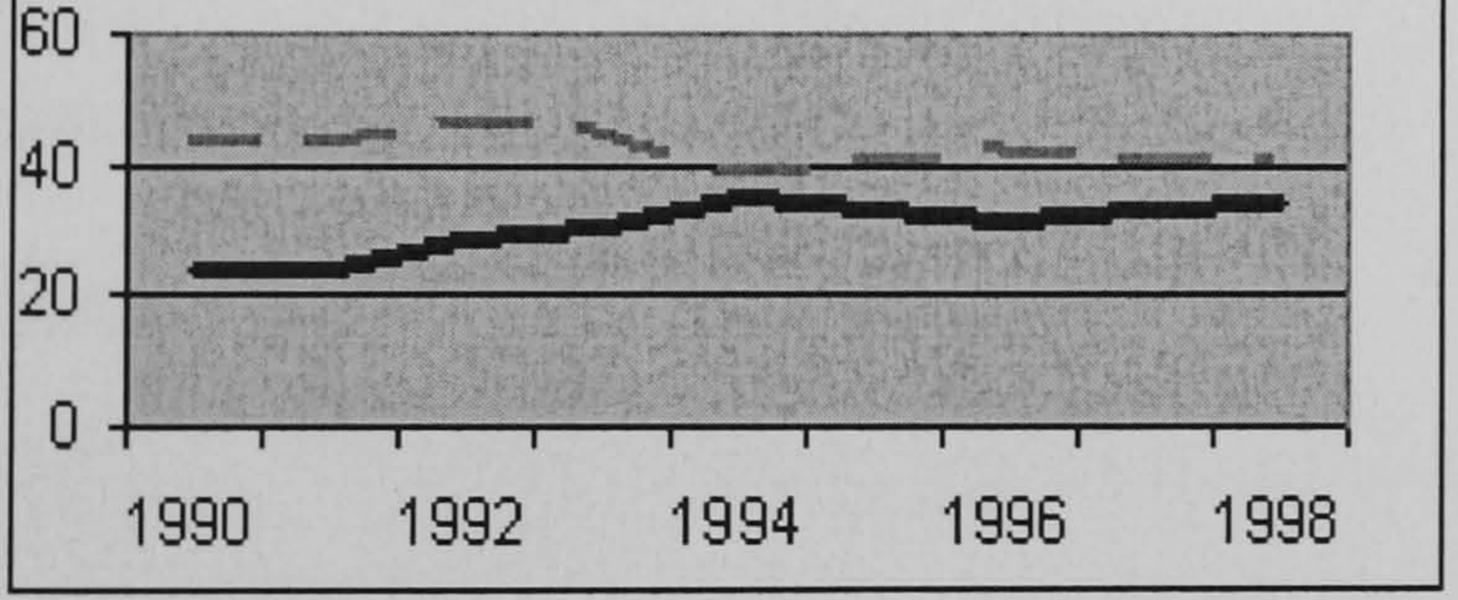


Figure 4.7 - Asset diversification in Public Sector Banks in India

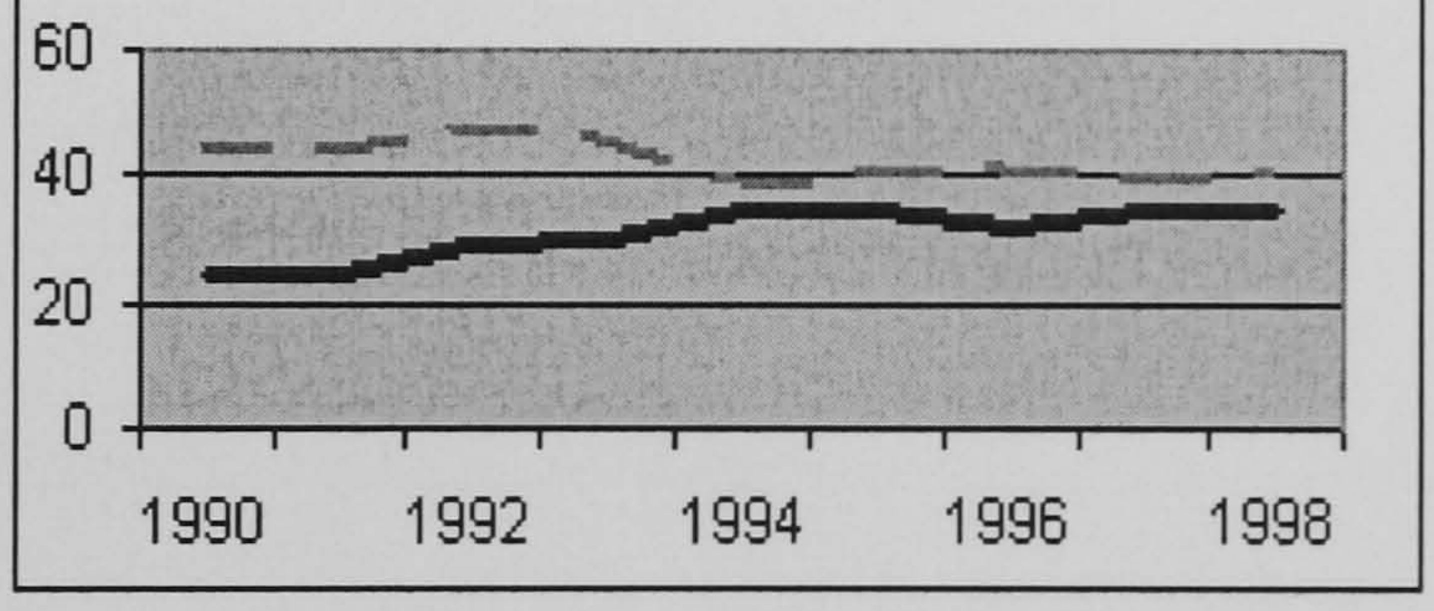


Figure 4.8 - Asset diversification in Domestic Private Banks in India

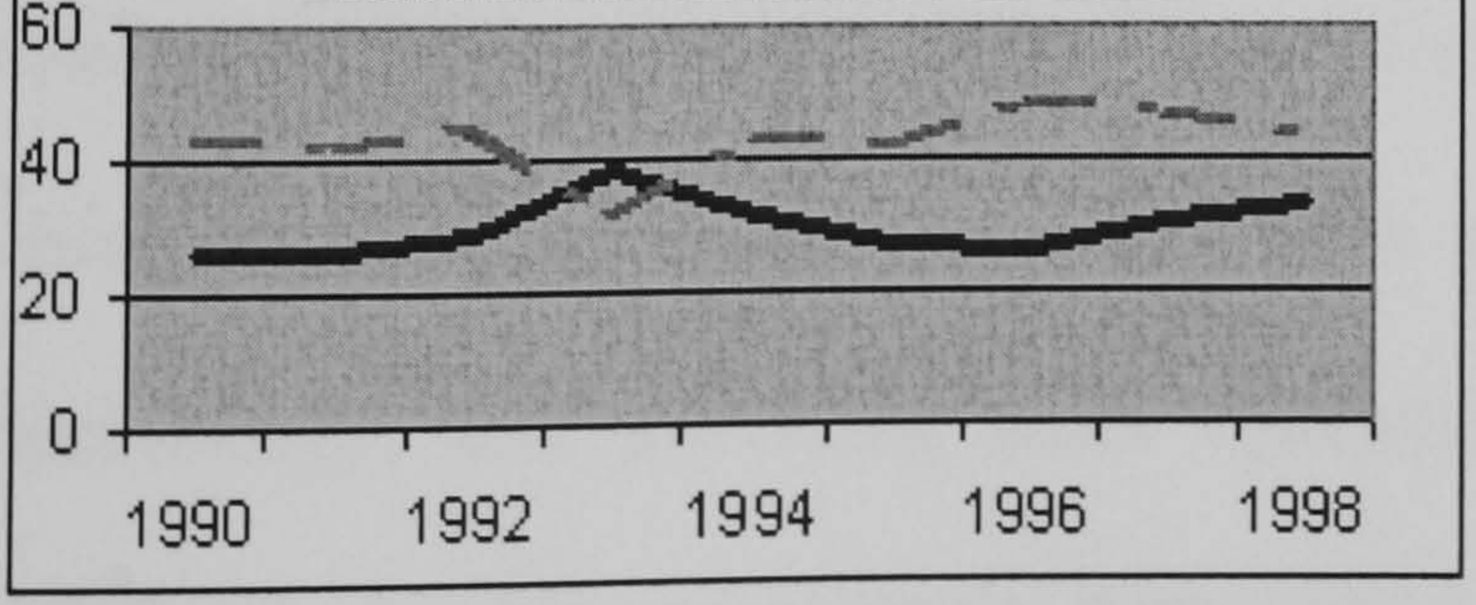
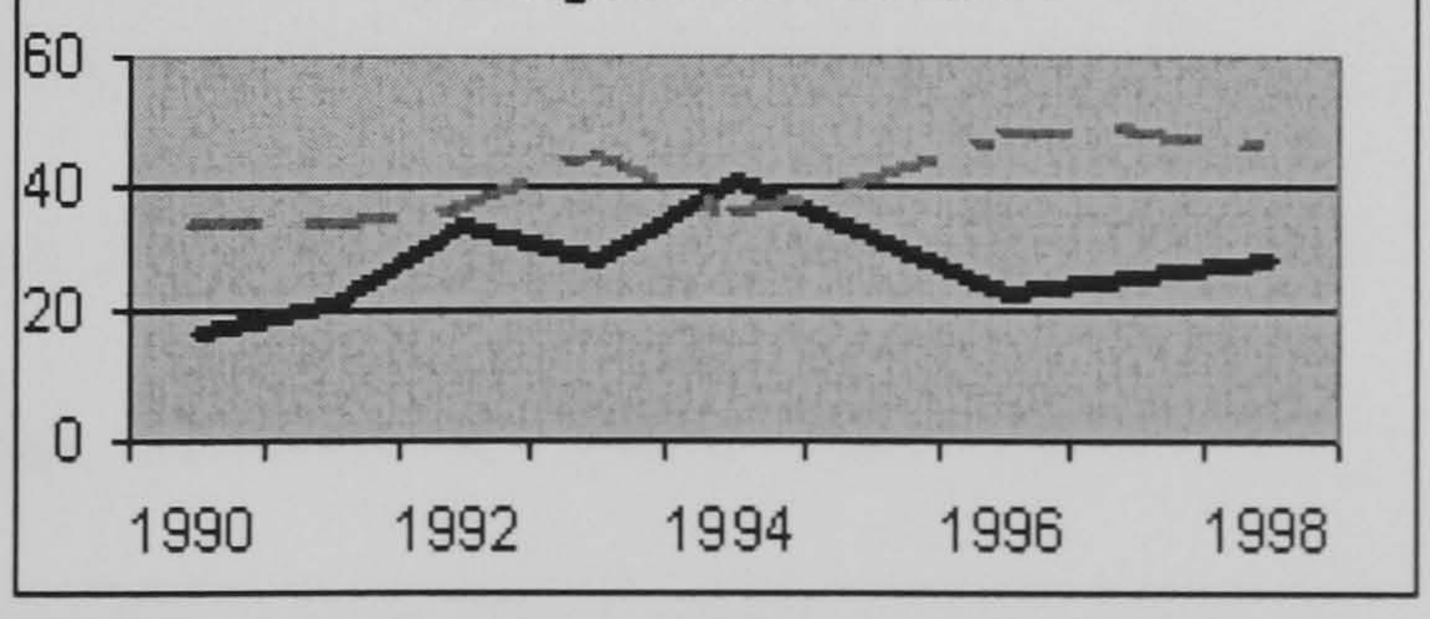


Figure 4.9 - Asset diversification in Foreign Banks in India



Investment / Total Assets ———— Credit / Total Assets – – – – – –

Although the share of investment in total assets was lower than that of credit prior to 1992, the increasing trend of the former made the gap between the two ratios very trivial. Sarkar (1999) argues that this increasing trend of investment in the Indian commercial banking industry bears some consistency with the 'credit crunch hypothesis', in which reforms characterised by relatively large increases in riskless interest rates are more likely to see a substitution away from riskier loans and a flight to government securities. He also suggests that the stickiness of government securities investment and the inability of banks to diversify to changes in regulatory and market conditions was due to the absence of an active secondary market for such securities. Bhaumik and Mukhopadhyay (1997), however, advocate a 'demand side' explanation for the increase in the share of investments in banks' portfolios. They argue that this could be due to the lack of adequate demand for bank credit in the economy. This demand side explanation, as we shall see in chapter 6, could have implications for the efficiency of banks as higher demand for banks' output (e.g. loans) could lead to higher resource utilisation by allowing banks to enhance their outputs (e.g. credit) with given amount of inputs (see, for example, Berger and Mester, 1997).

c – Competition

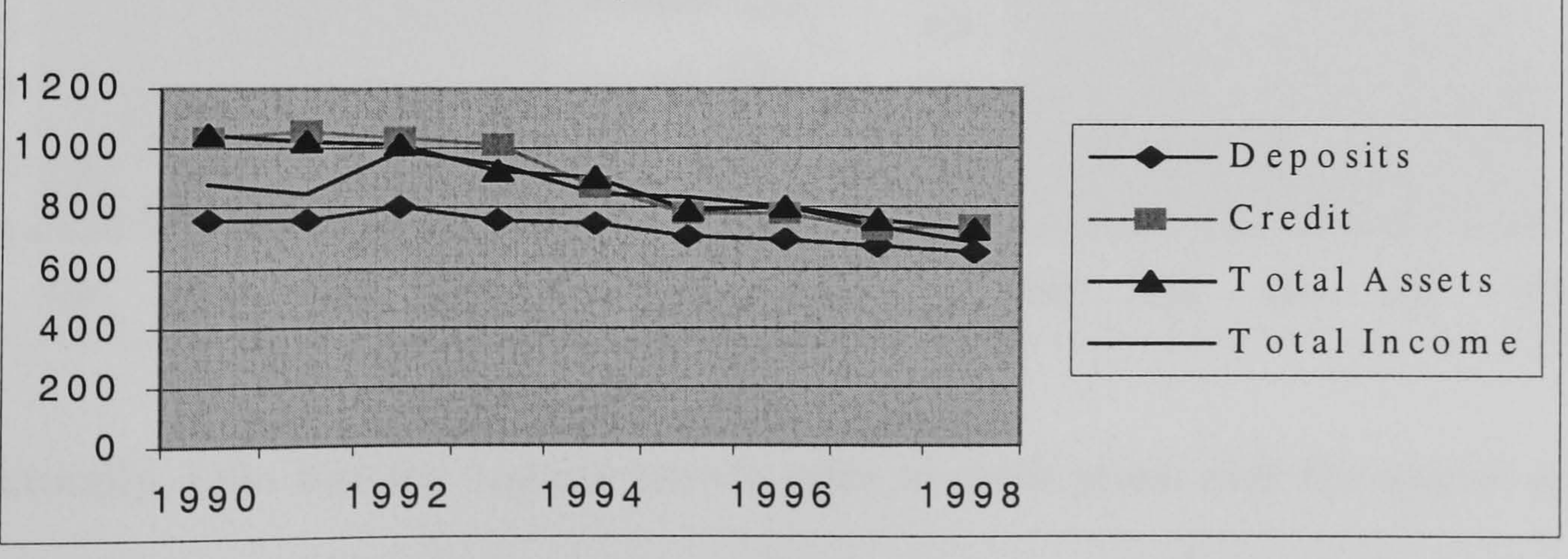
One of the key objectives of the financial sector reforms was to promote competition through allowing the entry of new DBs and FBs, encouraging new products and technology, and providing more operational freedom to banks (see Ahluwalia, 1999a,b). In this increasingly deregulated environment there were some signs of increasing competition within the commercial banking industry. With the entry of new DBs and FBs the number of banks in the industry increased rather significantly.

In 1990 there were 28 PSBs, 24 DBs and 21 FBs. In 1998 there were 27 PSBs, 34 DBs and 41 FBs (see RBI, various issues).

To measure the level of competition in the commercial banking industry more accurately, the *Herfindahl index of relative concentration* is used. This index is constructed using the market share of each bank in four different aspects: deposits, credit, total assets and total income. A declining index shows a declining trend of concentration or increase in competition[6]. Figure 4.10 shows the trends of the Herfindhal index of concentration in the Indian commercial banking industry.

Figure 4.10 shows similar declining trends in concentration, i.e. increasing in competition, in providing credit and in generating assets. Although the competition pressure in generating income declined between 1991 and 1992, it increased thereafter. There was an increasing trend in competition in mobilising deposits although such increase was more gradual than in providing credit, and generating assets and income.

Figure 4.10 - Herfindahl Index for the Banking Industry in India (1990-1998)



[6] For more information about this index see Appendix 4.2

Increase in competition could also be seen from the declining share of PSBs in the industry. The shares of PSBs in deposits, credit, total assets and total income of the industry decreased from 90% before the reforms were initiated to around 80% in 1998[7]. Meanwhile the shares of FBs in the commercial banking industry increased, especially in the total income of the industry[8]. Such an increase in the share of FBs in the banking industry's activities is said to promote a healthy competition leading to the adoption of a better technology and expertise in offering specialised banking products such as derivatives, advisory services and trade finance (Talwar, 2001).

d – Profitability

With the initiation of the liberalisation, profitability was considered as an important indicator to gauge the performance of banks, especially that of PSBs (Sarkar, 1999). Figure 4.11 shows no clear trend in the income growth of the commercial banking industry in the 1990s.

Figure 4.11 - Growth of Income of the Banking Industry in India (1991-1998)

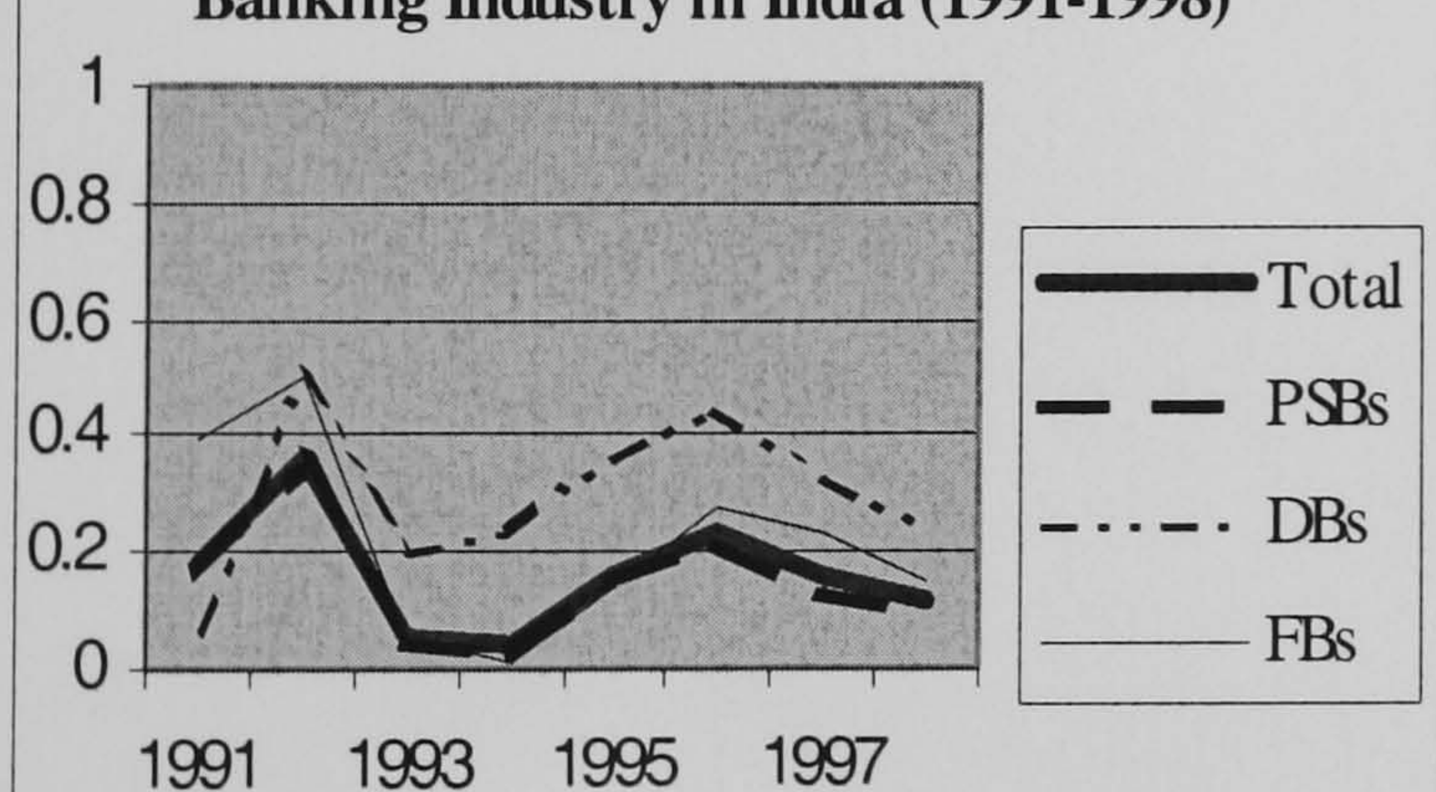
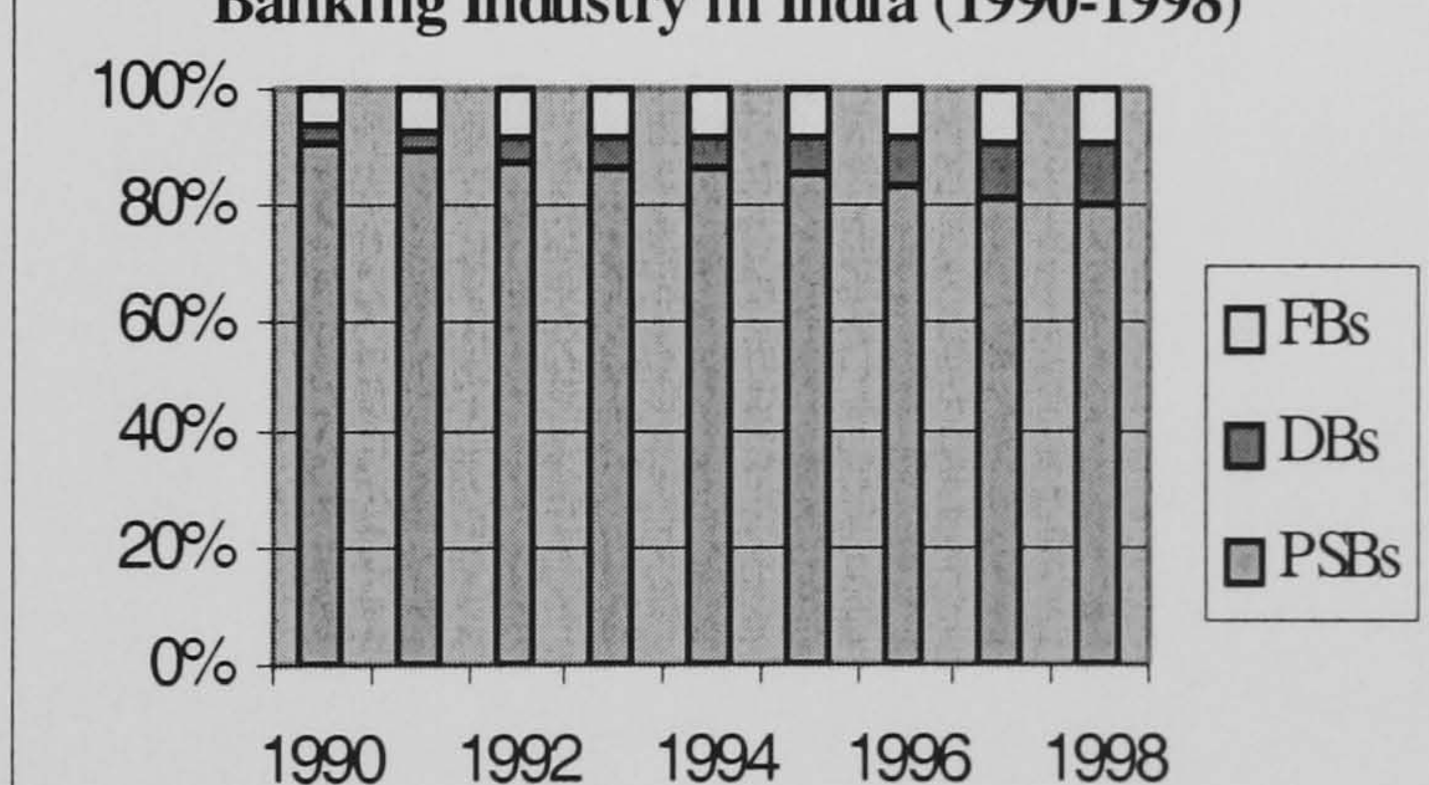


Figure 4.12 - Income Share of the Banking Industry in India (1990-1998)



Sectorally, DBs had the highest growth rates in most years with the annual average rate of 29.7%. Income of FBs grew at 21.9% per year. Although PSBs had the lowest annual average growth rates of income at 14.9%, they retained the highest but

7 See also Appendix 4.3

8 See also Appendix 4.4

declining share in income of the industry (see Figure 4.12). From 90% at the start of the 1990s, the share of PSBs gradually declined to 79% by the end of the decade. The share of DBs increased quite sharply from 3% to 11% while FBs maintained its share of around 9%.

e – Ratio-based efficiency

Increase in the level of competition discussed above was expected to enhance the efficiency of the banking industry. In this section six non-frontier-based measures of efficiency are presented, including: total income over total assets; net return on assets, defined as the difference between total income and total expenses divided by total assets; interest margin, defined as the difference between interest earned and interest paid divided by total assets; total expenses over total income; staff expenses over total assets and non-performing loans (NPLs) over total advances.

Figure4.13 - Efficiency in the Banking Industry in India (1990-1998) - Total Income / Total Assets

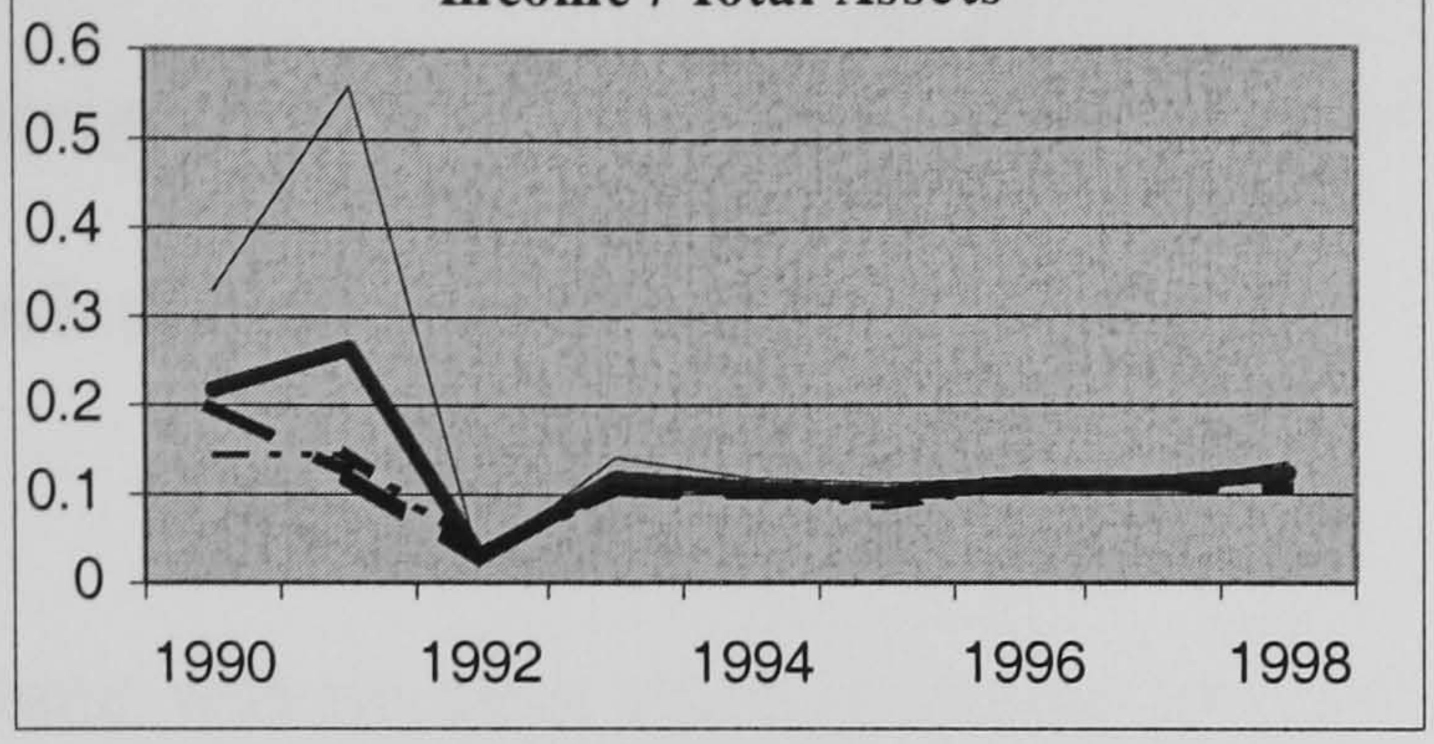


Figure 4.14 - Efficiency in the Indian Banking Industry (1990-1998) - Net Return on Assets

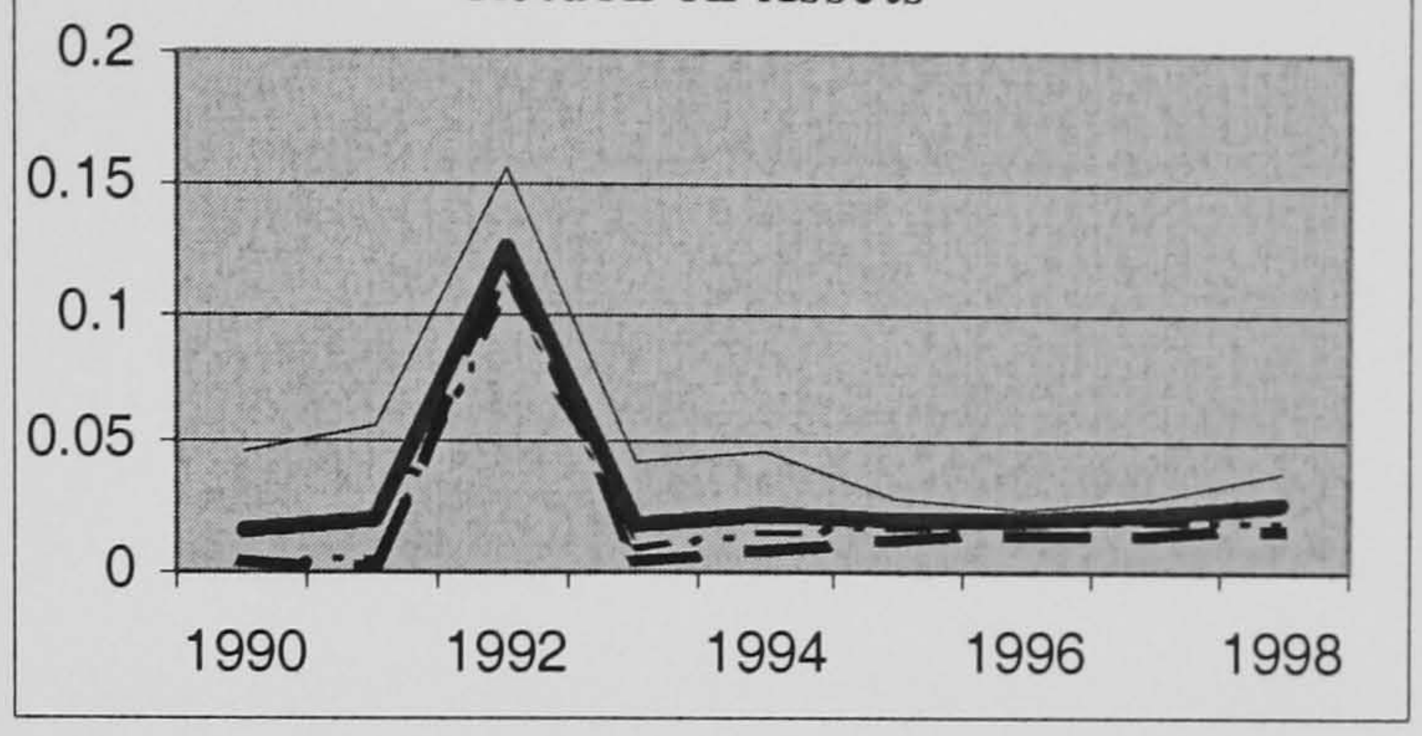


Figure 4.15 - Efficiency in the Banking Industry in India (1990-1998) - Interest Margin / Total Assets

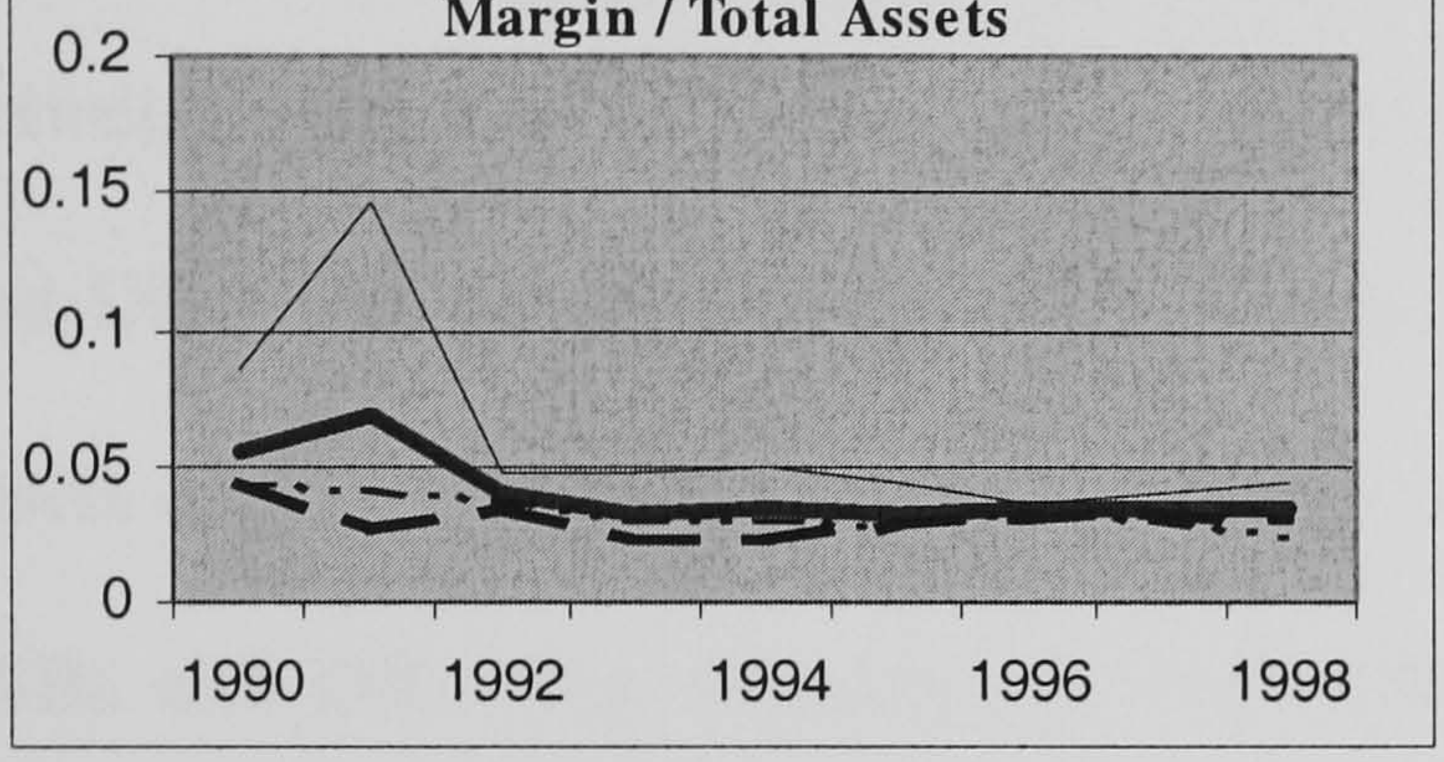


Figure 4.16 - Efficiency in the Banking Industry in India (1990-1998) - Total Expenses / Total Income

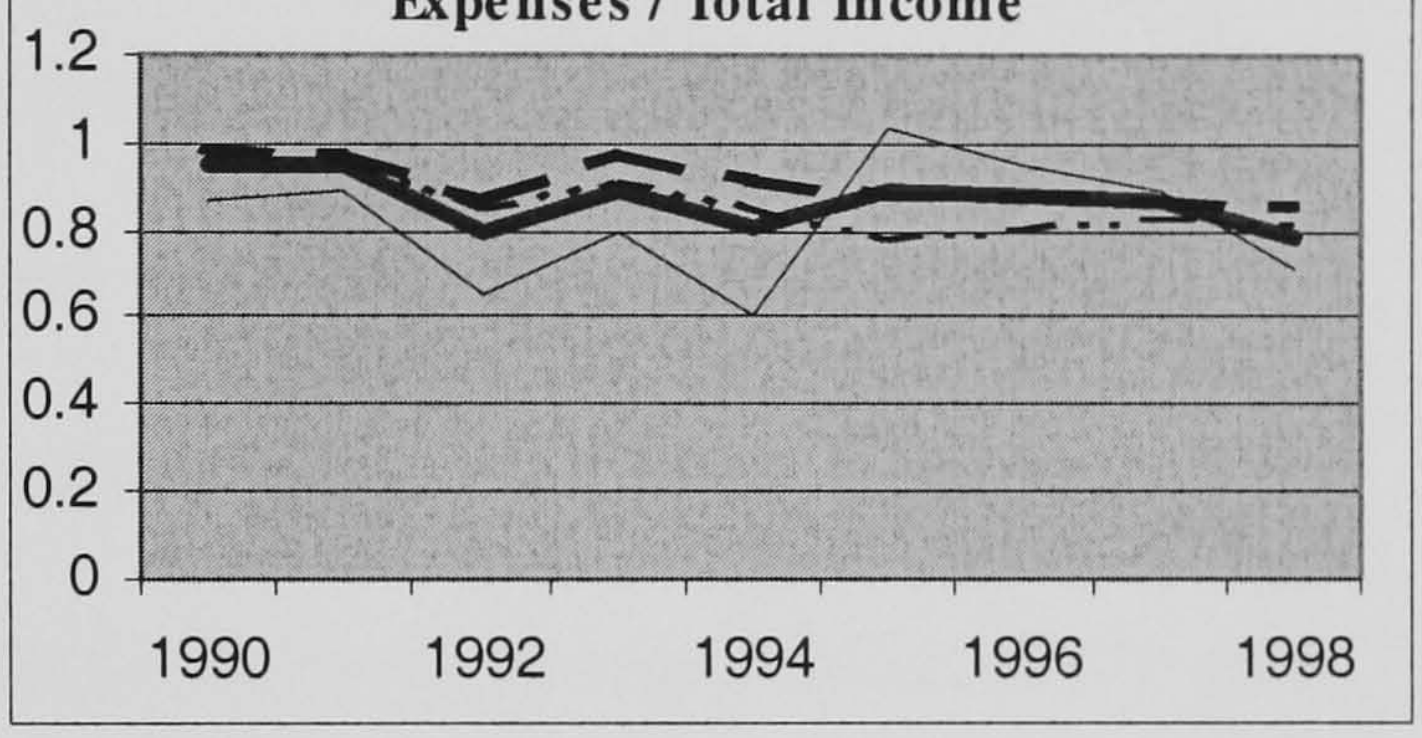
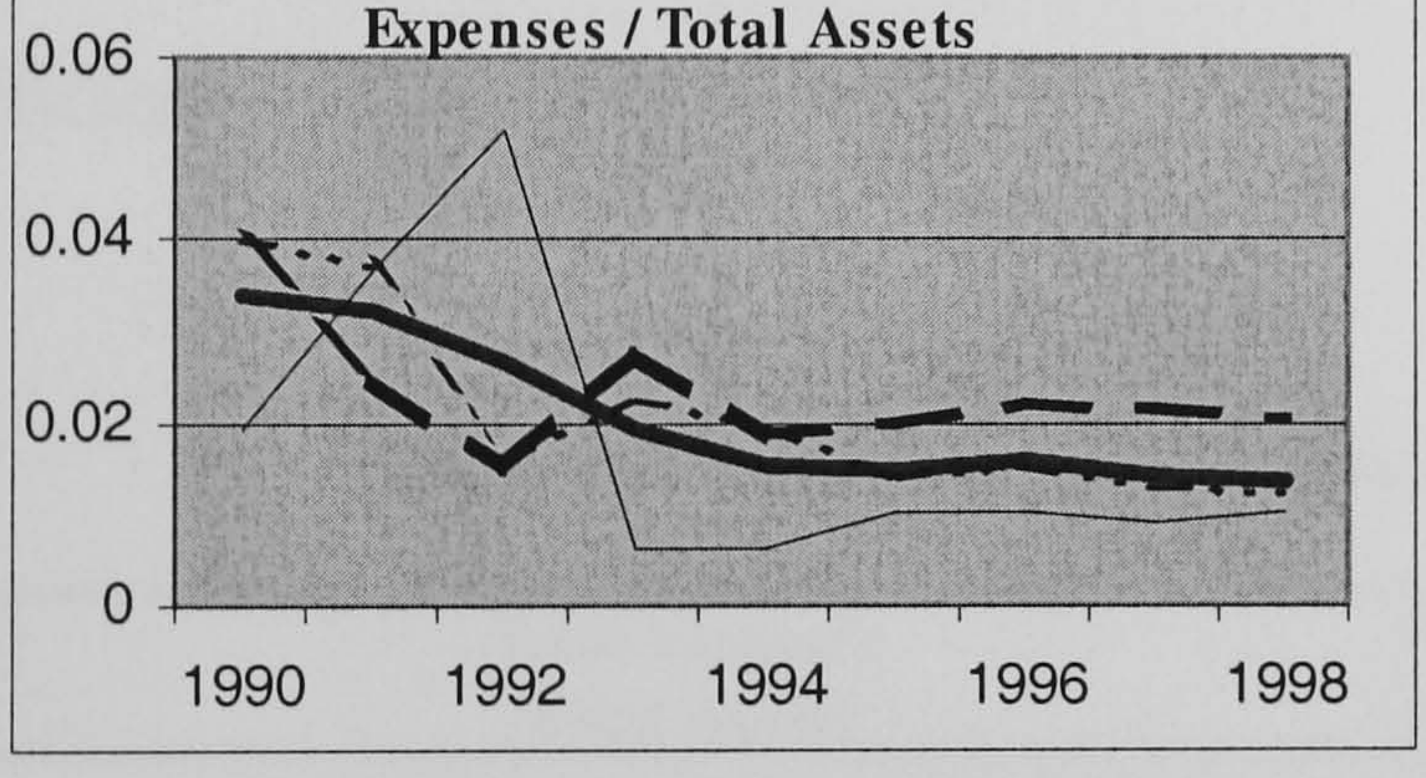


Figure 4.17 - Efficiency in the Indian Banking Industry (1990-1998) - Staff Expenses / Total Assets



Total PSBs DBs FBs

The first two ratios measure the efficiency of banks in generating earnings and profit. The interest margin is an indicator of operating efficiency, or core earning capacity of banks (Sarkar, 1999). The ratio of total expenses over total income measures banks' ability to economise costs while the ratio of staff expenses over total assets measures manpower expenses. An increase in the first three ratios and decreases in the last three ratios is considered as an improvement in efficiency. Also, all the indicators show a sudden improvement in the performance of foreign banks in the year 1992. This could be attributed to relaxation of restrictions on the operations of foreign banks in 1991-1992 after years of government restrictions on this groups such as branch opening restrictions.

There was no clear trend in banks' efficiency during the 1990s. The annual average of all ratio-based measures of efficiency between 1990 and 1995 are similar to those between 1996 and 1998. Sectorally, FBs were much more efficient than both PSBs and DBs. The annual average ratios of total income over total assets, net return on assets and the interest margin of FBs were almost two times higher than those of PSBs and DBs. The measures of cost efficiency showed no significant difference among three sectors. By all ratio-based measures DBs were marginally more efficient than PSBs.

Table 4.2 – Efficiency in the Banking Industry in India (1990-1998)

	Total Income[a]/ Total Assets			**Net Return on Assets[b]**			**Interest Margin[c]**		
	1990-1998	*1990-1995*	*1996-1998*	*1990-1998*	*1990-1995*	*1996-1998*	*1990-1998*	*1990-1995*	*1996-1998*
Total	0.131	*0.139*	*0.115*	0.032	*0.037*	*0.022*	0.040	*0.044*	*0.034*
PSBs	0.108	*0.109*	*0.107*	0.021	*0.024*	*0.014*	0.030	*0.030*	*0.030*
DBs	0.108	*0.105*	*0.115*	0.024	*0.027*	*0.020*	0.033	*0.036*	*0.030*
FBs	0.182	*0.214*	*0.121*	0.052	*0.063*	*0.030*	0.060	*0.070*	*0.040*
	Total Expenses/ Total Income[d]			**Staff Expenses/ Total Assets**					
	1990-1998	*1990-1995*	*1996-1998*	*1990-1998*	*1990-1995*	*1996-1998*			
Total	0.869	*0.882*	*0.843*	0.020	*0.024*	*0.011*			
PSBs	0.912	*0.934*	*0.870*	0.023	*0.024*	*0.021*			
DBs	0.867	*0.891*	*0.822*	0.021	*0.025*	*0.013*			
FBs	0.823	*0.809*	*0.850*	0.017	*0.022*	*0.009*			

FBs= Foreign Banks; DBs=Domestic Private Banks; PSBs=Public Sector Banks

a= Total income includes both interest and non-interest income; b= Net return on assets in net profit divivded by total assets; c = Interest margin is the difference between total interest income and interest expense as a percentage of assets; d= total expenses divided by total income

All values are simple averages for the specified group

Non-performing assets of PSBs was identified as a big problem in the Indian banking industry. This, according to Hanson and Kathuria (1999), is consistent with experience of PSBs in other developing countries as these banks find it difficult to lend without generating large NPLs. High levels of NPLs indicate low asset quality and earnings, thus decreases in NPLs indicate improvement in banks' performance. Table 4.3 shows the trends in NPLs of PSBs in the post-ESRs[9]. From 1993 to 1995 NPLs as a percentage of total advances decreased from 24.3% to 18.5%. The number of banks with the ratio of NPLs over total advances of more than 20% decreased from 16 to 10 in the same period. Nevertheless the volume of gross NPLs increased from around Rs. 410 billion to Rs. 435.8 billion. According to Sarkar (1999) the problem of NPLs of PSBs was so serious that it was not clear whether the reforms ushered in a higher level of asset quality in the banking industry. Factors responsible for the persistence of the NPLs problem include inadequate credit appraisal skills, on-site and off-site monitoring and supervision and inadequate loan recovery by PSBs. While the recovery of advances improved, such improvement was marginal despite several institutional arrangements such as debt recovery tribunals and specialised task forces (Sarkar, 1999).

Table 4.3 – Non-Performing Loans of Indian PSBs (1993-1997)

	1993-4	*1994-5*	*1995-6*	*1997-8*[a]
Percentage of NPLs to total advances	24.3	20	18.5	15.89
No. of Banks with NPLs more than 20%	16	10	10	6
Volume of NPLs (Rs bn)	410.4	384.2	416.6	442.8

Source: Sarkar (1999); a= From RBI's Trends and Progress in the Indian banking industry

[9] As Sarakar (1999) mentioned except some aggregated data on NPLs of the PSBs, data on NPLs of the whole industry and of other sector are not available and there is very little published disaggregated information on the nature of NPLs, the sectors in which NPLs are concentrated, the list of defaulters and the recovery performance of NPLs.

4.3 – The ESRs and the banking industry in Pakistan during the 1990s

4.3.1 – Key elements of the ESRs and macroeconomic performance during the 1990s

Like India, Pakistan followed a policy of state-directed resource allocations after the independence in 1947. However, private participation in the financial and real sectors was encouraged until the early 1970s. The policy of state-determined resource allocation intensified during the 1970s when major industries and financial institutions were nationalised (see Zaidi, 1999). Like in India, a liberalisation was started in the 1980s with the preparation of the Sixth Five-Year Plan (1983-1988). However, the scope of the liberalisation programme of the 1980s was limited (see Zaidi, 1999; Husain, 1999). The ESRs of the early 1990s, sponsored by the IMF and the World Bank, were relatively more extensive in nature. Like the ESRs in India, key elements of the ESRs in Pakistan were: controlling fiscal deficits, tariff reforms, promoting exports and foreign investment, promoting private investment, reforms in the industrial sector and the financial liberalisation.

Table 4.4 shows key macroeconomic indicators of Pakistan from 1980 to 2001 reflecting the economic performance in key areas targeted by the ESRs. The figures suggest that the overall performance of the economy after the implementation of the ESRs was not considerably better than in the pre-ESRs period. While the annual average growth rates of GDP in the first and second half of the 1980s were 7.3% and 6.4%, respectively, the average rate between 1990 and 2001 was 3.89%. This lack of improvement in the GDP growth rate could be partially attributed to high political instability in Pakistan during the 1990s (see Zaidi, 1998).

Tackling high fiscal deficits, a key objective of the ESRs, was a disappointing aspect of the ESRs in Pakistan. When the ESRs were initiated, the target was set to lower fiscal deficits to 4% of GDP. In addition, the ESRs endeavoured to reduce reliance on domestic and foreign borrowings (Zaidi, 1999). Towards this end, taxes were increased and public expenditures were curtailed. For example, between 1994 and 1997 additional taxes of Rs. 140 billion were levied in the form of sales tax and other indirect taxes. Despite these measures, however, the ratio of fiscal deficits over GDP during 1990-2001 was always much higher than the target 4% in all years.

Table 4.4 – Macroeconomic Performance Indicators of Pakistan (1980 – 2001)

	GDP Growth[1]	Fiscal Deficit[2]	Inflation[3]	C/A Balance[4]	Reserves[5]	Exports Growth[6]	Imports Growth[7]	FDI[8]	GDI[9]
1980/4[10]	7.30	-5.84	8.65	-2.56	1038.768	10.53	0.20	64.1	18.7176
1985/9[11]	6.43	-7.70	6.11	-2.78	586.702	10.78	2.67	152.72	18.6306
1990	4.46	-5.40	6.45	-3.38	295.91	1.13	-3.50	245.3	18.935
1991	5.06	-7.58	13.06	-3.01	526.52	33.47	-7.40	258.4	19.026
1992	7.71	-7.92	10.06	-1.84	850.19	13.82	30.84	336.5	20.251
1993	1.76	-8.93	8.70	-6.46	1196.8	1.32	14.84	348.6	20.835
1994	3.71	-7.27	12.92	-3.18	2929.4	3.11	-10.79	421	19.568
1995	4.99	-6.63	13.85	-3.97	1732.8	-3.08	3.97	722.6	18.57
1996	4.85	-7.99	8.37	-7.25	548.29	1.99	13.59	922	19.028
1997	1.01	-7.82	13.38	-5.71	1194.8	-6.54	-3.79	716.3	17.957
1998	2.55	-6.42	7.53	-2.73	1028	-5.73	-5.62	506	17.75
1999	3.66	-6.88	5.86	-3.63	1511.4	-2.85	-5.40	532	15.565
2000	4.24	-5.47	2.75	-1.97	1513.3	16.02	-2.25	308	16.014
2001	2.74	-4.71	5.66	-1.90	3640	11.84	1.53	383	15.935

[1] Real in %. [2] Overall budget balance of the central government, including grants as % of GDP. [3] Consumer Price Index %. [4] Current Account Balance as % of GDP. [5] Net International Reserves, excluding gold, in current million US$. [6] and [7] %. [8] Net inflows of FDI in current million US$. [9] Gross Domestic Investments as % of GDP. [10] and [11] Annual Average.
Source: World Developing Indicators 2003

Another key area of the ESRs was to open the economy to foreign trade and investment. The Government of Pakistan claimed that it was committed to making extensive changes in the trade regime, including liberalisation of the foreign exchange regime, reduction in the level of protection by reducing tariff rates and gradual removal of most tariff exemptions and concessions, and enhancing export incentives. For example, the list of restricted import items was reduced from 125% in 1992 to around 45% in 1999. Meanwhile a 55% income tax rebate on export earnings was changed into a 75% rebate for export of high value added products and a 50% rebate for all other products.

During the post-ESRs, there was little or no improvement in the external payment position. The current account deficits between 1990 and 2001 were much higher than in the 1980s. The annual average current account deficit as a percentage of GDP in the 1990s was 3.7%, compared with 2.56% and 2.78% in the first and second half of the 1980s, respectively. This increased to 6.4% and 7.2% in 1993 and 1996, respectively. Foreign reserves, however, increased from US$ 295 million in 1990 to US$ 3,640 million in 2001. The annual average foreign reserves during 1990 and 2001 were US$ 1,414 million, compared with US$ 1,038 million and US$ 586 million in the first and second half of the 1980s, respectively.

The export performance was disappointing despite export incentives provided by the government. During 1990 and 2001 the annual average growth rate of exports was 5.3%, which was much lower than the growth rate of 10% in the 1980s. This was due to the fact that high rates of export growth in some years were offset by low and even negative growth rates in other years (see Table 4.4). The annual average growth rate of imports between 1990 and 2001 was similar to that of the second half of the 1980s at 2%. Between 1997 and 2000 the import growth rates were even negative. Even though import growth was not high after the ESRs were initiated, the trade reforms were criticised for being responsible for the de-industrialisation of the economy because a large number of imported goods that were previously produced locally (Zaidi, 1999; Husain, 1999).

Like the ESRs in India, encouraging FDI was another important element of the ESRs in Pakistan. A number of measures to attract FDI were implemented, such as removing the requirement for government approval of FDI, allowing 100% ownership with few exceptions, allowing foreign firms to engage in export trading activities, removing controls in technology transfer, and offering various fiscal and monetary incentives (Zaidi, 1999). Until 1996 the annual FDI inflows to Pakistan increased quite steadily, reaching the highest level of US$ 922 million, compared with US$ 64 million and US$ 152 million in the first and second half of the 1980s, respectively. From 1997 to 2001 FDI inflows declined sharply probably due to an intensified competition for FDI among developing countries, and due to the nuclear experiment of 1998 that resulted in severe economic restrictions by various international institutions like the World Bank and the IMF.

The ESRs also emphasised the enhancement of growth by encouraging domestic private investors in both financial and non-financial sectors. Not only was sanctioning of private investment discontinued, but also a number of other regulatory restrictions were removed. Areas of investment previously reserved for the public sector were opened to the private sector and the government also provided incentives to the private sector (World Bank, 1993). Along with this, reforms in the industrial policy were implemented, including: limiting the list of specific industries, de-regulating business decisions, phasing out industrial location policies and provision of infrastructural services, and divesting the shares of public sector companies to the private sector. After the reforms were launched investment by the private sector increased substantially. The share of the private sector in gross fixed capital formation increased from 39.3% in the first half of the 1980s to 46.5% in the second half of the 1980s and to 51.7% in 1995 (Zaidi, 1999; Husain, 1999). The growth rate of investment of the whole economy, however, was not higher than that of the 1980s, which was around 18%.

4.3.2 – Reforms in the financial sector

The financial liberalisation programme was initiated in 1990-1992, and was augmented by a series of policy measures in 1997. The key objectives of the liberalisation programme were: institutional strengthening, restructuring of banks and Development Finance Institutions (DFIs), improving the regulatory framework, promoting competition, switching over to market-based and relatively more efficient monetary and credit mechanisms and tackling the problem of non-performing loans.

Regarding institutional strengthening, the reforms gave the regulator of the financial sector, the State Bank of Pakistan, higher autonomy in formulating and implementing monetary policy by a number of amendments in the Banking Law, and consolidated its role as regulator of banks and Non-Bank Financial Institutions (NBFIs). A process of internal restructuring in the State Bank of Pakistan was also initiated in order to address core financial issues such as strengthening on-site and off-site surveillance, creating government securities, monitoring NBFIs, dealing with non-performing loans and enhancing the capacity of the State Bank (SBP, 2000).

As the government ownership of commercial banks was identified as a source of inefficiency in the banking industry a number of policies were undertaken to encourage the participation of the private sector (SBP, 2000). A major break from the past was the decision to allow new private sector commercial banks to function in 1990 (Zaidi, 1999). Subsequently in 1991 ten new DBs were permitted to commence their operations. The government was also empowered to sell all or any part of the share capital of PSBs.

Various measures were taken to promote market-based and relatively more efficient monetary and credit mechanisms. The debt management reforms were initiated to reduce the segmentation in government debt market, rationalise the cost of raising long-term government debt, and establish a market-based rate of return structure for government securities. Consequently, debt auctioning was set up in 1991, FBs and corporations were allowed to invest in Treasury Bills and Federal Investment Bonds (FIBs) in the same year and open market operations become a major instrument of market-based monetary management in 1995.

In 1995 the system of credit ceilings and credit-deposit ratios was abolished to encourage banks to extend credit to the private sector through market-based mechanisms. Maximum caps on lending rates were reduced and maximum caps on lending rates for exports related modes of financing were removed in 1995. Floors on minimum lending rates for projects and trade related financing were also lifted in 1997 and accordingly banks and NBFIs were able to set their lending rates in relation to the demand-supply condition in the market.

Another important policy to promote market-based and relatively more efficient credit mechanisms was to phase out concessional credit. Before the financial sector reforms, credit was allocated in a detailed manner through an annual credit plan. Through their structural adjustment loans, international financial institutions brought considerable pressure to bear upon the Pakistani planners to phase out concessional credit (Zaidi, 1999). In 1991, concessionary financing schemes were pared down with the termination of cotton financing. In order to eliminate the subsidy element and the attendant financial market distortion, the lending rates on special financing schemes including locally manufactured machinery and export finance were gradually raised (SBP, 2000). To ensure that financial institutions were not burdened with subsidised credit, all new schemes involving concessional finance were capped. In 1994 rates for concessional loans were raised from 11% to 12% and to 14% during the second half of the 1990s (SBP, 2000).

As the rapidly deteriorating governance and credit discipline, especially in PSBs, aggravated structural problems and led to a worsening level of non-performing loans (NPLs), the financial liberalisation focused on prudential measures, including capital adequacy, adequate provisioning, and effective loan recovery mechanisms and legal procedure (SBP, 2000). In 1992 prudential regulation was amended with compliance mandatory. Information from early warning systems, off-site and on-site inspection was integrated and focused on risk analysis. At the same time, a system was put in place whereby performance of each bank and NBFI was evaluated under the CAMELS system[10]. As NPLs were a major problem in the financial sector, the State

[10] The acronym "CAMEL" refers to the five components of a bank's condition that are assessed: *C*apital adequacy, *A*sset quality, *M*anagement, *E*arnings, and *L*iquidity. A sixth component, a bank's *S*ensitivity to market risk, was added in 1997; hence the acronym was changed to CAMELS.

Bank of Pakistan promised to strengthen loan recovery process. In November 1993, the State Bank of Pakistan asked banks to set quarterly recovery targets, submit progress reports and form strategies to improve the future recovery process. At the same time, minimum conditions for borrowers were also established to ensure that defaulters were not provided with fresh loans. All financial institutions were instructed not to accommodate defaulters unless rescheduling or restructuring of outstanding liabilities was completed to the satisfaction of lending institutions. In 1993 a list of loan defaulters were published, banks and DFIs were asked to provide details of bad debts and loans written off, and to consult the Credit Information Bureau of the State Bank of Pakistan prior to financial accommodation of RS 0.5 million or above. Steps were also taken to institutionalise the credit rating process of banks and NBFIs. In 1998 the State Bank of Pakistan's prudential regulation for loan classification was rationalised, thereby requiring banks to make qualitative evaluation of their credit portfolios for risk assessment on the basis of adequacy of security, cash flows and credit worthiness of borrowers (SBP, 2000).

4.3.3 – Reforms in the commercial banking industry

The financial liberalisation programme discussed above brought about major changes to the operation of the commercial banking industry in Pakistan. A key policy was that new private sector commercial banks were allowed to operate. Before 1988 the banking sector consisted of only two sectors, the domestic public sector, which had five main nationalised commercial banks PSBs and the foreign sector, which had 24 banks. In 1991 the government issued licences to ten new DBs and denationalised two smallest PSBs (Muslim Commercial Bank and Allied Bank Limited). The reforms also enabled banks to operate and function with a higher level of freedom.

Banks were allowed to close their branches entirely on commercial considerations. The interest rate rationalisation and the promotion of market-based and efficient credit mechanisms aimed at allowing banks to be able to set their lending rates in relation to the demand-supply condition in the market. Furthermore, concessional credit was also phased out and all new schemes involving concessional finance were capped to ensure that banks are not burdened with subsidised credit. Prudential practices in the banking industry were focused. The loan recovery process was strengthened and various measures were applied to tackle the problem of NPLs.

In the post-reforms period, besides financial sector reforms, the Pakistani commercial banking industry was also exposed to major changes brought about by other elements of the overall economic reforms initiated in 1988 such as controlling fiscal deficits and government expenditure, removing controls on private investment and encouraging foreign direct investment. In the following sections the trends and performance of the Pakistani commercial banking industry in the 1990s is evaluated on the basis of deposit mobilisation and credit provision, asset diversification, competition, profitability, and ratio-based efficiency.

a – Deposits mobilisation and credit provision

The financial liberalisation programme, especially the interest rate rationalisation and the promotion of a flexible and market-based credit mechanism, was designed to increase the deposits mobilisation and credit provision by the banking industry. Although there was no interest rate deregulation for deposits, there were several measures to enhance deposit mobilisation. Resident Pakistanis were allowed to open foreign currency deposit accounts and banks paid higher interest rates on these deposits than LIBOR. According to a report by the World Bank, foreign currency deposits increased from US$ 1.6 billion in 1988 to US$ 3.7 billion in 1992 and US$ 8.5 billion in 1996 (World Bank, 1993). Several policies were also launched to increase credit provided to the economy. The system of credit ceilings and credit-deposit ratios was abolished to encourage banks to extend credit to the private sector through market-based mechanisms. In 1991 foreign companies were allowed to borrow for their capital expenditure from banks and other financial institutions.

Despite such polices Figure 4.14 shows no significant improvements in the post-reforms period in terms of deposit mobilisation and credit provision by the Pakistani commercial banking industry. After an increase between 1990 and 1993, both demand deposits and time deposits decreased sharply in 1994 and decreased gradually thereafter. Over the post-reforms period, demand deposits as a percentage of GDP decreased by half from 16.9% in 1990 to around 8.9% in 1998. Time deposits also decreased from 18.8% of GDP to 13.3% in the same period. Saving deposits however increased steadily from 14.5% to 17.6% of GDP between 1990 and 1998. Figure 4.18 also shows that in the post-reforms period credit provided by the commercial banking industry stayed almost the same at around 50% of GDP.

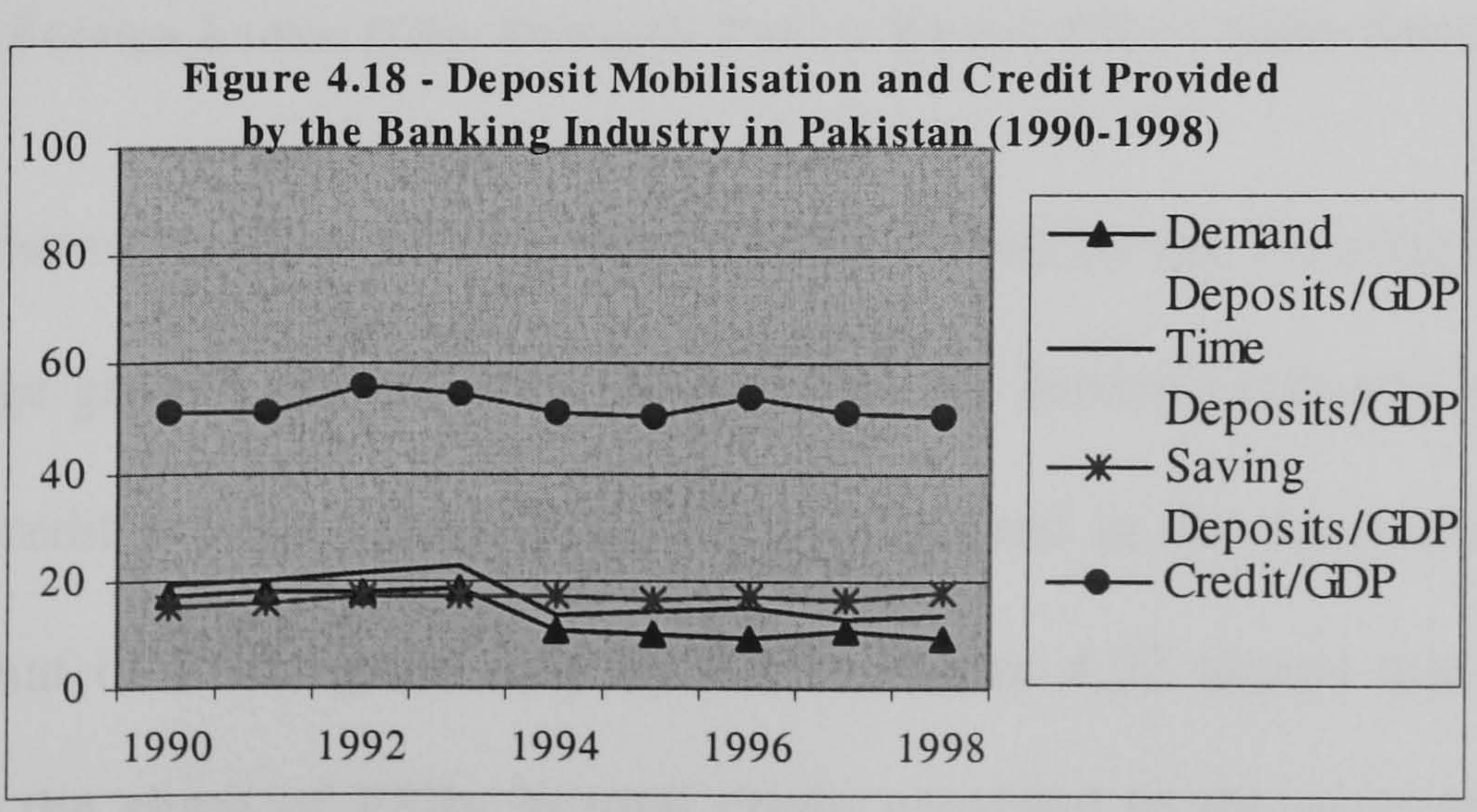


Figure 4.19 shows the growth rates of deposits mobilised by the commercial banking industry during 1991 and 1998. The annual average growth rate of the whole industry was around 15%. Sectorally, FBs had the highest annual average rate of 25.7%, while the average rates of DBs and PSBs were 21% and 8%, respectively. In the 1990s changes in the growth rates of deposit mobilised by PSBs and DBs were not as much as changes in the growth rates of deposit mobilisation of FBs. From 56% in 1992, the deposit mobilisation growth rates of FBs declined sharply to 14% in 1997 and below zero in 1998. Despite this declining trend Figure 4.20 shows that the share of FBs in deposit mobilisation increased rapidly from 4.7% in 1990 to 17.3% in 1998. The share of DBs also increased rapidly from 18% in 1992 to 29.7% in 1998. Meanwhile the share of PSBs decreased sharply from 92.5% in 1990 to 52.8% in 1998.

Figure 4.19 - Growth of Deposits in the Banking Industry in Pakistan (1991-1998)

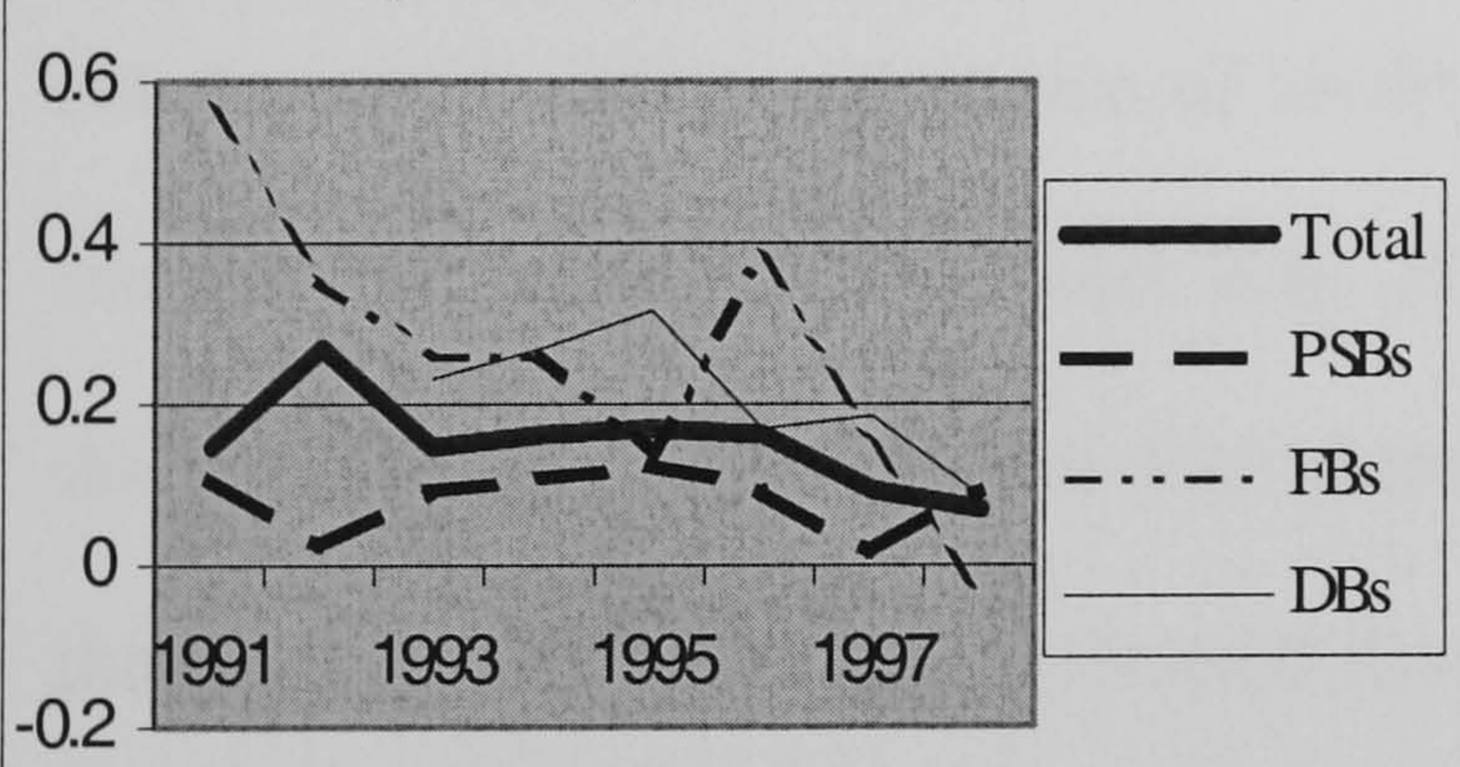
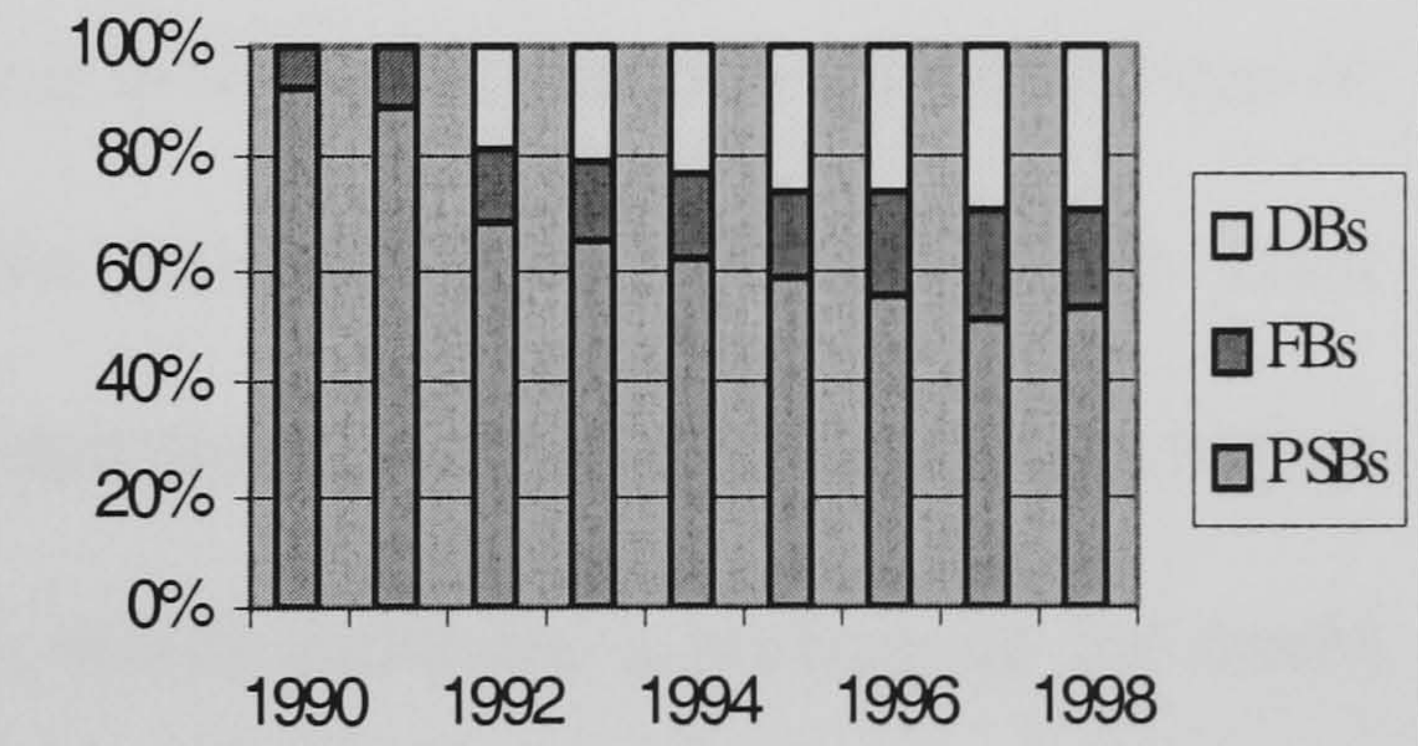
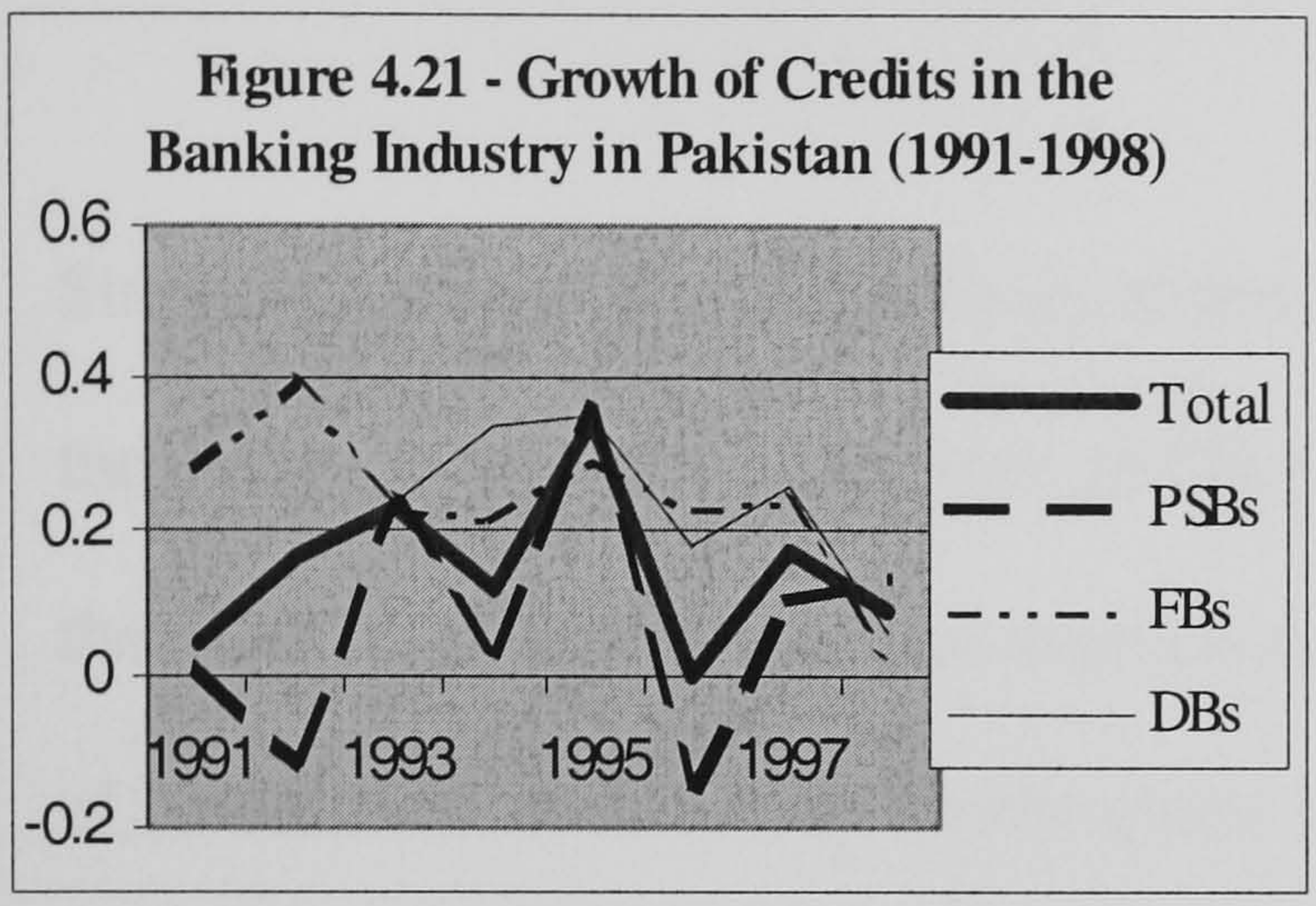


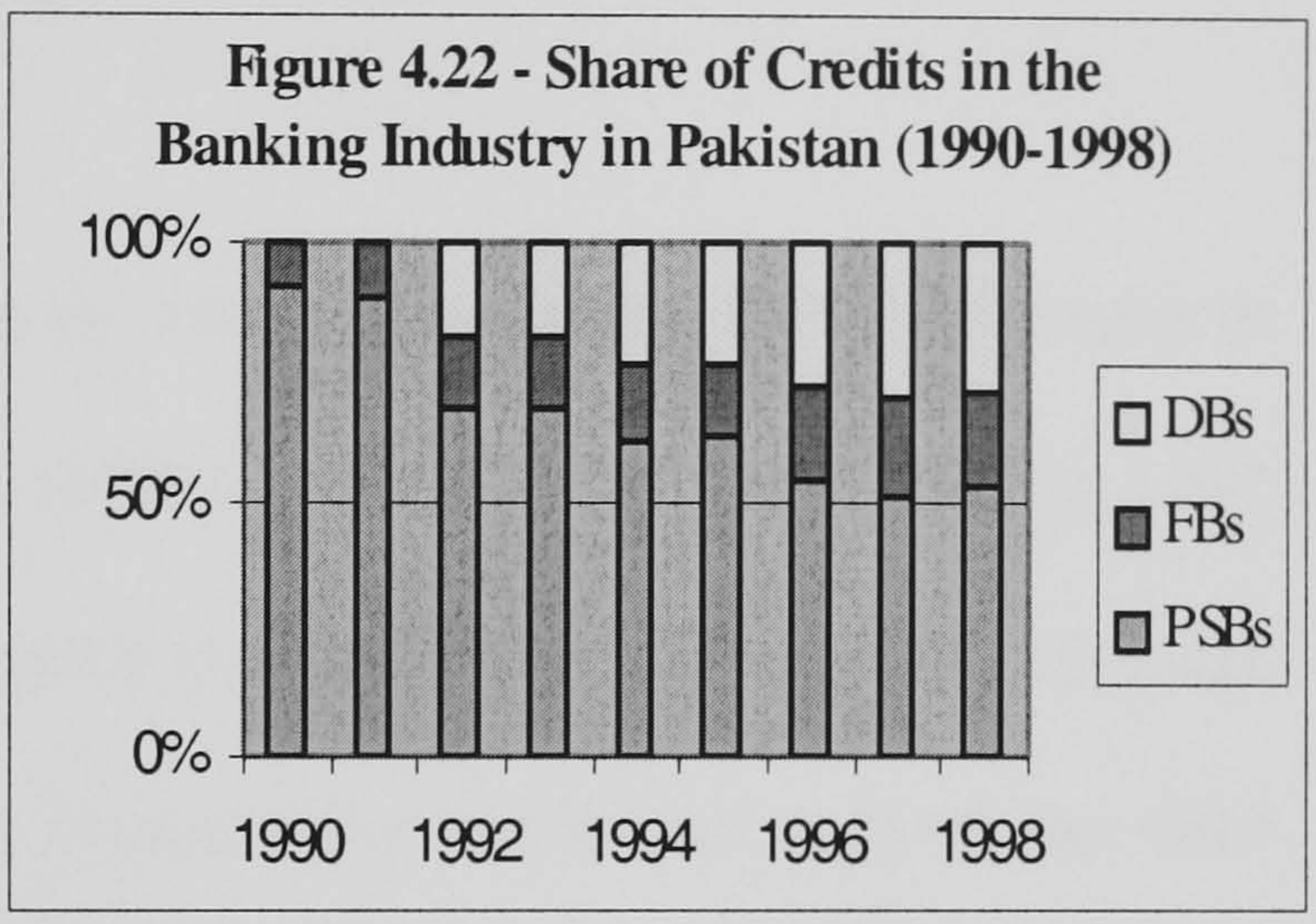
Figure 4.20 - Share of Deposits in the Banking Industry in Pakistan (1990-1998)



FBs= Foreign Banks; DBs= Domestic Private Banks; PSBs= Public Sector Banks

Figure 4.21 shows no clear trend in the credit provided by the banking industry. The annual average growth rate of credit provided by the banking industry was 14.3% in the 1990s. Credit provided by DBs and FBs increased at the same average rate of 23% while that of PSBs grew only by 7.4%. Figure 4.22 shows that like deposit mobilisation, the share of PSBs in total credit provided to the economy decreased sharply by half from 91% in 1990 to 52% in 1998. Meanwhile, the share of FBs doubled from 8.6% in 1990 to 17.7% in 1998 and of DBs increased from18.6% in 1992 to 30% in 1998.





FBs= Foreign Banks; DBs= Domestic Priavet Banks; PSBs= Public Sector Banks

b – Asset diversification

As discussed earlier, the choice of credit and investment, the two major sources of income for banks on the asset side of the balance sheet, determines the asset diversification of banks. Figure 4.23 shows that the share of credit was always higher than the share of investment in total assets, which indicates a preference for credit over investment in the Pakistani banking industry. Despite increasing from 36.4% in 1990 to 47.5% in 1998, the share of credit in total assets of the whole banking industry fluctuated and showed no clear trend in the 1990s. Sharp increases were witnessed between 1994 and 1995 when the share of credit increased from 30.7% to 36.6% and between 1996 and 1997 when the share of credit increased from 32.1% to 47.5%. With the removal of maximum cap on lending interest rates, one would expect banks to alter their asset diversification in favour of credit because banks could set the rates according to the demand-supply condition in the market rather than being under constraint by the rates set by the State Bank. However, like in India, there was no such trend in Pakistan probably because banks became more cautious in providing credit under the implementation of prudential measures to strengthen the loan recovery process and to tackle the problem of NPLs.

Similar to credit, there were fluctuations in the share of investment in total assets in the 1990s. After increasing from 18.2% in 1990 to 23.4% in 1991 and 25% in 1992 the share of investment in total assets decreased gradually to 21.6% in 1996. Increase of investment in the early 1990s could be because the implementation of the debt management reforms, which established a market-based rate of return structure for government securities, an auction system of public debt and a secondary market for government securities, thus encouraged banks to hold government securities. Also a new type of government paper, the Federal Investment Bonds, was introduced in view of ample demand for a market-based long-term government paper by banks (SBP, 2000). The share of investment in total assets jumped from 21.6% in 1996 to 30.1% in 1997 and 28.9% in 1998 because of a better rate of return on government securities attracted large investment, especially from DBs (SBP, 2000).

Figure 4.23 - Diversification in the Banking Industry in Pakistan (1990-1998)

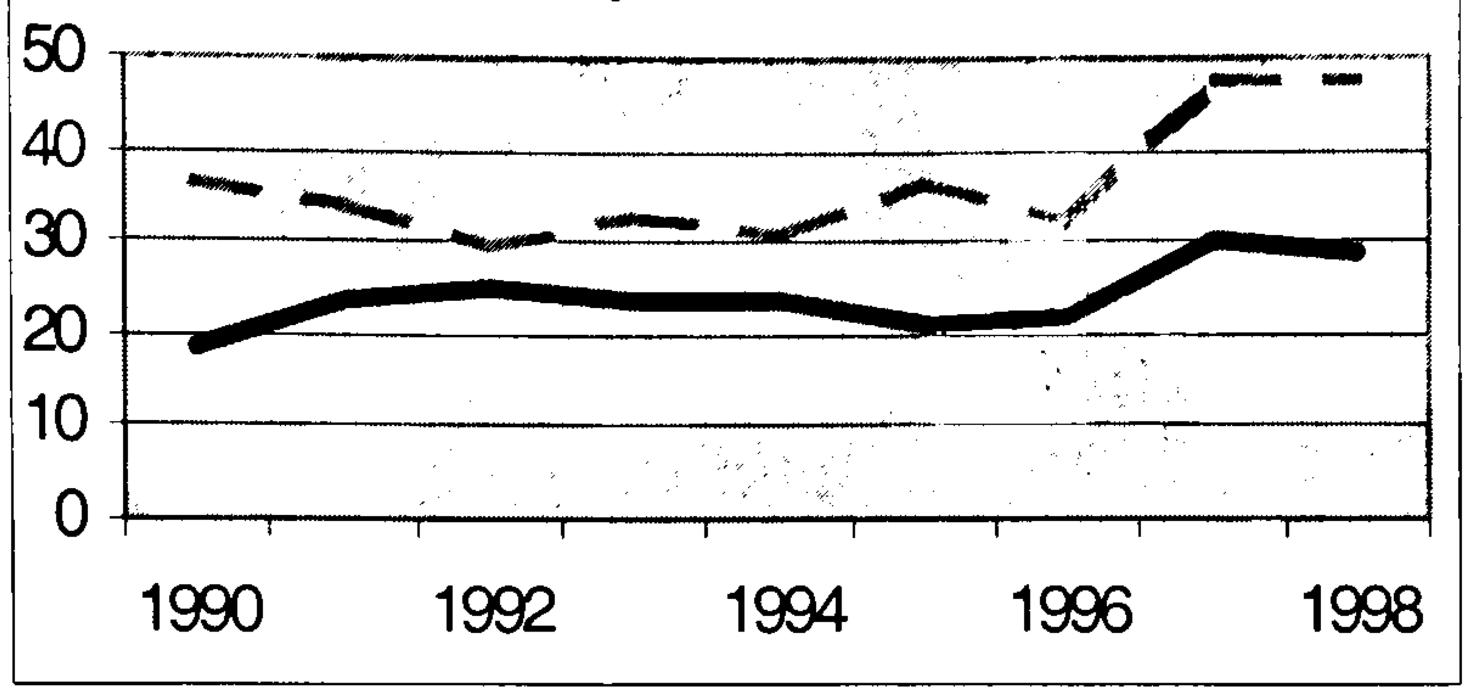


Figure 4.24 - Diversification in Public Sector Banks in Pakistan (1990-1998)

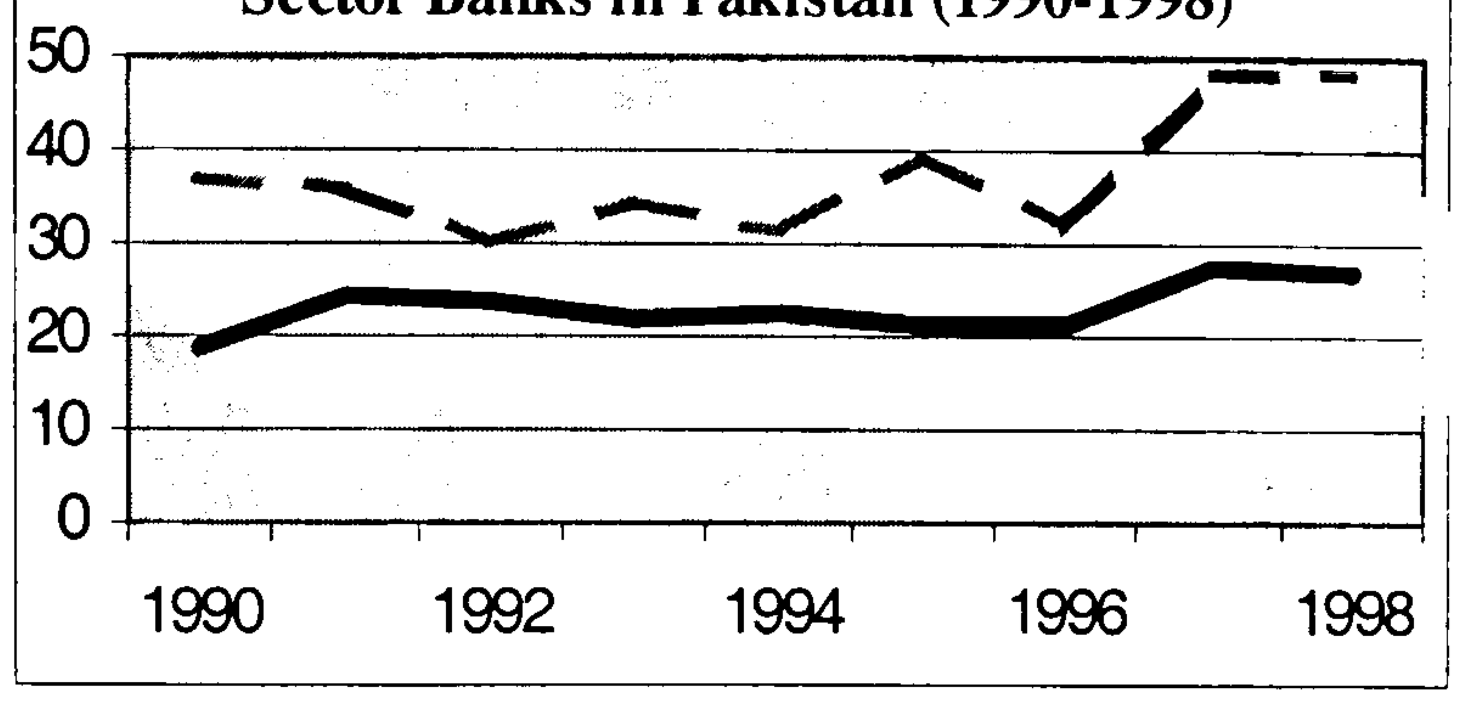


Figure 4.25 - Diversification in Domestic Private Banks in Pakistan (1990-1998)

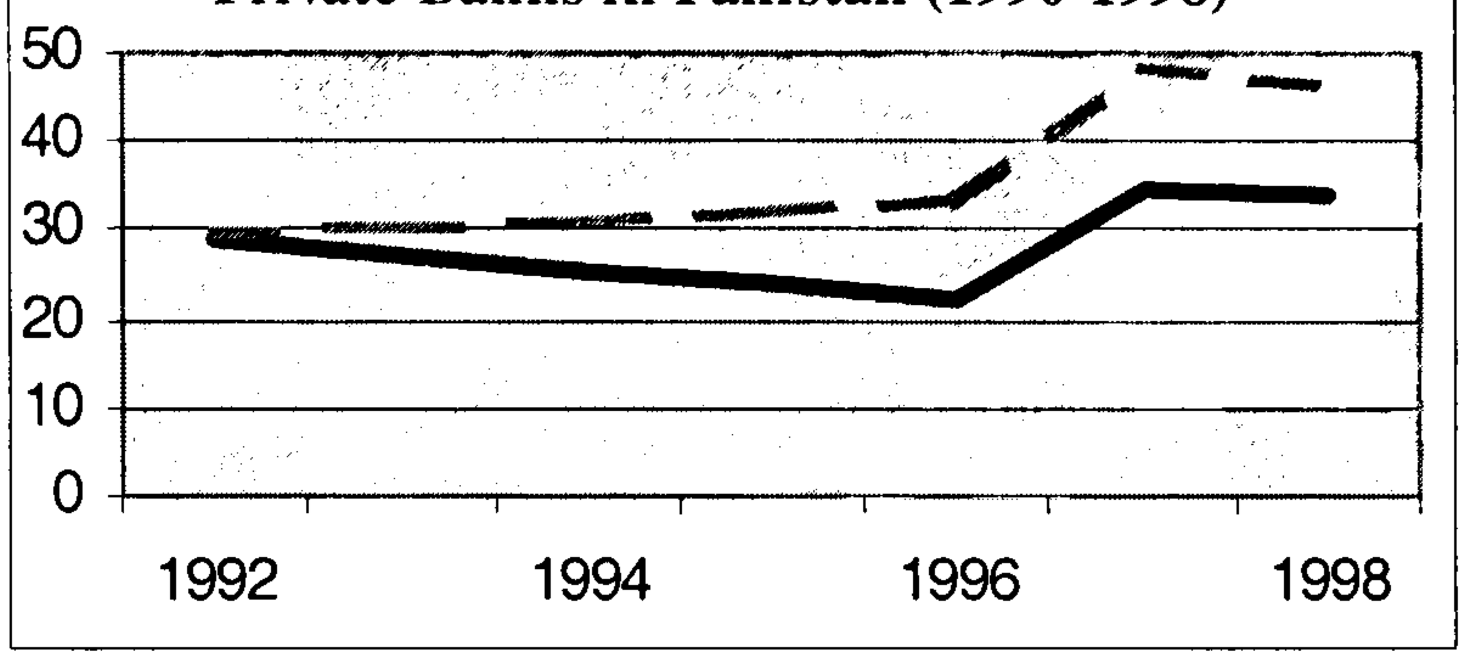
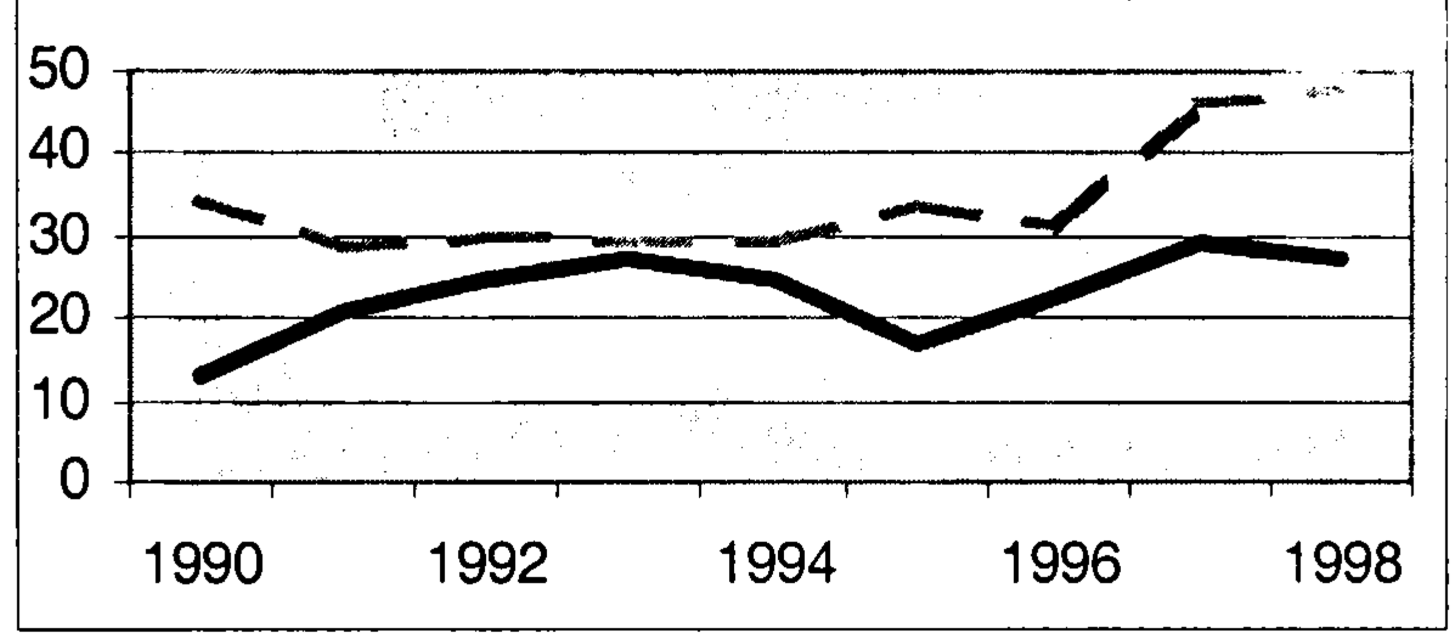


Figure 4.26 - Diversification in Foreign Banks in Pakistan (1990-1998)



Investment / Total Assets

Credit / Total Assets

Figures 4.24, 4.25 and 4.26 show that the trends of asset diversification in PSBs, DBs and FBs resembled that of the whole industry. The only exception was that in the late 1990s DBs increased their holding of government securities and thus the shares of investment in total assets of DBs were much higher than those of PSBs and FBs. In 1998 for example the share of investment in total assets of DBs was 34.2% compared with 26.6% and 26.9% of PSBs and FBs, respectively.

c – Competition

One of the key objectives of the financial liberalisation programme was to enhance the efficiency of the banking industry by promoting a competitive environment. Allowing new private sector commercial banks to function was commended as a major break from the past (Zaidi, 1999), which made the number of banks in the industry increase significantly in the 1990s. In 1990 there were 5 PSBs and 15 FBs. In 2000 there were 4 PSBs, 21 DBs and 17 FBs. According to Khan (1999) the competition among banks and other financial intermediaries resulted in improved service quality and higher yields.

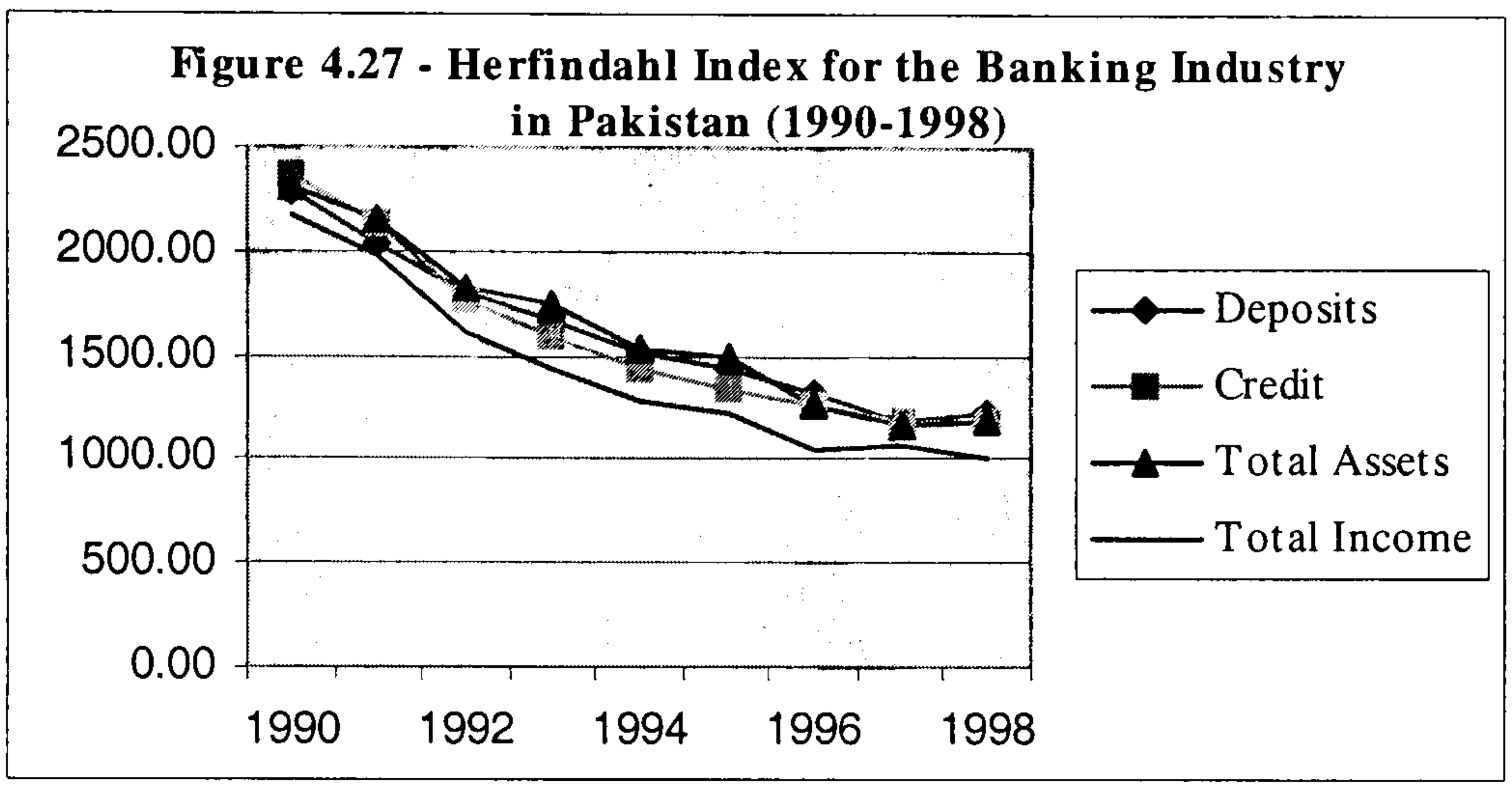


Figure 4.27 - Herfindahl Index for the Banking Industry in Pakistan (1990-1998)

Figure 4.27 shows the Herfindahl index of concentration in the Pakistani commercial banking industry. It shows similar declining trends in concentration, i.e. increasing trends in the level of competition, in mobilising deposits, providing credit, total assets and total income. Competition in generating income was however lower than in all other aspects.

An increasing level of competition could also be seen from the declining share of PSBs in the industry. The shares of PSBs in deposits mobilised, credit provided and total assets of the industry decreased from above 90% in 1990 to less than 70% in 1998. The shares of PSBs in total income of the industry decreased even more significantly from above 90% in 1990 to around 60% in 1998[11]. Several elements of the financial liberalisation could be responsible for this declining share of PSBs in

[11] See also Appendix 4.5

the industry, including the amendment of Act 1974 that allowed the entry of new private banks and empowered the government to sell all or any part of the share capital of PSBs, measures taken by SBP to require PSBs to rationalise their size; and growing competition from the private sector.

d – Profitability

Figure 4.28 shows the fluctuations in growth rates of income in the Pakistani commercial banking industry in the 1990s. Although the annual average growth rate of income of the whole industry in the 1990s was 18% there were years when the growth rates of income of the industry were either well above or below this rate. For example, the growth rate of income decreased from 19% in 1995 to 10% in 1996, increased sharply to 30% in 1997 and abruptly became negative in 1998. The growth rates of income of PSBs were much lower than those of DBs and FBs in all years except 1997. Accordingly, the annual average rate of PSBs was much lower than that of DBs and FBs, 9% compared with 28%. Despite high growth rates, the growth rates of income of DBs and FBs showed a decreasing trend. The growth rates of income of DBs decreased dramatically from 48% in 1993 to around 10% in 1998. The growth rates of income of FBs decreased even more severely from 50% in 1991 to around 3% in 1998.

Figure 4.28 - Growth of Income in the Banking Industry in Pakistan (1991-1998)

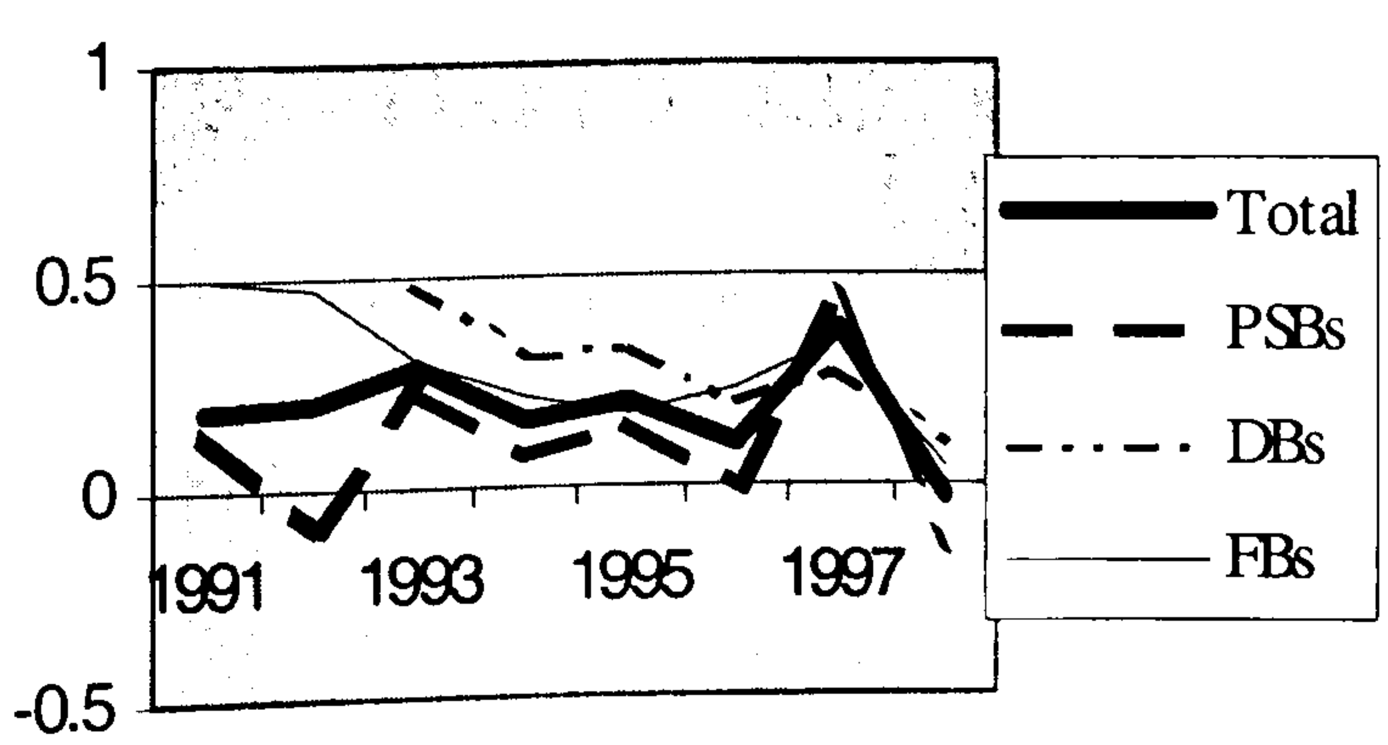
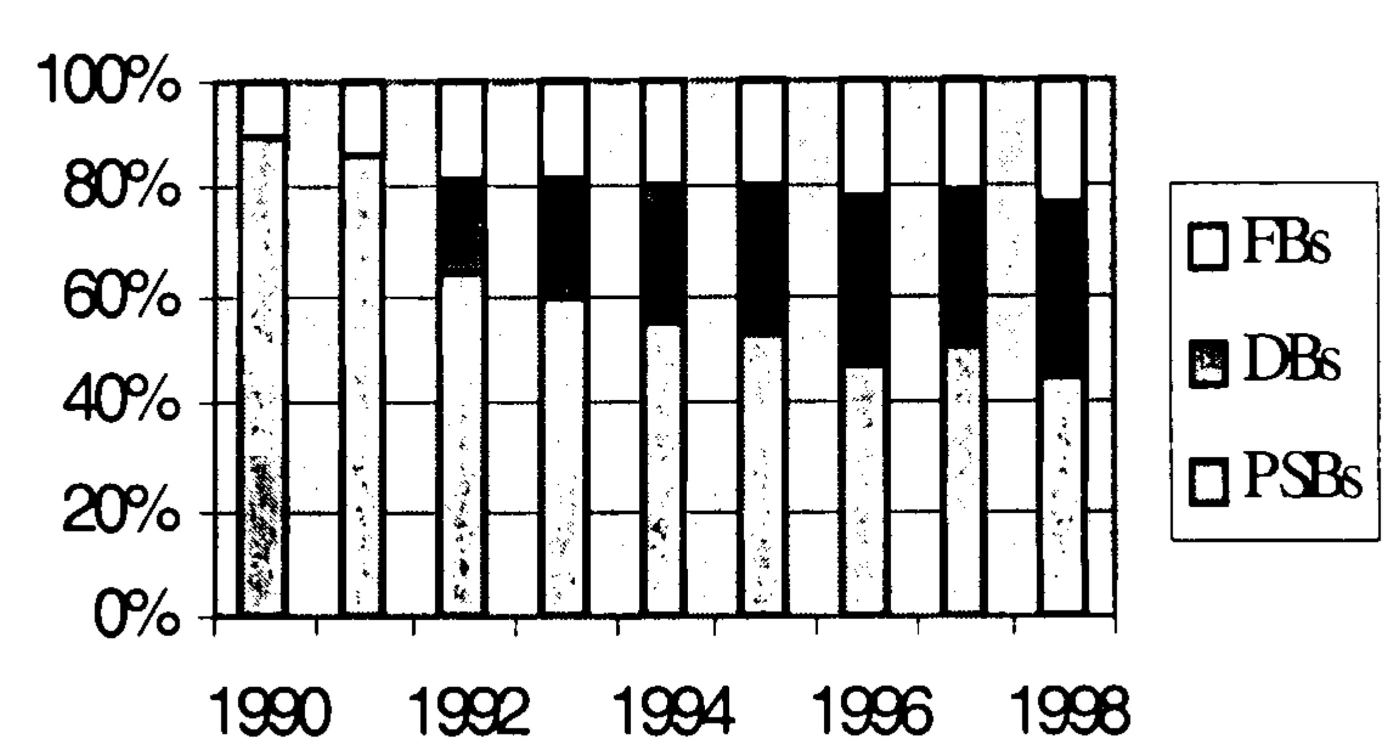


Figure 4.29 - Income Share in the Banking Industry in Paksitan (1990-1998)



FBs= Foreign Banks; DBs= Domestic Private Banks; PSBs= Public Sector Banks

Having the lowest growth rates of income, PSBs retained the highest but declining share in income of the industry (see Figure 4.29). From 90% at the start of the 1990s, the share of PSBs decreased significantly by half by the end of the decade. The share of DBs almost doubled from 17.6% to 32.5% while the share of FBs increased from 10% to 22.6% in the same period.

e – Efficiency

This section evaluates the efficiency of the Pakistani commercial banking industry using six different measures: total income over total assets; net return on assets; interest margin; total expenses over total income; staff expenses over total assets and non-performing loans (NPLs) over gross advances[12]. Overall there was very little improvement in the efficiency of the commercial banking industry in the 1990s. There was an increasing trend in the ratio of total income over total assets and the interest margin (see Figures 4.30 and 4.32). Nevertheless the net return on assets, which is defined as the difference between total income and total expenses divided by total assets, were decreasing (see Figure 4.31) which could be due to increasing trends in expenses (see Figures 4.33 and 4.34) and NPLs (see Figure 4.35). Also Khan (1999) suggests that intense competition among banks and other financial institutions squeezed spreads and lowered margins.

[12] Compare this with Section 4.2.2 on the efficiency of banks in India.

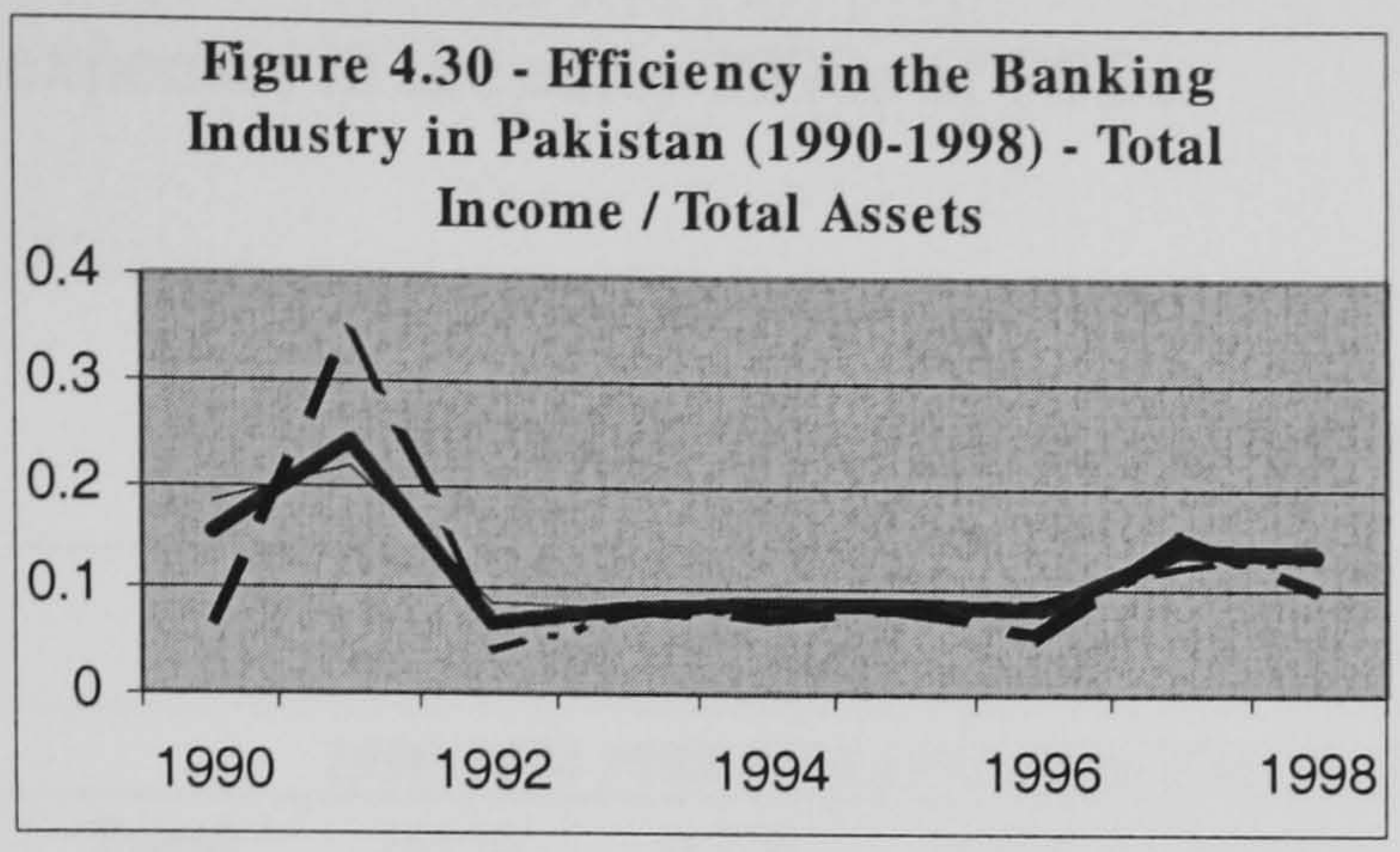


Figure 4.30 - Efficiency in the Banking Industry in Pakistan (1990-1998) - Total Income / Total Assets

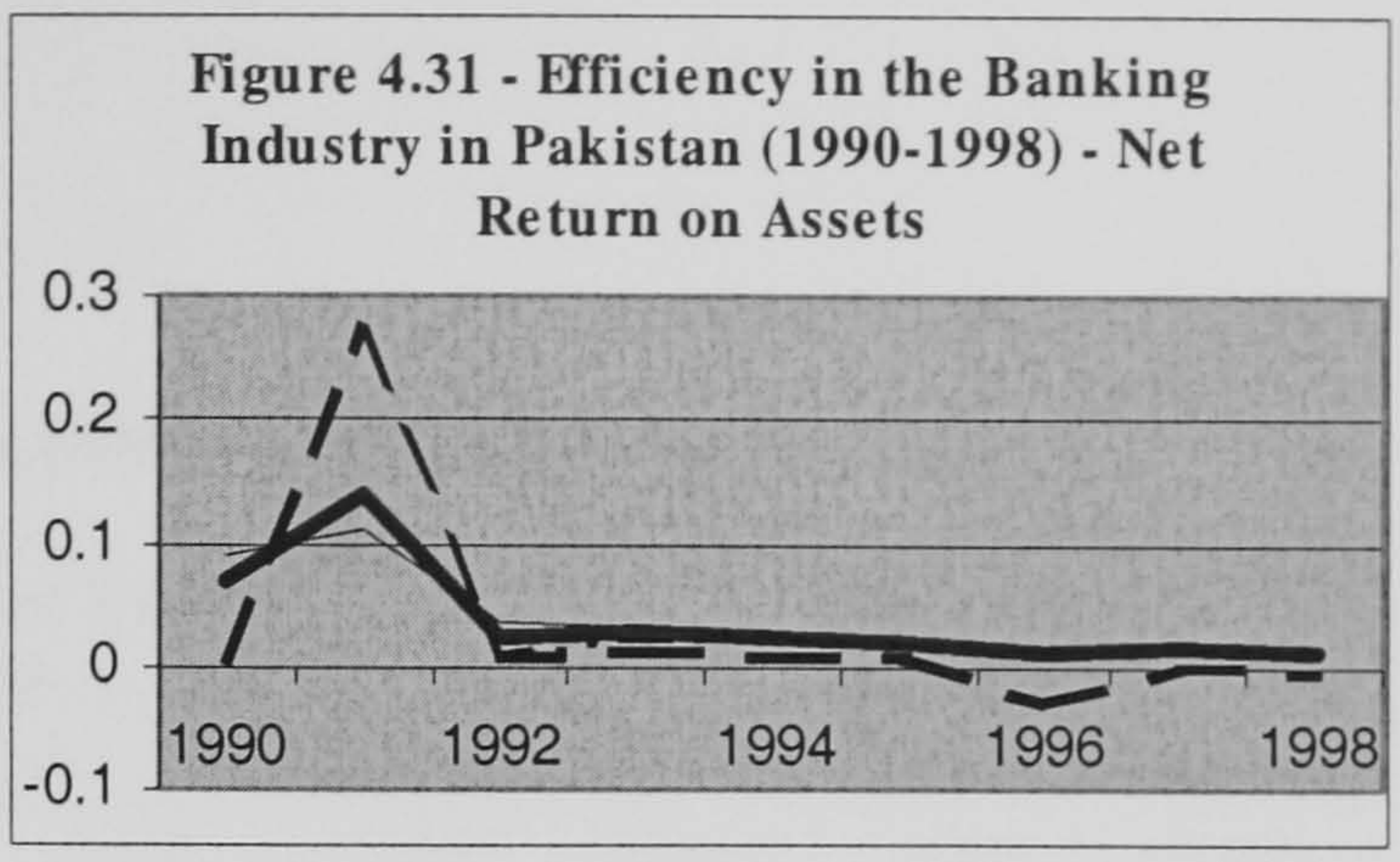


Figure 4.31 - Efficiency in the Banking Industry in Pakistan (1990-1998) - Net Return on Assets

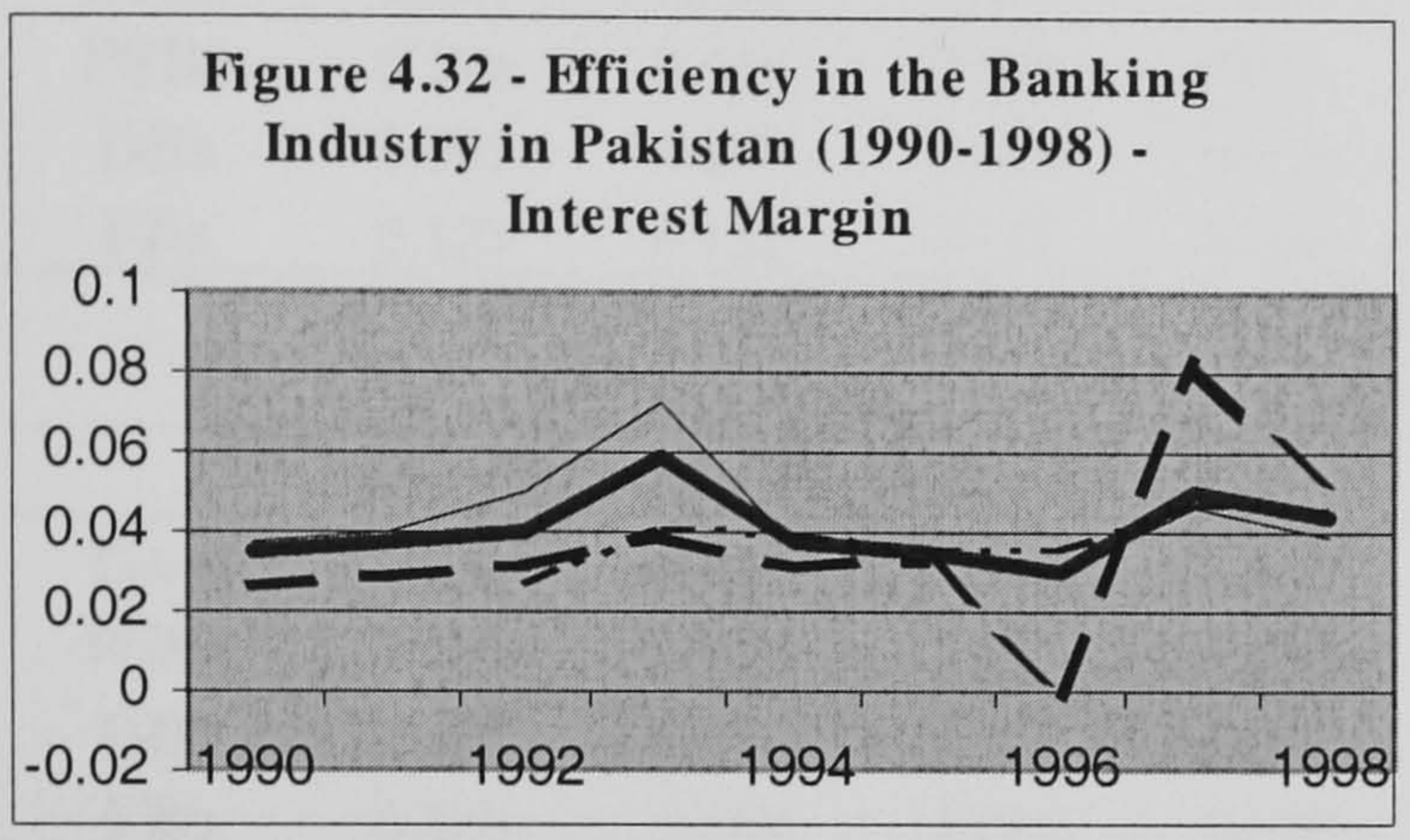


Figure 4.32 - Efficiency in the Banking Industry in Pakistan (1990-1998) - Interest Margin

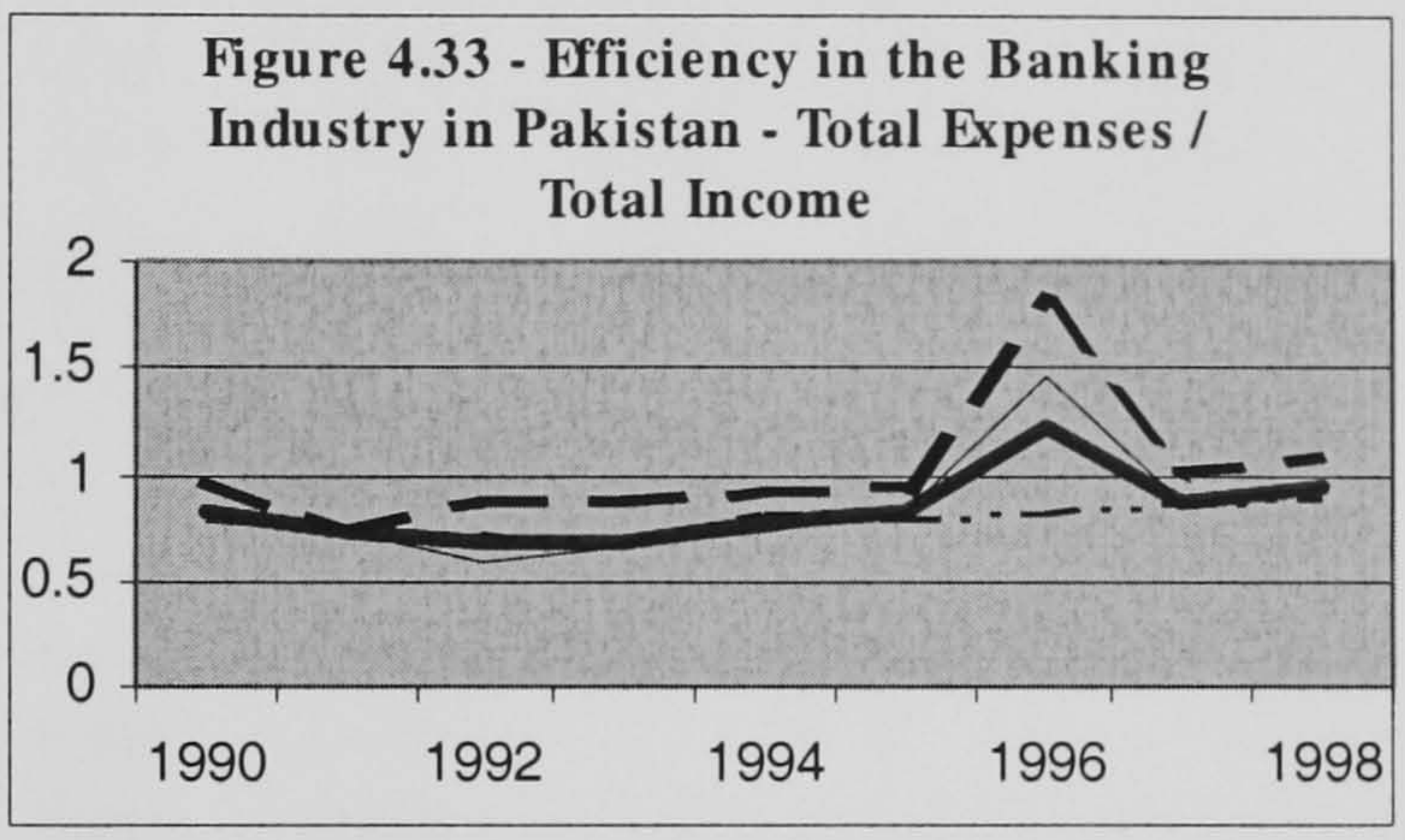


Figure 4.33 - Efficiency in the Banking Industry in Pakistan - Total Expenses / Total Income

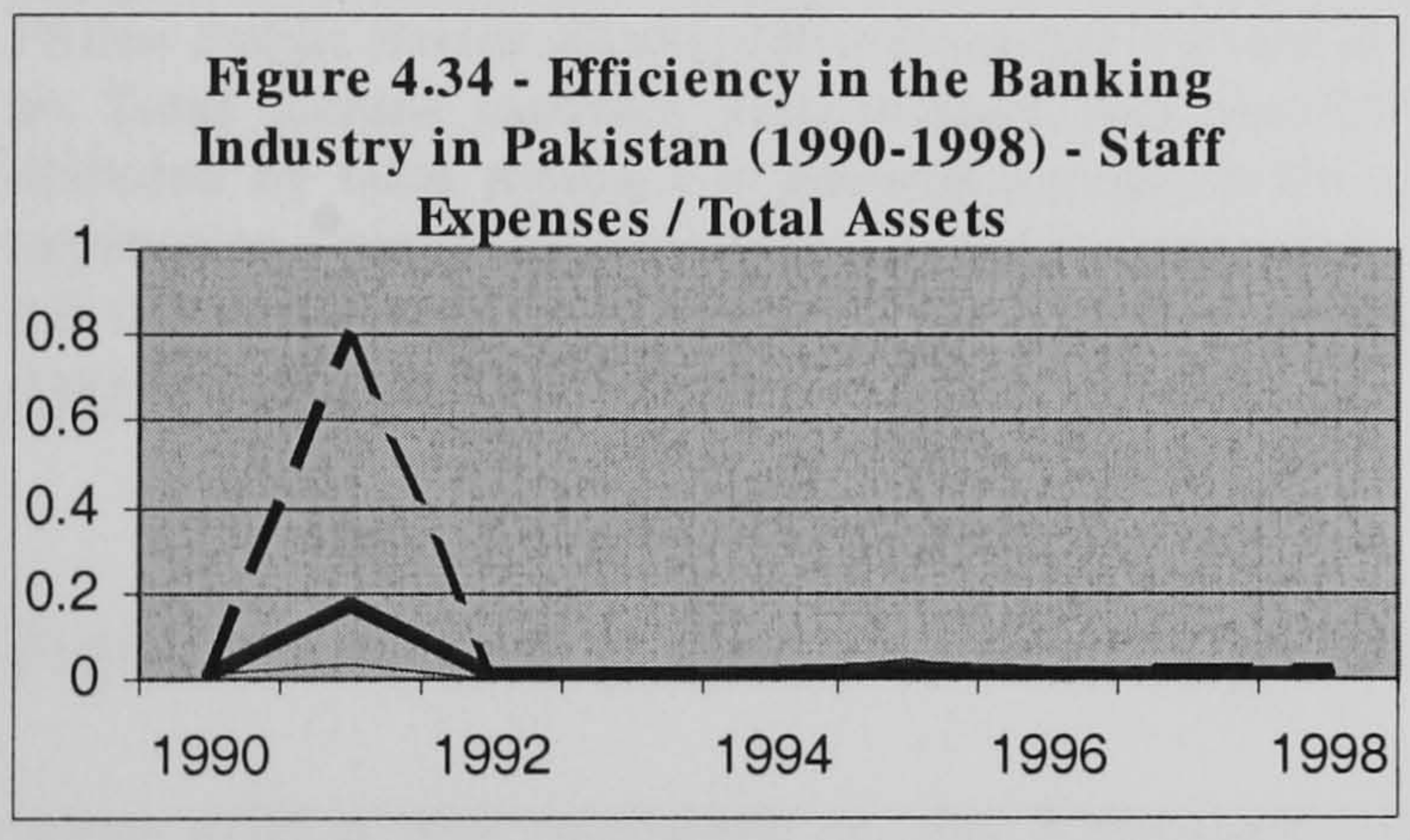


Figure 4.34 - Efficiency in the Banking Industry in Pakistan (1990-1998) - Staff Expenses / Total Assets

Total PSBs DPBs FBs

income over total assets of FBs and PSBs were twice as much as that of DBs. In the 1990s the annual average net return on assets of FBs and PSBs was around twice that of DBs. Between 1990 and 1994 this ratio of FBs and PSBs was three times higher than that of DBs. In terms of cost efficiency, PSBs were much less efficient than DBs and FBs. The annual average ratio of total expenses over total income of PSBs in the 1990s was 1 compared with 0.8 for DBs and FBs. The annual average ratio of staff expenses over total income of PSBs in the 1990s was ten times higher than that of

DBs and six times higher than that of FBs. This was mainly due to high staff expenses in the early 1990s of PSBs.

Table 4.5 – Efficiency in the Banking Industry in Pakistan (1990-1998)

	Total Income[a]/ Total Assets			Net Return on Assets[b]			Interest Margin[c]		
	1990-1998	*1990-1994*	*1995-1998*	*1990-1998*	*1990-1994*	*1995-1998*	*1990-1998*	*1990-1994*	*1995-1998*
Total	0.120	*0.126*	*0.111*	0.037	*0.056*	*0.014*	0.041	*0.042*	*0.039*
PSBs	0.114	*0.126*	*0.098*	0.031	*0.061*	*-0.006*	0.036	*0.031*	*0.041*
DBs	0.092	*0.069*	*0.109*	0.018	*0.020*	*0.017*	0.039	*0.036*	*0.041*
FBs	0.125	*0.132*	*0.116*	0.039	*0.058*	*0.016*	0.043	*0.047*	*0.038*

	Total Expenses/ Total Income			Staff Expenses/ Total Assets[d]		
	1990-1998	*1990-1994*	*1995-1998*	*1990-1998*	*1990-1994*	*1995-1998*
Total	0.842	*0.741*	*0.968*	0.030	*0.043*	*0.015*
PSBs	1.019	*0.871*	*1.203*	0.103	*0.170*	*0.019*
DBs	0.803	*0.742*	*0.848*	0.010	*0.008*	*0.012*
FBs	0.843	*0.699*	*1.023*	0.016	*0.014*	*0.018*

PSBs= Public Sector Banks; DBs=Domestic Private Banks; FBs= Foreign Banks
a= Total income includes both interest and non-interest income; b= Net return on assets in net profit divivded by total assets; c = Interest margin is the difference between total interest income and interest expense as a percentage of assets; d= total expenses divided by total income
All values are simple averages for the specified group; Number of banks: PSBs=4, DBs= 17, FBs= 18 (see Appendix 5.2 for more details

Figures 4.35 and 4.36 show that despite the implementation of the reforms NPLs were still a big problem in the Pakistani commercial banking industry in the 1990s. NPLs of the whole industry as a share of gross advances had an increasing trend. This, according to the State Bank of Pakistan, was partly because strict disclosure requirements forced banks to disclose the true classification of their loans, many of which had been undeclared NPLs.

The problem of NPLs was particularly serious in PSBs. The ratios of NPLs over gross advances of PSBs were much higher than those of DBs and FBs in all years. The annual average NPLs over gross advances of PSBs was 23.1% compared with only 8% and 5.9% of DBs and FBs, respectively. The share of NPLs in gross advances of FBs declined from 1990 to 1994, increased from 1994 to 1995 and remained stable in the later part of the 1990s. The share of NPLs in gross advances of DBs declined from 1994 to 1995 and increased especially after 1998, which was due to aggressive lending by these banks (SBP, 2000). Meanwhile, the share of NPLs in gross advances of PSBs was increasing, which according to SBP (2000) was due to substantial loans provided on political grounds especially during the early and mid 1990s that resulted in NPLs after a time lag.

Figure 4.35 - Efficiency in the Banking Industry in Pakistan (1990-1998) - Non Performing Loans / Gross Advances

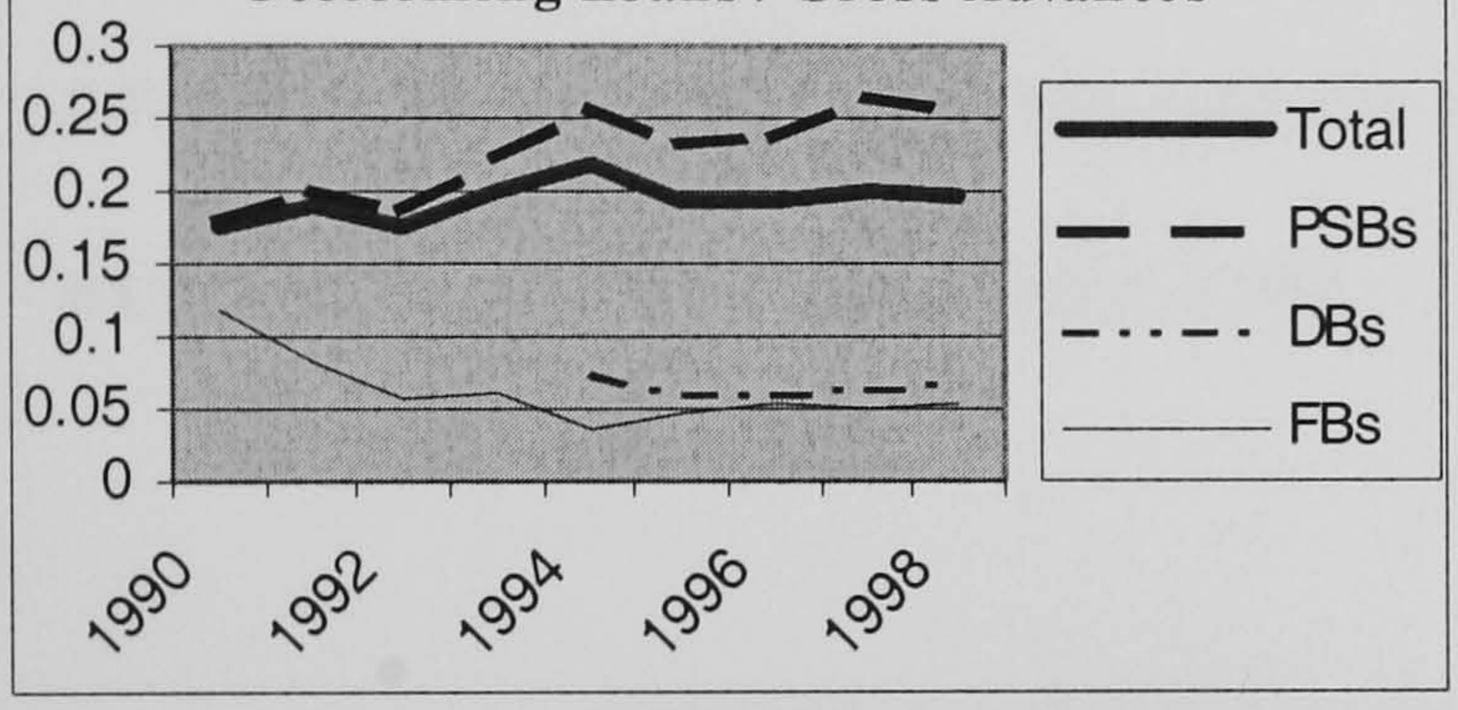
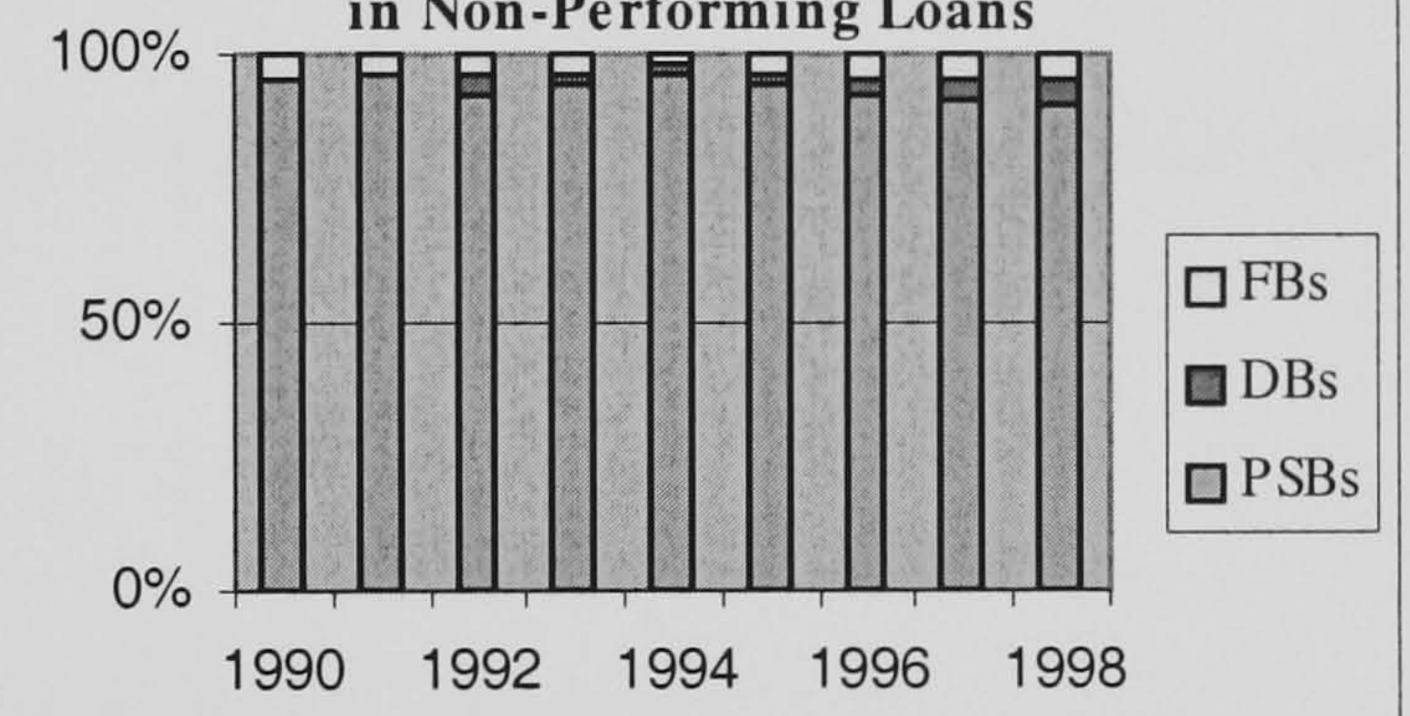


Figure 4.36 - Efficiency in the Banking Industry in Pakistan (1990-1998) - Share in Non-Performing Loans



FBs= Foreign Banks; DBs=Domestic Private Banks; PSBs=Public Sector Banks

Figure 4.36 shows that PSBs had the largest share in total NPLs of the banking industry, which was much greater than their share in deposits, credit, total assets or total income[13]. Although this share declined slightly in the later part of 1990s, from 95% in 1990 to 91% in 1998, according to SBP (2000) this was more due to an increase in NPLs of DBs and FBs rather than to any improvement in NPLs of PSBs.

The analysis of five measures of efficiency reveals that with lower earnings and profit and higher expenses PSBs were less efficient than DBs and FBs. This could be due to several reasons, including growing competition from the private sector, political intervention, overstaffing and over-branching (SBP, 2000). High and fast growing NPLs also contributed to the inefficiency of PSBs.

[13] See also Appendix 4.5.

4.4 – Summary and conclusion

In both India and Pakistan a programme of economic and structural reforms was initiated in the early 1990s. The reforms in India were triggered by an economic crisis that included high fiscal deficits and a severe balance of payment crisis. However, in the case of Pakistan there were no crises. The reforms in both countries included similar elements, including controlling fiscal deficits, liberalising imports, encouraging exports and foreign investment, removing controls on private investment, and reforming the financial sector. However, the performance of the two countries in the 1990s after the reforms were initiated was not very similar (see, for example, Figure 4.37 and Figure 4.38).

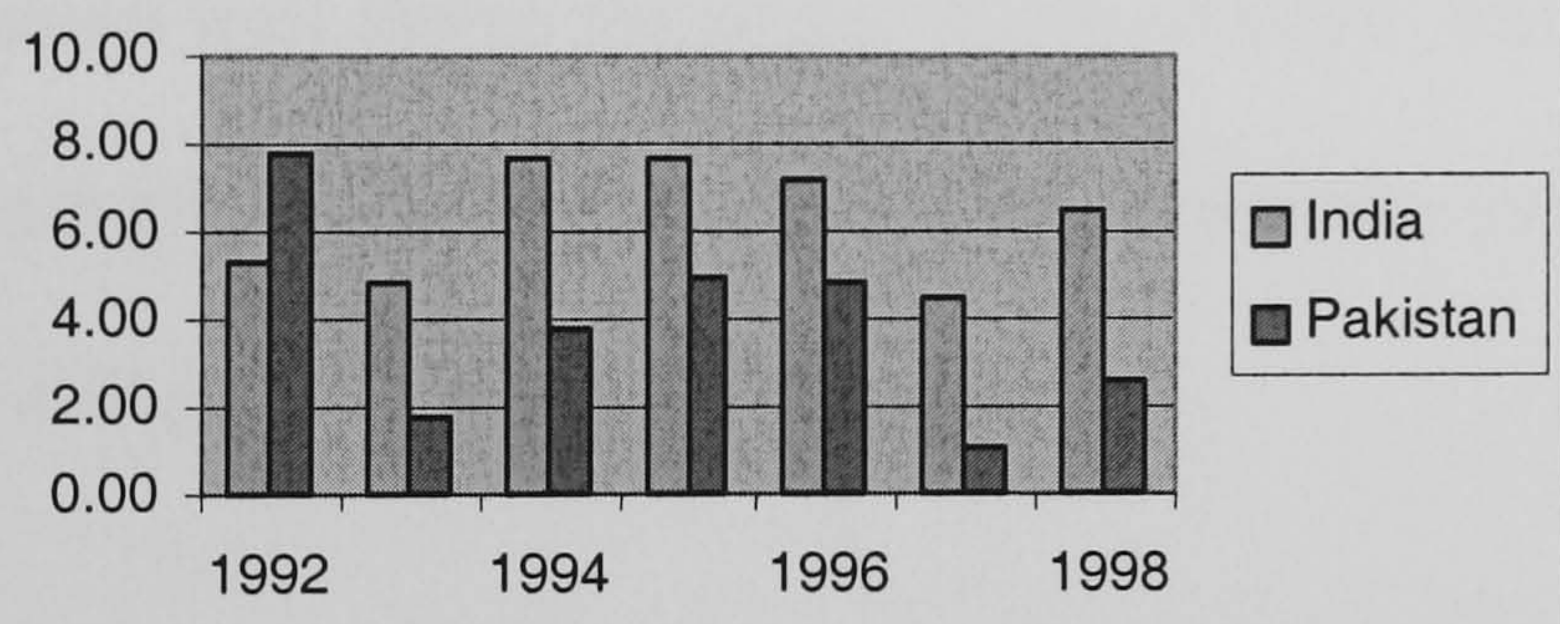


Figure 4.37 - Comparison of GDP India and Pakistan 1992-1998

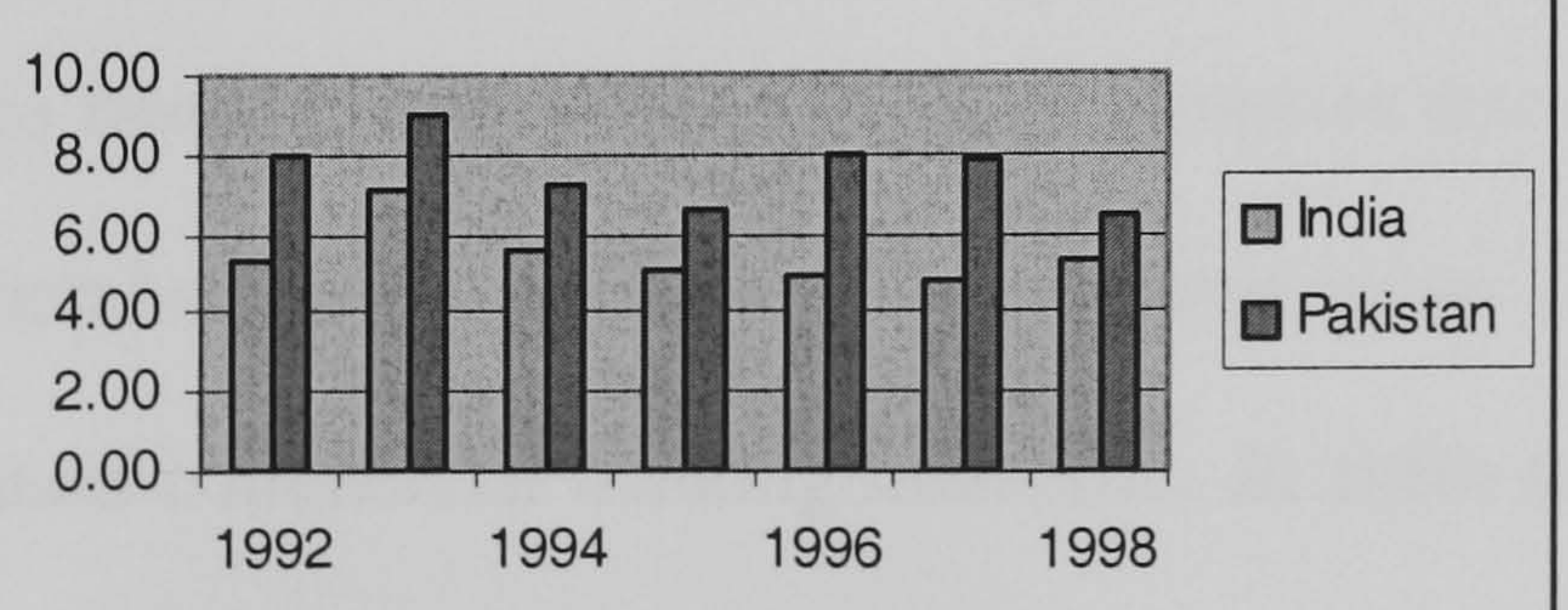


Figure 4.38 - Conmparison of Fiscial Deficits (as % of GDP) of India and Pakistan (1992-1998)

India seems to be more successful with its ESRs compared to Pakistan. The Indian economy saw higher economic growth rates, lower fiscal deficits, increasing international reserves, higher growth in exports, imports and foreign investment, and increase in investment, especially by the private sector. Meanwhile the overall performance of the Pakistan economy was disappointing and even worse than the pre-reforms period. The economy was growing at lower rates than before with higher current account deficits, and lower growth rates of exports and imports. There was, however, some progress in the form of increase in foreign investment in the first half of 1990s and in investment by the private sector.

For both countries, tackling high fiscal deficits was the key objective of the economic reforms and both countries failed to achieve their targets. Even though the fiscal deficits in India in the 1990s were significantly lower than the pre-reforms period, they remained well above the target of 3% of GDP. Meanwhile Pakistan still had very high fiscal deficits compared with the pre-reforms period and much higher than the target of 4% of GDP set by the reforms.

As a key element of the 1990s reforms in both India and Pakistan, the financial liberalisation programme included efforts to increase competition, allowing banks to operate with more freedom, and strengthening supervision and prudential measures. The financial liberalisation programme brought about major changes to both the Indian and Pakistani commercial banking industries. In India new domestic private sector banks were given licenses and foreign banks were allowed to expand much more liberally than in the past. In Pakistan the major break from the past was the decision to allow domestic private sector commercial banks to function. In both countries banks were allowed to operate with higher flexibility through such policies as liberalising interest rates, liberalising branch policies, and establishing a market-based rate of return structure for government securities.

In India deposit rates and lending rates were gradually deregulated during the post-ESRs period. Quantitative restrictions on credit allocation by banks were eliminated and mandatory requirements for investment by banks in low-interest government securities were sharply lowered. Similarly, the system of credit ceilings and credit-deposit ratios was abolished in Pakistan. Banks were encouraged to extend credit to the private sector through market-based mechanisms and concessional credit was phased out. In order to establish a strong and stable financial sector, the reforms in both countries emphasised prudential measures, including implementing prudential norms and standards on capital adequacy and asset classification and provisioning, strengthening supervision, especially on-site and off-site surveillance, and evaluating banks' performance based on the new prudential standards. Such higher prudential standards aimed at forcing banks to seek quality borrowers in order to improve their asset quality and tackle the problem of non-performing loans. A loan recovery mechanism and legal procedure was implemented, requiring banks to set quarterly recovery targets, submit progress reports and form strategies to improve the future recovery process. Some other measures were also established such as minimum conditions for borrowers to ensure that defaulters were not provided fresh loans and a list of loan defaulters.

The analysis of non-frontier-based ratios shows that under the similar financial liberalisation, the performance of the commercial banking industry in India and

Pakistan was not the same. In India there were some achievements in terms of deposits mobilised and credit provided by the banking industry (see Figure 4.1, 4.2. and 4.3). In Pakistan there were no significant achievements (see Figure 4.18, 4.19, and 4.20). Both demand deposits and time deposits as a percentage of GDP decreased in Pakistan. In terms of core earning assets, India witnessed an increasing trend in the share of investment, which was mainly due to increases in the share of government securities. Although the share of investment in total assets initially was lower than that of credit, the increasing trend of the former made the gap between the two ratios very trivial. In Pakistan the share of investment in total assets was always lower than the share of credit, although there was some increase of investment in the early 1990s due to the implementation of the debt management reforms. Both countries witnessed an increase in the level of competition in the banking industry. In both countries the number of banks in the industry increased significantly in the 1990s and the Herfindahl index of concentration bears similar declining trends. In India the increase in competition for deposits was more gradual than for credit, assets, and income. In Pakistan the increase in competition for income was more gradual than for deposits, credit and assets. The analysis of ratio-based efficiency of both countries, however, showed no clear trends.

Sectorally, although public sector banks still retained the highest share in the industry both countries saw a decline in the share of these banks, which occurred to a higher extent in Pakistan. In India the shares of public sector banks in deposits, credit, total assets and total income of the industry decreased from 90% before the reforms were initiated to around 80% in 1998. In Pakistan the shares of public sector banks decreased from above 90% in 1990 to less than 70% of deposits, credit and total assets of the industry and 60% of total income in 1998. In both the countries public sector banks had the lowest growth rates of deposit, credit and income. In India, both domestic private banks and foreign banks had high growth rates of deposits, credit and income, and domestic private banks' shares in the industry increased while those of foreign banks remained quite stable. In Pakistan, foreign banks had the highest growth rates of deposits, credit and income and its shares in the industry increased rapidly. Domestic private banks also had high growth rates of deposits, credit and income and its shares in the industry also increased but more gradually than foreign banks. Relating to the efficiency, in both the countries foreign banks were the most efficient while public sector banks were the least. The gap in efficiency between foreign banks and public sector banks and domestic private banks in India was larger than in Pakistan. In Pakistan, the gap was marginal. In both countries the problem of non-performing loans remained serious in the post-ESRs, particularly for public sector banks. In the following chapter, we employ frontier techniques to analyse whether these conclusions regarding the efficiency of banks are robust.

Chapter 5: The Technical Efficiency and Total Factor Productivity of Banks in India and Pakistan during 1990-1998[1]

5.1 – Introduction

The preceding chapter reviewed the economic and structural reforms (ESRs) in India and Pakistan during the 1990s. Within the context of this study, emphasis was placed on the implementation of the financial liberalisation programme that transformed the banking industry in both the countries during the post-ESRs era. This chapter describes and employs non-parametric data envelopment analysis (DEA) to measure the technical efficiency and total factor productivity change of banks in India and Pakistan during 1990-1998[2]. Our aim is to examine whether the efficiency and productivity of banks improved after the implementation of the financial liberalisation programme in 1991-1992.

The rest of the chapter is structured as follows. Section 5.2 presents some technical details of the DEA. Section 5.3 measures technical efficiency for the banking industry in India and Pakistan during 1990-1998. Following Bauer et al. (1998) and Resti (1997), we also check the consistency of our results. In addition, stochastic frontier

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[1] An extended version of section 5.3 of this chapter has been accepted for publication in the *Applied Economics*. Also, a paper based on section 5.4 of this chapter has been accepted for publication in the *Service Industries Journal*.

[2] As mentioned earlier, due to price distortions in the banking industry caused by excessive government restrictions on interest rates and wages, we will not calculate allocative efficiency. Another reason for not calculating allocative efficiencies is the unavailability of data on number of employees.

analysis (SFA) is employed to check the robustness of our DEA results. Section 5.4 measures changes in total factor productivity during 1992-1998. We also decompose total factor productivity change into technological change and efficiency change. Section 5.5 concludes.

5.2 – Methodology and Data

Chapter 3 highlighted various parametric and non-parametric techniques that have been employed in the empirical literature to measure the frontier-based efficiency of banks. This section provides some technical details of the DEA, the technique used in this chapter. We will also discuss the construction of the Malmquist total factor productivity index, and its decomposition into technological change and efficiency change[3].

5.2.1 – Technical efficiency measurement using Data Envelopment Analysis

Based on Farrell's (1957) work, Charnes, Cooper, and Rhodes (1978) introduced a basic DEA model to calculate the technical efficiency of decision-making units (DMUs) (i.e. firms, branches, subsidiaries, and so forth). Before outlining the mathematical formulation, a graphical example would be useful to illustrate the underlying concept of the DEA (see Ali and Seiford, 1993).

Consider an industry comprising six firms that use two inputs ($x1$ and $x2$) to produce a single output Y. Assuming constant returns to scale, Figure 5.1 plots the input-output correspondence (ordered-pairs in the R^2 plane) for the six firms, where x1/Y and x2/Y

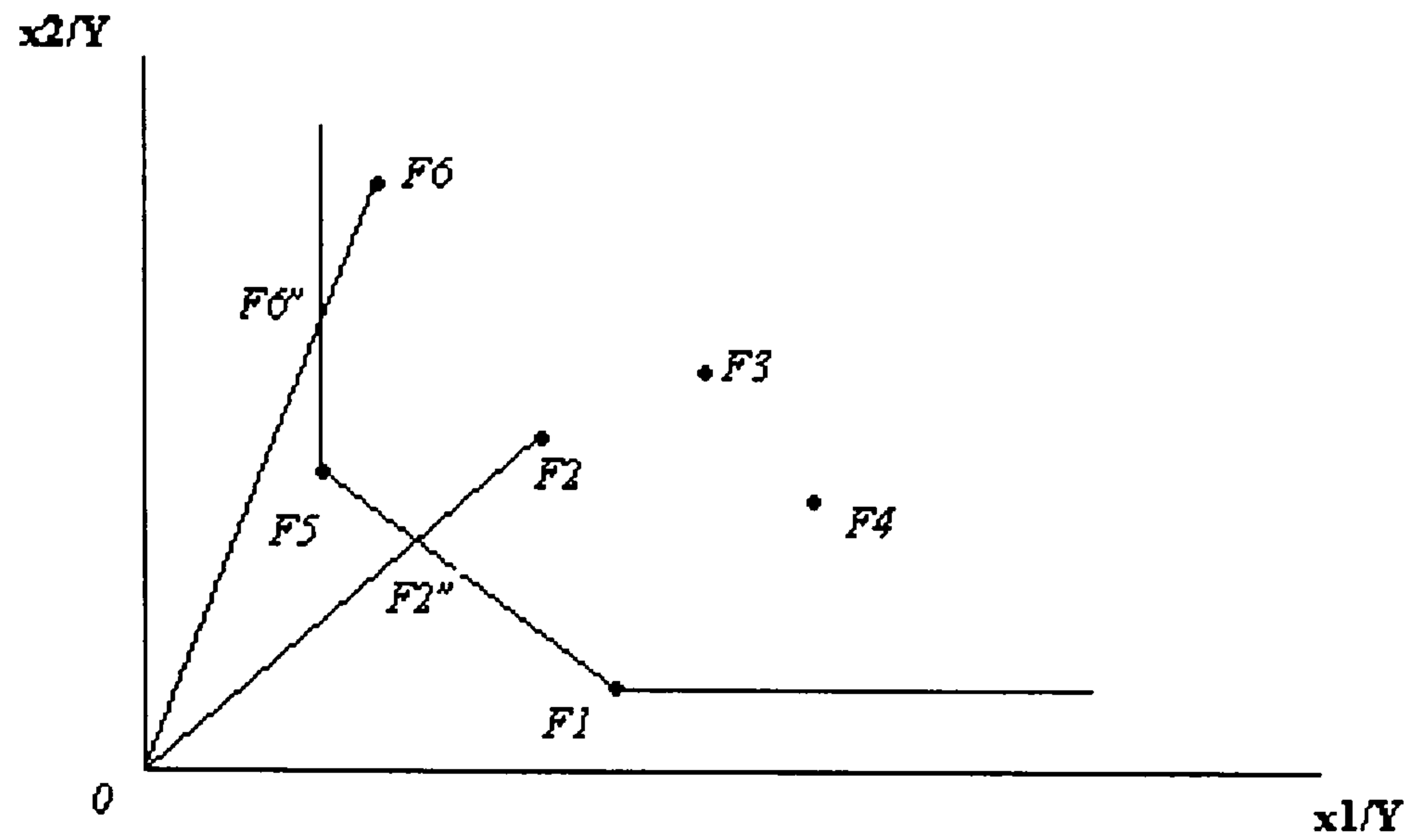
[3] For a comprehensive review of theory and applications of DEA, see Thanassoulis (2001) and Coelli et al. (1998). The notations used in this chapter are primarily from Coelli et al. (1998).

represent inputs per units of *Y*. F1 refers to the input-output correspondence set of firm 1, F2 refers to the input-output correspondence set of firm 2, and so forth. As discussed in Chapter 3 (section 3.3.1), the measurement of the efficiency of a firm requires comparing that firm's actual input-output correspondence set with a best-practice production frontier. As highlighted earlier, Farrell (1957) suggested that the best practice production frontier for a given industry can be obtained by a theoretical production function specified by engineers and/or by an empirical determination based on actual data on resource usage and output generation by firms operating in that industry[4].

With the DEA, for a given sample of firms, the best-practice frontier is obtained through a piece-wise linear combination of input-output correspondence sets that envelops the input-output correspondences of all firms in the sample. The assumptions underlying such a piece-wise linear combination are (see Thanassoulis, 2001, p. 10): (1) Interpolation between feasible input-output correspondences (i.e. actually observed correspondences) leads to new input-output correspondences that are feasible in principle, and (2) Inefficient production is possible (i.e. some firms may not produce on the interpolated linear combination). In Figure 5.1, for example, the best practice frontier (i.e. an empirically determined isoquant) is formed by interpolating between the observed input-output correspondence sets of firm 1 and firm 5 in such a way that no firm lies to the left of the linear combination. The efficiency of each firm not on the *calculated* frontier is then measured as a distance from the frontier (the firms constituting the frontier are considered 100% efficient). For example, the efficiency of firm 2 is given by the ratio *0F2''/0F2*.

[4] As outlined in chapter 3, parametric or non-parametric techniques can be used in this regard.

Figure 5.1 – Piecewise-linear combination and technical efficiency



Adopted from Coelli et al. (1998, p. 143)

This measure of efficiency is usually known as Farrell's 'radial efficiency' (i.e. possible *proportional* contraction in both inputs while maintaining the existing input mix). It is argued that there is a problem with this measure of efficiency due to the sections of the calculated production frontier that run parallel to axes because, for example, for firms 2 and 6 Farrell's measure of radial technical efficiency is given by *0F2''/0F2* and *0F6''/0F6*, respectively. However, as evident from the figure, it is pertinent to question the inclusion of point *F6''* in the best-practice frontier because any firm at point *F6''* can reduce its usage of input x2 (i.e. from F6'' to F5) and still produce the same output. This is referred to as 'slacks' in the empirical literature. Unlike Farrell's definition of efficiency, which only considers radial movement, Koopmans' (1951) definition of efficiency considers both radial efficiency and all associated slacks (see, for example, Lovell, 1994; Aly and Seifod, 1993; Coelli et al. 1998). According to Koopmans' definition, a firm is efficient if it is not possible to raise (lower) anyone of its outputs (inputs) without lowering (increasing) at least another one of its outputs (inputs) and/or without increasing (lowering) at least one of its inputs (outputs).

This chapter focuses on radial efficiency only and ignores any slack because, following Ferrier and Lovell (1990), it is assumed that any slacks in the Indian and Pakistani banking industry could be due to allocative inefficiency (see also Coelli et al., 1998, p. 176). As highlighted earlier, allocative efficiency is not considered because of the non-availability of price data and a possibility of distortions in prices due to state-determined interest rates and wages. Also, the general evidence from developed and developing countries suggests that compared to technical efficiencies, allocative efficiencies in the banking industry are negligible (see Berger and Humphrey, 1997; Isik and Hassan, 2003; Sathye, 2001). Furthermore, Bhattacharyya et al. (1997) find that slacks in the Indian banking industry are insignificant compared to the radial inefficiencies. Therefore, given this previous empirical evidence, we concentrate on Farrell's radial efficiency measure.

Mathematical formulation of a simple DEA with Constant Returns to Scale (CRS)

In their original paper, Charnes, Cooper, and Rhodes (1978) introduced a basic DEA model by assuming that the production frontier exhibits constant returns to scale. Banker, Charnes, and Cooper (1984) allowed for the possibility of variable returns to scale (VRS). We first consider simple CRS DEA. Following Coelli et al.'s (1998) notations, assume we have N firms (or DMUs) each producing M number of outputs using K number of inputs. For the i^{th} firm, the inputs and outputs are represented by column vectors x_i and y_i, respectively. The $K \times N$ input matrix, X, and the $M \times N$ output matrix, Y, represent the data for all the N firms. In ratio form, the efficiency of a firm would be the maximum of the ratio $u`y_i/v`x_i$, where u is an $M\times 1$ vector of output weights and v is a $K\times 1$ vector of input weights. The optimal weights are obtained by solving the mathematical programming problem with an objective function and specified constraints:

$$\begin{aligned}
&\max_{u,v}(u`y_i / v`x_i) \\
&\qquad \textit{subject to} \qquad\qquad\qquad\qquad (5.1) \\
&\qquad u`y_j / v`x_j \le 1; \quad j = 1,2,\ldots,N \\
&\qquad u,v \ge 0
\end{aligned}$$

The above problem requires finding values of the optimal weights in such a way that the efficiency measure for the i^{th} firm is maximised given that the efficiency measure for each firm in the sample is equal to or less than 1. The difficulty with the above ratio form is that it has an infinite number of solutions because if (u^*, v^*) is a solution, the (ru^*, rv^*) is another solution (where r is any constant). To avoid this, the above ratio form can be formulated in the following linear programming problem:

$$\begin{aligned}
&\max_{\mu,v}(\mu`y_i) \\
&\qquad \textit{subject to} \qquad\qquad\qquad (5.2) \\
&\qquad v`x_i = 1 \\
&\qquad \mu`y_j - v`x_j \le 0; \quad j = 1,2,\ldots,N \\
&\qquad \mu,v \ge 0
\end{aligned}$$

Where the change of notation from u and v to μ and ν stresses that this is a different linear programming problem (see Coelli et al., 1998, p. 141). Using the duality in linear programming[5], the dual of the above maximisation problem can be written in the following envelopment form that provides the technical efficiency of the i^{th} firm:

[5] See Chiang (1984) for a simple exposition of linear programming techniques and duality theorem.

$$\min_{\theta,\lambda} \theta$$

$$\begin{aligned} &\textit{subject to} \\ &-y_i + Y\lambda \geq 0 \\ &\theta x_i - X\lambda \geq 0 \\ &\lambda \geq 0 \end{aligned} \qquad (5.3)$$

where θ is a scalar and λ is a $N \times 1$ vector of constants. The value of θ obtained is the efficiency score for the i^{th} firm. The above linear mathematical problem is solved N number of times to get the efficiency score for each firm in the sample. A value of 1 represents a 100% efficient firm, i.e. firm producing on the best practice production frontier.

DEA with Variable Returns to Scale (VRS)

The above DEA model with CRS assumption does not take into account the information on the scale economies as it assumes that all the firms operate at the optimal scale, i.e. at the CRS. However, factors like imperfect competition and constraints on finance may cause firms to diverge from producing at the optimal scale (see Coelli et al., 1998, p. 150). Banker et al. (1984) extended the above DEA model by relaxing the CRS assumption and allowing for VRS. The DEA with the VRS assumption allows decomposing the overall technical efficiency into its two exhaustive components, namely pure technical efficiency and scale efficiency. The DEA model in 5.3 above can be modified to account for the possibility of VRS, by adding a convexity constraint N1`λ as follows:

$$
\begin{aligned}
&\min_{\theta,\lambda} \theta \\
&\quad \textit{subject to} \\
&\quad -y_i + Y\lambda \geq 0 \qquad\qquad (5.4) \\
&\quad \theta x_i - X\lambda \geq 0 \\
&\quad N1`\lambda = 1 \\
&\quad \lambda \geq 0
\end{aligned}
$$

where *N1* is a *Nx1* vector of ones. 'This approach forms a convex hull of intersecting planes which envelop the data points more tightly than the CRS conical hull and thus provides technical efficiency scores which are greater than or equal to those obtained using the CRS model...[T]he convexity constraint (N1`λ=1) essentially ensures that an inefficient firm is only "benchmarked" against firms of a similar size. That is, the projected point (for that firm) on the DEA frontier will be [a] convex combination of observed firms. This convexity restriction is not imposed in the CRS case. Hence, in a CRS DEA, a firm may be benchmarked against firms which are substantially larger (smaller) than it. In this instance the λ-weights will sum to a value greater than (less than) one'. (Coelli et al., 1998, p. 150).

Input and output orientation

Efficiency can be defined in terms of input-orientation or output-orientation. The input-oriented efficiency examines by how much can input quantities be proportionally reduced without changing given output quantities. On the other hand, output-oriented efficiency examines by how much can output quantities be proportionally expanded without altering input quantities used. Under the CRS assumption, output-oriented and input-oriented measures are equal. However, when production frontier exhibits variables returns to scale, input-oriented measures are different from the output-oriented measures (see Thanassoulis, 2001, chap. 4).

Nevertheless, 'the output- and input-oriented models will estimate exactly the same frontiers and therefore, by definition, identify the same set of firms as being efficient. It is only the efficiency measures associated with inefficient firms that may differ between the two models' (Coelli et al., 1998, p159). Following recent studies on the efficiency of banks in developing countries (e.g. Bhattacharyya et al. 1997, Leightner and Lovell, 1998; Gilbert and Wilson, 1998; Yildirim, 2002), this chapter measures output-oriented efficiency for banks in India and Pakistan because as interest rates and wages in the banking industry are determined by governments, banks have relatively less control over their inputs (e.g. interest expenses and operating expenses).

Measuring Scale efficiency using CRS and VRS DEA model

The extension of CRS DEA model to take into account the possibility of VRS technology could be used to calculate the scale efficiency of firms. This is achieved by running both CRS and VRS DEA models, and then decomposing technical efficiency obtained from the CRS DEA into pure technical efficiency and scale efficiency as follows:

$$TE_{CRS} = TE_{VRS} \times SE \qquad (5.5)$$

Figure 5.2 represents the CRS and VRS frontiers for firms producing one output, *Y*, using one input, *X*. Under the CRS, the input-oriented technical inefficiency of the firm producing at point P is the distance PP_c, while under the VRS assumption the technical inefficiency would be the distance PP_v. The difference between these two represents the scale efficiency of the firm.

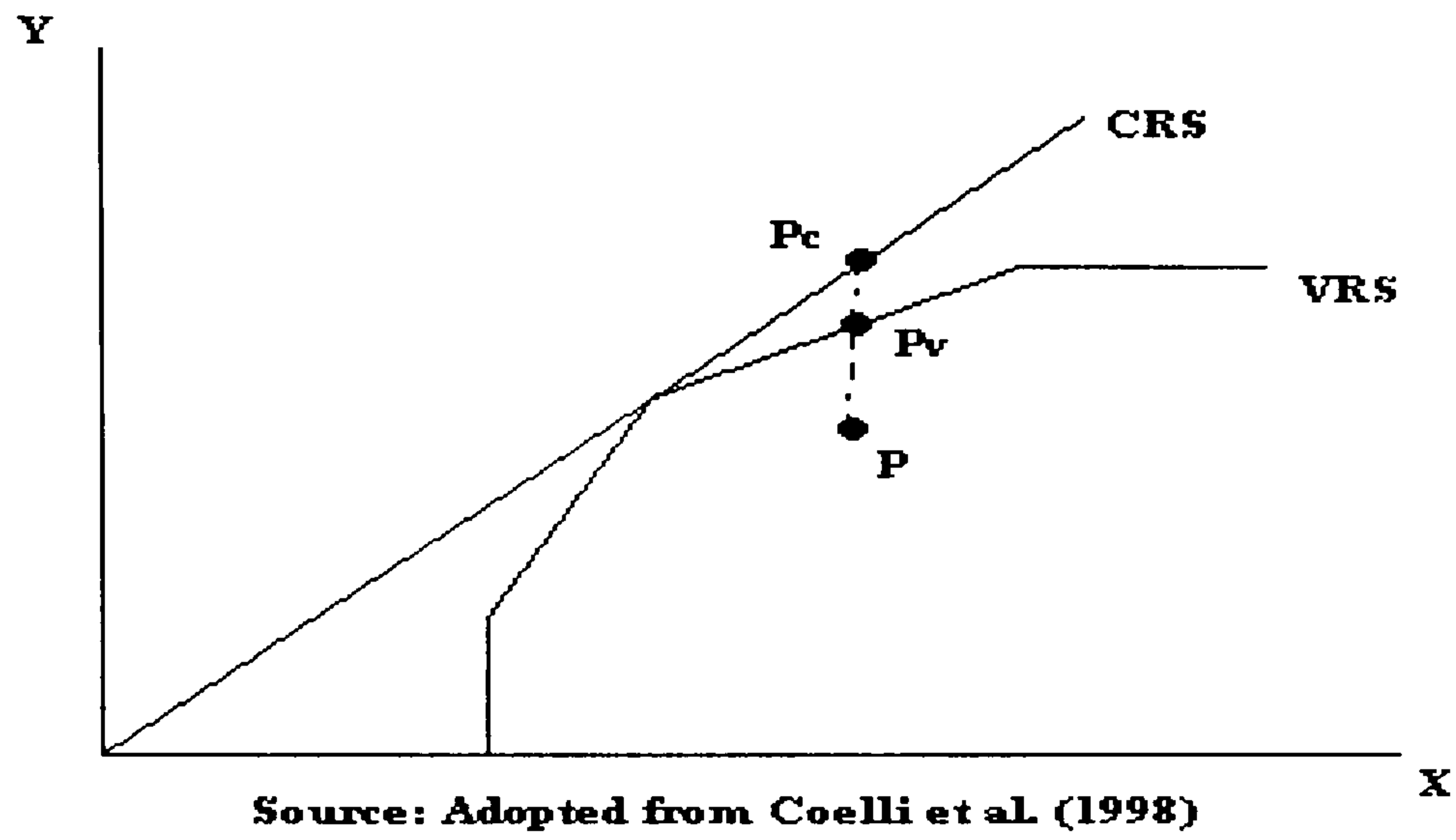
$$TE_{CRS} = AP_c/AP$$

$$TE_{VRS} = AP_v/AP$$

$$SE = AP_c/AP_v$$

This measurement of scale efficiency can be extended in order to examine whether a firm operates in the area of increasing or decreasing returns to scale. To accomplish this, the DEA model in 5.4 is altered by substituting $N1'\lambda=1$ with $N1'\lambda\leq1$ (see Färe, Grosskopf and Lovell, 1994; Lovell, 1993).

Figure 5.2 – Pure technical efficiency and scale efficiency



Source: Adopted from Coelli et al. (1998)

The measurement of efficiency using both the CRS and VRS assumptions is pertinent in the context of the banking industry in India and Pakistan where governments restricted the scale of operation of private sector banks (especially foreign banks) and directed public sector banks to extend their branch network to rural and suburban areas. These restrictions could hinder banks' ability to exploit scale economies. The implementation of the financial liberalisation may enable banks to improve their scale efficiency. However, as both the countries adopted a gradual approach towards the liberalisation, and as our study only considers the period until 1998, the improvement in scale efficiency may not be very significant. For example, public sector banks in both the countries were only able to start closing some of their branches after 1995-1996. Also, due to strong labour unions, both public sector and private sector banks in India found it difficult to convince government to allow them to reduce their number of employees (see Ahluwalia, 1999a). Therefore, although we do examine variations in the scale efficiency of banks in India and Pakistan, like Bhattacharyya et al. (1997), our main emphasis would be pure technical efficiency obtained by assuming a VRS production frontier. Following the existing empirical studies, we refer to the pure technical efficiencies as managerial efficiencies (see, for example, Bhattacharyya et al., 1997). That is, how efficient the managers are to utilise their existing resources.

5.2.2 – Malmquist total factor productivity change index

The total factor productivity (TFP) of a firm is defined as the quantity of its output per unit of input. In a single-output and single-input case, the productivity is simply the ratio of the firm's output to input quantities (see Coelli et al., 1998). However, in a multiple outputs inputs situation, indices of outputs and inputs are used to measure the productivity of the firm.

The measures of efficiency discussed above do not take into account shifts in the calculated production frontier relative to which the efficiency of each unit is assessed. In this section, we discuss the Malmquist total factor productivity change index that enables us to measure changes in productivity over time or space, and to decompose this change into change in efficiency and shifts in the production frontier due to either technological progress or technological regress in the industry in question.

An index number is a real number that measures inter-temporal and/or intra-temporal change in a variable, such as price level (see, for example, Anderson et al., 1996, chap. 17). In terms of measuring productivity changes, index numbers are used in measuring changes in the level of output produced and the level of input used in the production process over two time periods or across two firms. In the empirical literature, two techniques have been used to measure changes in TFP: an econometric approach and an index number approach (see Coelli et al. 1998). In this paper, the index number approach is adopted for two reasons. *Firstly*, in contrast to the econometric approach, it does not impose a pre-specified functional form on the production frontier. *Secondly*, as a recent study by Kumbhakar and Sarkar (2003) has already employed the econometric approach to measure TFP change in Indian banks, it is pertinent to ascertain whether their conclusions would still hold using the index number approach.

The index number approach incorporates the following three alternatives: the Fischer Index, the Tornqvist Index, and the Malmquist Index (see Coelli et al., 1998). However, the Malmquist approach has a number of advantages compared to the other two methods (see, Grifell-Tatje and Lovell, 1996). First, unlike the Tornqvist and Fischer indices, the Malmquist Index does not require a behavioural assumption, such as cost minimisation or profit maximisation. Second, in contrast to the Tornqvist and Fischer indices, the Malmquist index can also be calculated without any information on the prices of inputs and outputs. Finally, provided that panel data are available, the Malmquist Index provides a decomposition of productivity change into technical change and efficiency change, and thereby offers an insight into the potential sources of change in TFP. This is important because efficiency change reveals whether a firm is moving closer to or further away from the best practice frontier in a particular industry, and technological change shows whether the best practice frontier (or technology) to which a firm is being compared is either improving, static or deteriorating. This is particularly relevant to developing countries, like India and Pakistan, where the banking industry is expected to enhance its technological level by adopting new financial products (e.g. credit cards) and financial technology (e.g. Automated Teller Machines) already in use in developed countries. The decomposition of total factor productivity into efficiency change and technical change will, therefore, allow us to determine whether the productivity of commercial banks in India and Pakistan is improving either because of a more efficient utilisation of resources or because of more investment in new technology (or a combination of both).

The Malmquist TFP index is defined using distance functions, which enable us to describe a multi-input, multi-output production technology without the need to specify a behavioural objective (such as cost-minimisation or profit maximisation) (see Shephard, 1970; Coelli et al. 1998, p. 62-64). One may specify input distance function or output distance function. An input distance function characterises the production technology by looking at a minimal proportional contraction of input vector, given an output vector. An output distance function considers a maximal proportional expansion of output vector, given an input vector.

We utilise the concept of output distance function. Let us assume that the production $P^t(x)$ can be defined by:

$$P^t(x) = \{(x, y) : y \text{ can be produced from } x\}$$

The output distance function for a given output vector, y, an input vector, x, for period t technology is defined as:

$$D_o{}^t(x, y) = \min\{\delta : (y/\delta, x) \in P^t(x)\} \tag{5.6}$$

where $P^t(x)$ is the production possibility set. The distance here represents the smallest factor, δ, by which output needs to be deflated so as to be feasible with the given input vector, x, under period t technology. The distance function takes a value equal to or less than unity if the output vector, y, is an element of the feasible production set, $P(x)$. Using this definition of distance function, the Malmquist TFP index measures the TFP change between two data points by calculating the ratio of the distance of each point relative to a common technology. Following Färe et al. (1994), the output-oriented Malmquist TFP change index, M_o, between two time period s (the base or initial period) and t is defined as:

$$M_o(y_s, x_s, y_t, x_t) = \left[\frac{D_o^s(y_t, x_t)}{D_o^s(y_s, x_s)} \times \frac{D_o^t(y_t, x_t)}{D_o^t(y_s, x_s)}\right]^{1/2} \quad (5.7)$$

where $D_o^s(y_t, x_t)$ represents the distance from the period t observation to the period s (the base period) technology, while $D_o^s(y_s, x_s)$ represents the distance from the period s observation to the period s technology. A value of M_o greater than 1 will indicate a TFP growth from period s to period t while a value less than 1 indicates a TFP decline relative to the base period s. The above equation is the geometric mean of TFP indices, the first evaluated with respect to period s technology and the second with respect to period t technology. This geometric mean could be written as:

$$M_o(y_s, x_s, y_t, x_t) = \frac{D_o^t(y_t, x_t)}{D_o^s(y_s, x_s)} \left[\frac{D_o^s(y_t, x_t)}{D_o^t(y_t, x_t)} \times \frac{D_o^s(y_s, x_s)}{D_o^t(y_s, x_s)}\right]^{1/2} \quad (5.8)$$

where the ratio outside the square brackets measures the change in the output oriented measure of Farrell's technical efficiency between periods s and t. That is, the efficient change is equivalent to the ratio of the Farrell technical efficiency in period t to the Farrell technical efficiency in the period s. The remaining part of the above equation is the geometric mean of the shift in technology between the two periods. Therefore, the decomposition of TFP change in the above equation into its two components, i.e. efficiency change and technical change, is:

$$\textit{Efficiency change} \quad = \quad \frac{D_o^t(y_t, x_t)}{D_o^s(y_s, x_s)} \qquad (5.9)$$

and

$$\textit{Technical chnage} \quad = \quad \left[\frac{D_o^s(y_t, x_t)}{D_o^t(y_t, x_t)} \times \frac{D_o^s(y_s, x_s)}{D_o^t(y_s, x_s)}\right]^{1/2} \qquad (5.10)$$

Following Färe et al (1994), and numerous studies following them, we employ the DEA to measure the distance functions required to calculate various components of TFP change during two time periods. Färe et al (1994) assume constant returns to scale technology in the analysis. Following the notations used above to explain the DEA, the linear programming (LP) problems for the distance functions are (see Coelli et al., 1998, p. 227):

$$\begin{aligned} &[D_o^t(y_t, x_t)]^{-1} = \max_{\phi,\lambda} \phi \\ &\quad \textit{subject to} \\ &\quad\quad -\phi y_{it} + Y_t\lambda \geq 0, \\ &\quad\quad x_{it} - X_t\lambda \geq 0, \\ &\quad\quad \lambda \geq 0 \end{aligned} \qquad (5.11)$$

$$\begin{aligned} &[D_o^s(y_s, x_s)]^{-1} = \max_{\phi,\lambda} \phi \\ &\quad \textit{subject to} \\ &\quad\quad -\phi y_{is} + Y_s\lambda \geq 0, \\ &\quad\quad x_{is} - X_s\lambda \geq 0, \\ &\quad\quad \lambda \geq 0 \end{aligned} \qquad (5.12)$$

$$
\begin{aligned}
&[D_o^t(y_s, x_s)]^{-1} = \max_{\phi,\lambda} \phi \\
&\quad subject \quad to \\
&\qquad -\phi y_{is} + Y_t\lambda \geq 0, \\
&\qquad x_{is} - X_t\lambda \geq 0, \\
&\qquad \lambda \geq 0
\end{aligned}
\tag{5.13}
$$

$$
\begin{aligned}
&[D_o^s(y_t, x_t)]^{-1} = \max_{\phi,\lambda} \phi \\
&\quad subject \quad to \\
&\qquad -\phi y_{it} + Y_s\lambda \geq 0, \\
&\qquad x_{it} - X_s\lambda \geq 0, \\
&\qquad \lambda \geq 0
\end{aligned}
\tag{5.14}
$$

Like the basic DEA model, the measurement of TFP change can be carried out by relaxing the CRS assumption. This enables one to decompose the technical efficiency change into its two components, namely 'pure technical efficiency change' and 'scale efficiency change' between the time period ***s*** and ***t***. This requires the solution of two additional LPs that involves repeating LPs 5.11 and 5.12 with the convexity restriction N1`λ=1.

5.2.3 – Input output specification

As is apparent from the above discussion, the calculation of efficiency and TFP change using the DEA requires data on inputs and outputs of firms in question. As highlighted in chapter 3, there is no consensus on a precise specification of inputs and outputs of banking firms. Therefore, as measurement of efficiency is usually sensitive to the way inputs and outputs are specified (see Berger and Humphrey, 1997; Molyneux et al., 2001; Sathye, 2001), our analysis is based on two alternative input-output models, which have been used by the recent empirical studies on the efficiency of banks in developing countries (see, for example, Leightner and Lovell, 1998). In

Model A (loan-based model), we postulate that banks incur operating and interest expenses to produce loans and advances, and investments. In Model B (Income-based model), banks incur operating and interest expenses to produce interest and non-interest income[6].

Following Leightner and Lovell (1998), we argue that these two models represent two alternative, and sometimes conflicting, objectives of banks in developing countries. On one hand, as governments in developing countries play an explicit role in deciding banks' asset portfolio through state-directed credit policies, Model A postulates that banks seek to mobilise financial resources to fund borrowers, including those in the so-called priority sectors. Model B, on the other hand, could represent the profit maximisation objective of banks (see Leightner and Lovell, 1998). The specification of these two input-output models also reiterates the key assertion of the behavioural theory of the firm that firms' objective is influenced by various economic agents. According to Model A, government is a key agent in determining the objective of banks in India and Pakistan.

It should be noted that the outputs in the two models are inter-related as banks' income (i.e. an output in Model B) depends largely on loans and advances (including priority sector lending), and investments (i.e. outputs in Model A) generated by banks. This is especially the case for commercial banks in developing countries where, unlike in developed countries, fee income is insignificant, and banks rely on traditional loans and government securities for their income generation. However, if governments see

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[6] We did not include deposits as an input because, following Leightner and Lovell (1998), we believe that deposits are a function of the two inputs that we did include (i.e. interest expenses and operating expenses).

banks as institutions to promote socially equitable economic growth (like during the era of financial repression), then banks are forced to pursue the objective outlined in Model A (especially by extending credit to priority sectors like agriculture) even if it leads to a failure in pursuing the objective outlined in Model B.

Another reason for a divergence between the efficiency according to the two models could be the presence of high non-performing loans in banks' asset portfolios. Due to high non-performing loans, efficiency in generating loans (Model A) may not always translate into efficiency in generating income (Model B). These two complementary models, therefore, could enable us to investigate, *to some extent*, the impact of non-performing loans on variations in the efficiency of the commercial banking industry in India and Pakistan. The impact of non-performing loans could be more appropriately analysed by explicitly including such loans in the specified input-output models (see Berger and Humphrey, 1997; Drake and Hall, 2003). However, at the time of this study, data on non-performing loans were not available for individual banks operating in India and Pakistan.

5.2.4 – Data

Our analysis covers the period from 1990 to 1998, a period characterised by changes brought about by the ESRs, particularly the financial liberalisation programme. We assume that the period 1990-1992 represents the pre-liberalisation era. We have excluded the period after 1998 because of the lack of availability of data, and because of the fact that the nuclear experimentation in both the countries in 1998 disrupted the ESRs as severe economic and financial restrictions were imposed on both the countries, especially on Pakistan, by the international community, including institutions like the World Bank and the IMF that were the main sponsors of the ESRs.

In the case of both the countries, the commercial banks included in our sample control more than 90% of total assets, deposits, and loans of the commercial banking industry. Data for commercial banks in Pakistan are obtained from various issues of the *Banking Statistics of Pakistan* published annually by the State Bank of Pakistan[7]. In the case of India, data from 1990 to 1998 are obtained from the recently uploaded data set on the website of the Reserve Bank of India[8]. Banks having zero recorded values for one or more outputs or inputs variables in any year are excluded from the sample for that year in recognition of the fact that the DEA is sensitive to outliers (see Yildirim, 2002, p. 2294). All data are converted into 1992 prices using the GDP deflator, which is obtained from World Development Indicators 2003. Appendix 5 provides descriptive statistics for inputs and outputs, and the number of banks included for each year during 1990 to 1998.

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[7] In case of Pakistan, data were not available in electronic format. Therefore, converting data into a spreadsheet format consumed a considerable amount of time. Also, there were many problems with the data provided in the Banking Statistics of Pakistan. For example, in many cases, asset and liability side did not match. The author tried his best to consult members of staff at the SBP to rectify problems where possible before performing the DEA.

[8] Data could be obtained from Bankscope. However, Bankscope does not provide data on all foreign banks present in India and Pakistan. This may question the conclusion of some recent influential studies (e.g. Claessens et al., 2001) that seek to examine the effect of foreign banks' entry on the domestic banking industry using data from Bankscope.

5.3 – The technical efficiency of banks in India and Pakistan

5.3.1 – The technical efficiency of banks using DEA

This section reports the DEA efficiency for commercial banks in India and Pakistan during 1990-1998, calculated for the two alternative input-output models using both the CRS and VRS assumptions. The empirical studies on bank efficiency either construct annual frontiers using input-output data for each single year in the sample (see, for example, Yildirim, 2002) or construct the so-called grand-frontier by pooling input-output data for all years in the sample (see, for example, Bhattacharyya et al., 1997). The analysis in this chapter is based on annual frontiers. The grand-frontier technique will be used in chapter 6.

Our primary objective in this section is to examine whether the technical efficiency of banks in India and Pakistan improved after the implementation of the financial liberalisation programme in 1991-92, which endeavoured to enhance the level of competition and private sector participation in the banking industry and reduce government interventions in deciding the price and direction of financial resources mobilised by commercial banks (i.e. through state-directed credit policies). Also, we seek to examine whether public sector banks are less or more efficient than private sector banks.

Table 5.1 and Table 5.2 present the average overall technical efficiency (OTE), and its two constituents, for the whole banking industry in India and Pakistan, respectively, for the period 1990 to 1998. The results show that the banking industry in both the countries exhibits very low OTE, and witnessed little improvement at least until 1995. In both the countries, especially in Pakistan, the major source of low OTE was low

SE, which has not been examined by the existing empirical studies on the banking industry in India and Pakistan. The low level of SE could be attributed to governments' restrictions on private banks to extend their operations, and governments' direction to public sector banks to extend their branch network to rural and sub-urban areas. The limited improvement in OTE until 1995 may suggest that banks reacted slowly to the relatively more liberalised and competitive environment during the post-ESRs period (see also, Bhattacharyya et al., 1997). In the case of India, this finding is consistent with that of Kumbhakar and Sarkar (2003) who analysed the productivity change of Indian domestic banks during 1986-1996.

The average OTE of the Indian banking industry improved from 68.6% (Model A) and 59.8% (Model B) in the pre-liberalisation period (i.e. 1990-1992) to 80.1% (Model A) and 68.8% (Model B) in the post-liberalisation period (i.e. 1996-1998). In Pakistan, the OTE of the banking industry increased from 39.9% (Model A) and 48.6% (Model B) in the pre-liberalisation period to 51.2% (Model A) and 64.8% (Model B) in the post-liberalisation period. So, in both the countries, the average improvement in OTE was around 11%. Following Casu and Molyneux (2003), the non-parametric Mann-Whitney test[9] is used to test whether there is a difference between the efficiency of banks in the pre-liberalisation (i.e. 1990-1992) and post-liberalisation period (1996-1998). According to the results of the test for both India and Pakistan (for both input-output models), the null hypothesis that the two populations (i.e. efficiency of banks in the pre-ESRs and post-ESRs period) are statistically same was rejected at 99% confidence level.

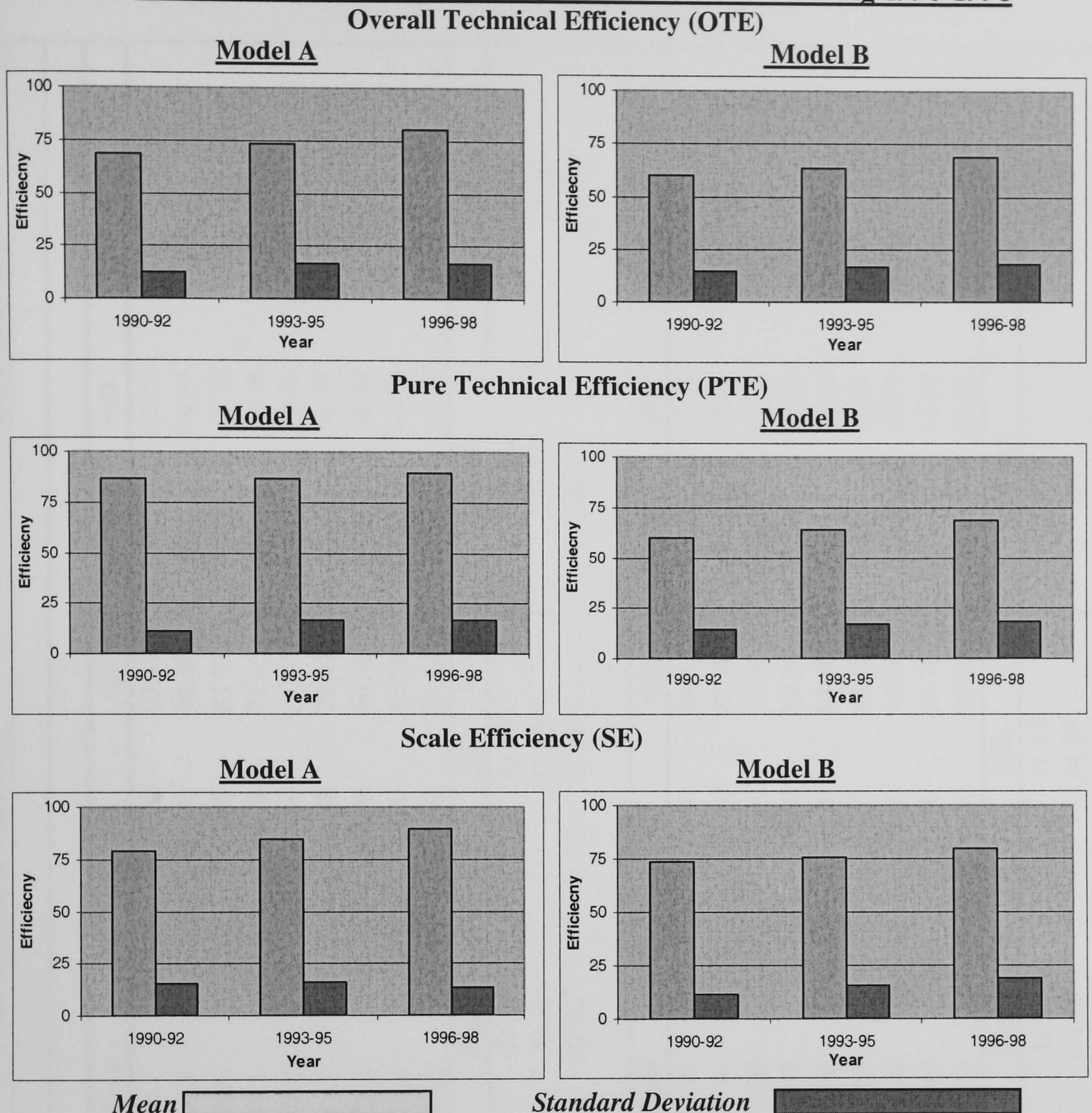
[9] See Anderson et al. (2002)

Table 5.1 – Technical efficiency of banks in India during 1990-98 (All Banks)

	CRS Technical Efficiency				Efficiency Decomposition: Pure Technical Efficiency				Efficiency Decomposition: Scale Efficiency			
Model A (Loan-based model)												
	Mean	StD.	Q1	Q3	Mean	StD.	Q1	Q3	Mean	StD.	Q1	Q3
1990	70.20	11.23	67.70	78.10	87.20	9.10	81.40	96.50	80.40	13.40	77.11	94.15
1991	67.00	11.54	63.80	77.30	84.80	10.30	80.60	97.30	78.80	15.20	74.15	94.95
1992	68.70	13.95	64.30	80.50	88.30	13.95	83.10	95.30	77.60	17.60	71.82	94.04
1993	71.00	10.98	69.10	80.35	88.30	10.98	81.30	95.50	80.30	16.20	74.52	96.59
1994	70.50	16.13	68.10	79.80	83.10	16.13	79.20	92.10	85.00	14.60	78.22	91.20
1995	79.10	22.45	66.90	83.10	88.60	22.45	82.60	93.70	89.40	16.90	82.62	92.80
1996	80.40	15.85	73.10	85.40	88.80	15.85	81.40	94.80	90.60	13.30	85.82	93.90
1997	78.00	16.77	65.40	87.50	88.40	16.77	83.10	92.30	88.30	14.70	83.52	91.22
1998	82.10	16.83	74.80	86.80	91.40	16.83	85.60	94.50	89.80	11.30	85.98	93.42
	Mean		StD.		Mean		StD.		Mean		StD.	
1990-92	*68.63*		*12.24*		*86.77*		*11.12*		*78.93*		*15.40*	
1993-95	*73.53*		*16.52*		*86.67*		*16.52*		*84.90*		*15.90*	
1996-98	*80.17**		*16.48*		*89.53**		*16.48*		*89.57**		*13.10*	
Model B (Income-based model)												
	Mean	StD.	Q1	Q3	Mean	StD.	Q1	Q3	Mean	StD.	Q1	Q3
1990	59.30	13.90	56.30	66.39	81.40	11.60	75.90	81.40	72.90	9.70	67.10	76.51
1991	60.60	13.20	55.30	69.50	81.80	9.30	74.20	79.60	74.10	10.80	69.80	74.21
1992	59.60	15.49	53.08	69.21	81.10	13.02	73.60	79.10	73.50	13.30	68.33	73.01
1993	60.50	15.44	52.75	68.20	82.60	12.41	75.40	89.90	73.40	12.98	67.87	84.11
1994	62.60	16.07	55.20	67.10	83.70	14.26	73.60	91.20	75.00	16.34	69.47	82.34
1995	67.90	19.01	54.30	63.74	86.40	17.67	73.47	94.50	78.50	16.60	73.96	85.44
1996	65.60	18.30	59.70	67.31	84.70	16.42	75.80	95.80	77.90	18.34	73.36	85.69
1997	69.40	18.68	61.30	71.96	86.70	14.82	72.00	94.00	80.30	19.30	76.08	81.60
1998	71.60	17.67	66.60	73.70	87.80	13.44	72.90	95.30	81.60	18.70	77.38	83.40
	Mean		StD.		Mean		StD.		Mean		StD.	
1990-92	*59.83*		*14.20*		*81.43*		*11.31*		*73.50*		*11.27*	
1993-95	*63.67*		*16.84*		*84.23*		*14.78*		*75.63*		*15.31*	
1996-98	*68.87**		*18.22*		*86.40**		*14.89*		*79.93**		*18.78*	

StD. = Standard deviation; Q1= Quartile 1; Q3= Quartile 3
* represent Mann-Whitney test that rejects null hypothesis at 1% significance level

Figure 5.3 – Technical efficiency of banks in India during 1990-1998



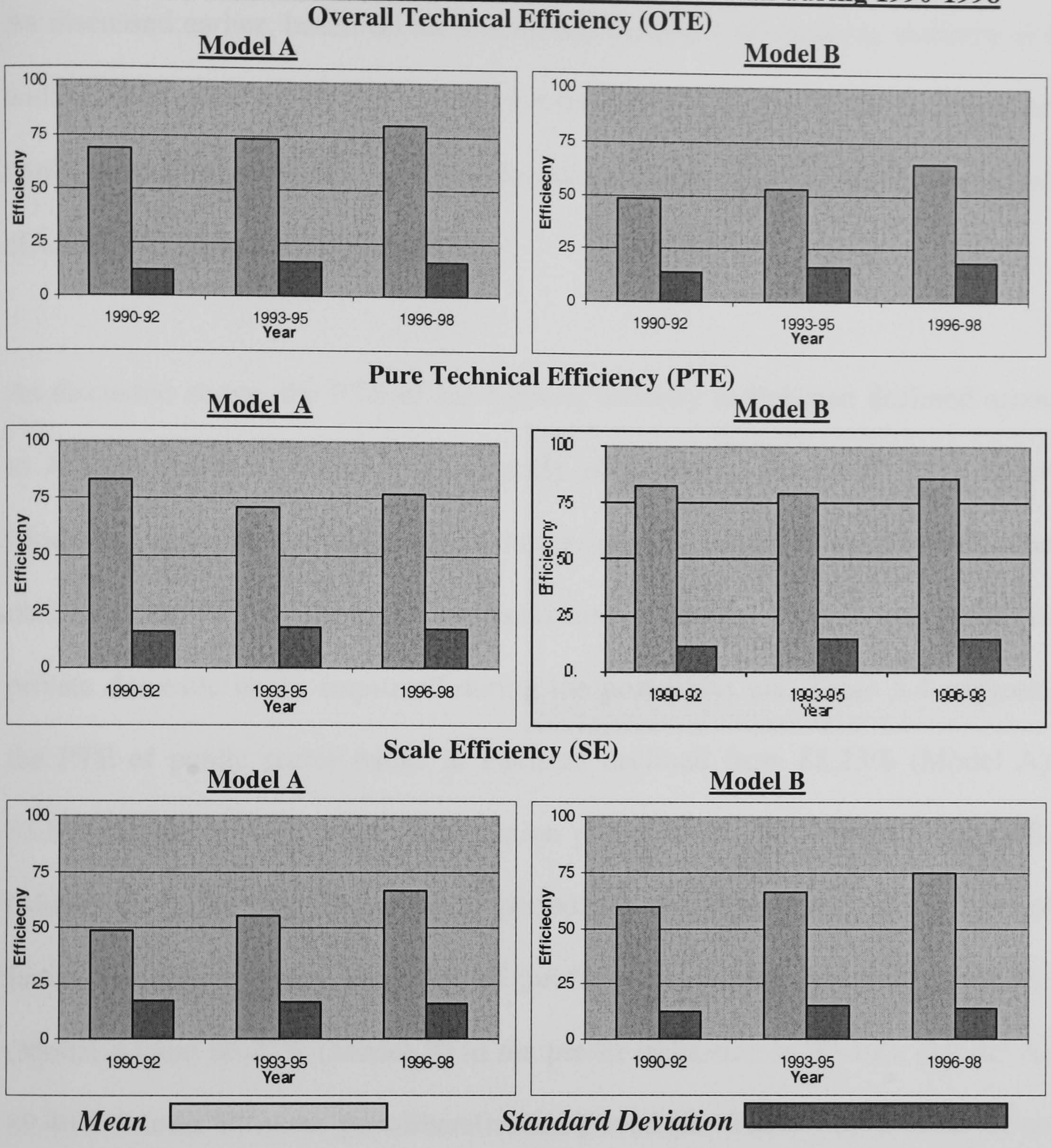
In India, the improvement in the OTE was due to improvement in both PTE and SE (see Table 5.1). The average PTE of the Indian banking industry improved from 86.77% (Model A) and 81.43% (Model B) in the pre-liberalisation period (i.e. 1990-1992) to 89.53% (Model A) and 86.40% (Model B) in the post-liberalisation period (i.e. 1996-1998). At the same time, SE in Model A and Model B improved by at least 10.6% and 6.4%, respectively. The improvement in SE in the Indian banking industry was less than in Pakistani industry perhaps because the Indian government was more cautious in allowing banks to reduce their staff and to close unprofitable branches.

Table 5.2 – Technical efficiency of banks in Pakistan during 1990-98 (All Banks)

	CRS Technical Efficiency				Efficiency Decomposition							
					Pure Technical Efficiency				Scale Efficiency			
Model A (Loan-based model)												
	Mean	StD.	Q1	Q3	Mean	StD.	Q1	Q3	Mean	StD.	Q1	Q3
1990	35.6	15.3	32.11	42.51	86.7	15.217	83.90	92.39	41.2	17.20	36.91	56.95
1991	40.2	13.61	36.88	50.82	86.9	14.360	81.70	94.40	46.4	19.35	39.75	59.55
1992	44.1	16.9	40.06	54.91	76.0	17.937	71.80	83.35	59.4	16.35	52.62	71.84
1993	35.9	13.54	33.01	45.01	68.1	14.967	63.10	75.65	54.9	17.36	49.12	69.19
1994	37.6	16.12	35.08	47.89	74.8	20.117	69.90	81.80	53.2	15.98	46.42	59.40
1995	39.9	15.75	28.06	43.22	71.3	18.326	65.30	79.47	57.8	16.47	52.02	61.20
1996	42.4	14.84	34.11	48.39	73.3	17.970	67.90	80.36	58.4	14.79	53.62	63.70
1997	53.9	13.78	41.18	64.39	77.9	18.360	73.60	85.88	69.6	15.74	63.82	72.52
1998	57.4	14.65	50.46	63.09	80.1	16.340	75.30	86.84	71.9	16.78	66.08	76.52
	Mean		StD.		Mean		StD.		Mean		StD.	
1990-92	*39.97*		*15.27*		*83.20*		*15.84*		*49.00*		*17.63*	
1993-95	*37.80*		*15.14*		*71.40*		*17.80*		*55.30*		*16.60*	
1996-98	*51.23**		*14.42*		*77.10**		*17.56*		*66.63**		*15.77*	
Model B (Income-based model)												
	Mean	StD.	Q1	Q3	Mean	StD.	Q1	Q3	Mean	StD.	Q1	Q3
1990	46.00	13.90	43.00	53.09	84.30	11.60	78.80	84.30	54.90	13.50	49.40	61.90
1991	47.40	13.20	42.10	56.30	84.50	9.30	76.90	82.30	56.70	12.70	49.10	54.50
1992	52.60	15.49	46.08	62.21	78.50	13.02	71.00	76.50	66.80	11.56	59.30	69.80
1993	52.80	15.44	45.05	60.50	82.00	12.41	74.80	89.30	64.00	13.96	56.80	71.30
1994	48.40	16.07	41.00	52.90	76.80	14.26	66.70	84.30	63.00	15.81	52.90	70.50
1995	56.90	19.01	43.30	52.74	79.30	17.67	66.37	87.40	71.90	15.22	58.97	80.00
1996	63.80	18.30	57.90	65.51	84.90	16.42	76.00	96.00	73.60	13.97	64.70	84.70
1997	64.40	18.68	56.30	66.96	86.40	14.82	71.70	93.70	73.80	14.37	59.10	81.10
1998	65.60	17.67	60.60	67.70	85.20	13.44	70.30	92.70	76.20	12.98	61.30	83.70
	Mean		StD.		Mean		StD.		Mean		StD.	
1990-92	*48.67*		*14.20*		*83.43*		*11.31*		*59.47*		*12.59*	
1993-95	*52.70*		*16.84*		*79.37*		*14.78*		*66.30*		*14.99*	
1996-98	*64.60**		*18.22*		*84.50**		*14.89*		*74.53**		*13.77*	

StD. = Standard deviation; Q1= Quartile 1; Q3= Quartile 3
* represent Mann-Whitney test that rejects null hypothesis at 1% significance level

Figure 5.4 – Technical efficiency of banks in Pakistan during 1990-1998



In contrast with the Indian banking industry, the improvement in the OTE of the banking industry in Pakistan was due mainly to improvement in SE. The SE of banks in Pakistan improved considerably after 1995-1996 when the government allowed public sector banks to reduce the number of employees and close unprofitable branches in rural areas. On the other hand, the Model A PTE of the banking industry declined from 83.20% in the pre-liberalisation period to 77.1%, while Model B PTE improved marginally from 83.43% to 84.50 in the post-liberalisation period.

5.3.2 – The technical efficiency of public, domestic private, and foreign banks

As discussed earlier, based on the ownership structure, the banking industry in India and Pakistan could be divided into three groups: public sector banks, domestic private banks, and foreign banks. This section sheds some light on the evolution of the efficiency of these three groups.

As discussed above, the PTE of the banking industry in Pakistan declined according to Model A and improved insignificantly according to Model B. This decline in Model A and the lack of a significant improvement in Model B was primarily due to a decline in the PTE of public sector banks even when the PTE of foreign banks and private domestic banks improved during the post-ESRs era. Table 5.4 suggests that the PTE of public sector banks in Pakistan declined from 88.23% (Model A) and 83.8% (Model B) in the pre-liberalisation period to 76.3% (Model A) and 78.87% (Model B) in the post-liberalisation period. On the other hand, in the case of the Indian banking industry, the PTE of public sector banks improved from 91.90% (Model A) and 83.27% (Model B) in the pre-liberalisation to 93.70% (Model A) and 89.40% (Model B) in the post-liberalisation period (see Table 5.3). It could be argued that, unlike in India, the financial liberalisation process in Pakistan failed to encourage the managers of public sector banks to enhance their utilisation of operating and interest expenses to generate an optimal quantity of earning assets (i.e. loans and advances, and investments) and income. This could be due to the fact that although both the countries followed a similar financial liberalisation programme to enhance the efficiency of large public sector banks, the economic environment in Pakistan was marred by high political instability during the 1990s (see Zaidi, 1999). This high political instability could have undermined the Pakistani government's commitment to the liberalisation process, and, therefore, failed to encourage public sector banks to enhance their resource utilisation. In contrast with the public sector banks, private sector banks, especially foreign banks, in both the countries witnessed improvements in both PTE and SE for almost all the years.

Another possible reason for the lack of improvement in the efficiency of Pakistani public sector banks could be the high level of non-performing loans that these financial institutions inherited at the start of the financial liberalisation programme (see chapter 4). The presence of the high level of non-performing loans could have hindered large public sector banks' ability to adapt themselves quickly to the changes brought about by the ESRs in general, and the financial liberalisation programme in particular.

Following Kumbhakar and Sarkar (2003), another reason for the slow improvement (or the lack of improvement) in the efficiency of public sector banks relative to their private sector counterparts could be that this group had become too dominant (controlling around 88% of the assets of the banking industry) to feel any need to quickly transform itself in the face of competition from smaller foreign and private domestic banks.

Table 5.3 - Technical Efficiency of Commercial Banks in India according to the three Ownership Groups

Loan-based model (Model A)

		1990	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1990-92*		*1993-95*		*1996-98*	
OTE	***PSBs***	75.50	75.50	78.30	76.90	73.70	79.50	80.40	82.70	83.20	76.43	*7.20*	76.70	*6.10*	82.10*	*6.70*
	DPBs	67.90	61.70	67.20	61.90	68.10	75.80	74.70	76.10	79.50	65.60	*20.00*	68.60	*17.80*	76.77*	*24.40*
	FBs	67.20	63.70	60.60	74.20	69.70	82.10	86.10	75.10	83.40	63.83	*7.70*	75.33	*8.80*	81.53*	*13.90*
PTE	***PSBs***	93.00	90.60	92.10	91.90	90.30	92.50	92.80	93.50	94.80	91.90	*8.50*	91.57	*8.10*	93.70	*6.70*
	DPBs	85.20	80.90	89.80	85.00	76.60	87.30	82.50	82.70	87.20	85.30	*17.00*	82.97	*15.80*	84.13	*21.20*
	FBs	83.50	82.70	83.00	87.90	82.50	85.90	91.10	89.00	92.20	83.07	*11.20*	85.43	*10.40*	90.77*	*14.00*
SE	***PSBs***	81.20	83.30	85.00	83.70	81.60	85.90	86.60	88.50	87.80	83.17	*7.70*	83.73	*6.50*	87.63*	*4.90*
	DPBs	79.60	76.20	74.80	72.80	88.90	86.80	90.60	92.00	91.20	76.87	*10.80*	82.83	*9.20*	91.27*	*18.20*
	FBs	80.50	77.00	73.00	84.40	84.50	95.60	94.50	84.40	90.50	76.83	*8.10*	88.17	*7.40*	89.80	*9.10*

Income-based model (Model B)

		1990	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1990-92*		*1993-95*		*1996-98*	
OTE	***PSBs***	52.50	53.80	57.20	52.00	54.30	57.10	54.60	60.80	66.20	54.50	*7.40*	54.47	*6.10*	60.53*	*5.40*
	DPBs	58.30	61.20	57.70	61.60	64.70	64.40	70.70	70.80	72.20	59.07	*17.30*	63.57	*14.30*	71.23*	*23.00*
	FBs	67.00	66.90	63.80	68.00	68.80	82.30	71.40	76.70	76.50	65.90	*8.40*	73.03	*6.40*	74.87	*14.90*
PTE	***PSBs***	83.50	82.10	84.20	84.30	86.10	87.30	89.10	89.00	90.10	83.27	*12.70*	85.90	*9.70*	89.40*	*7.50*
	DPBs	79.30	80.10	77.60	81.40	79.60	82.30	81.90	85.50	86.00	79.00	*7.80*	81.10	*8.80*	84.47*	*18.90*
	FBs	81.40	83.10	81.40	82.00	85.50	89.60	83.00	85.50	87.40	81.97	*8.50*	85.70	*12.60*	85.30	*14.00*
SE	***PSBs***	62.90	65.50	67.90	61.70	63.10	65.40	61.30	68.30	73.50	65.43	*8.50*	63.40	*5.10*	67.70	*4.10*
	DPBs	73.50	76.30	74.30	75.70	81.30	78.30	86.30	82.80	83.90	74.70	*13.90*	78.43	*12.30*	84.33*	*18.60*
	FBs	82.30	80.50	78.40	82.90	80.50	91.90	86.00	89.70	87.50	80.40	*4.50*	85.10	*8.70*	87.73	*13.00*

PSBs= Public Sector Banks; DPBs= Domestic Private Banks ; Foreign Banks; OTE = Overall Technical Efficiency; PTE = Pure Technical Efficiency; SE= Scale Efficiency; Figures in shaded columns are standard deviations

*** represent Mann-Whitney test that rejects null hypothesis at 1% significance level. This test is used to test whether there is a difference between the efficiency of banks in the pre-liberalisation (i.e. 1990-1992) and post-liberalisation period (1996-1998).**

Table 5.4 - Technical Efficiency of Commercial Banks in Pakistan according to the three Ownership Groups

Loan-based model (Model A)

		1990	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1990-92*		*1993-95*		*1996-98*	
OTE	***PSBs***	34.40	38.40	32.50	28.40	25.50	33.50	41.70	45.70	48.60	35.10	*10.45*	29.13	*9.00*	45.33	*6.50*
	DPBs	n.a.	n.a.	48.20	36.70	42.50	46.40	45.00	55.80	59.70	48.20	*n.a.*	41.87	*n.a.*	53.50	*n.a.*
	FBs	36.80	42.00	51.70	42.50	44.90	39.80	40.40	60.30	63.90	43.50	*14.37*	42.40	*12.40*	54.87	*8.90*
PTE	***PSBs***	91.20	89.50	84.00	78.50	86.10	75.40	74.10	76.70	78.10	88.23	*5.74*	80.00	*5.00*	76.30	*3.60*
	DPBs	n.a.	n.a.	65.30	51.50	56.60	58.50	65.50	70.00	72.60	65.30	*n.a.*	55.53	*n.a.*	69.37	*n.a.*
	FBs	82.10	84.30	78.70	74.30	81.60	79.90	80.20	87.00	89.60	81.70	*19.21*	78.60	*16.60*	85.60	*11.90*
SE	***PSBs***	37.70	43.00	38.60	36.10	29.60	44.40	56.20	59.60	62.20	39.77	*9.34*	36.70	*8.10*	59.33	*5.80*
	DPBs	n.a.	n.a.	73.80	71.30	75.10	79.30	68.70	79.70	82.30	73.80	*n.a.*	75.23	*n.a.*	76.90	*n.a.*
	FBs	44.80	49.80	65.70	57.20	55.00	49.80	50.40	69.30	71.20	53.43	*13.36*	54.00	*11.50*	63.63	*8.30*

Income-based model (Model B)

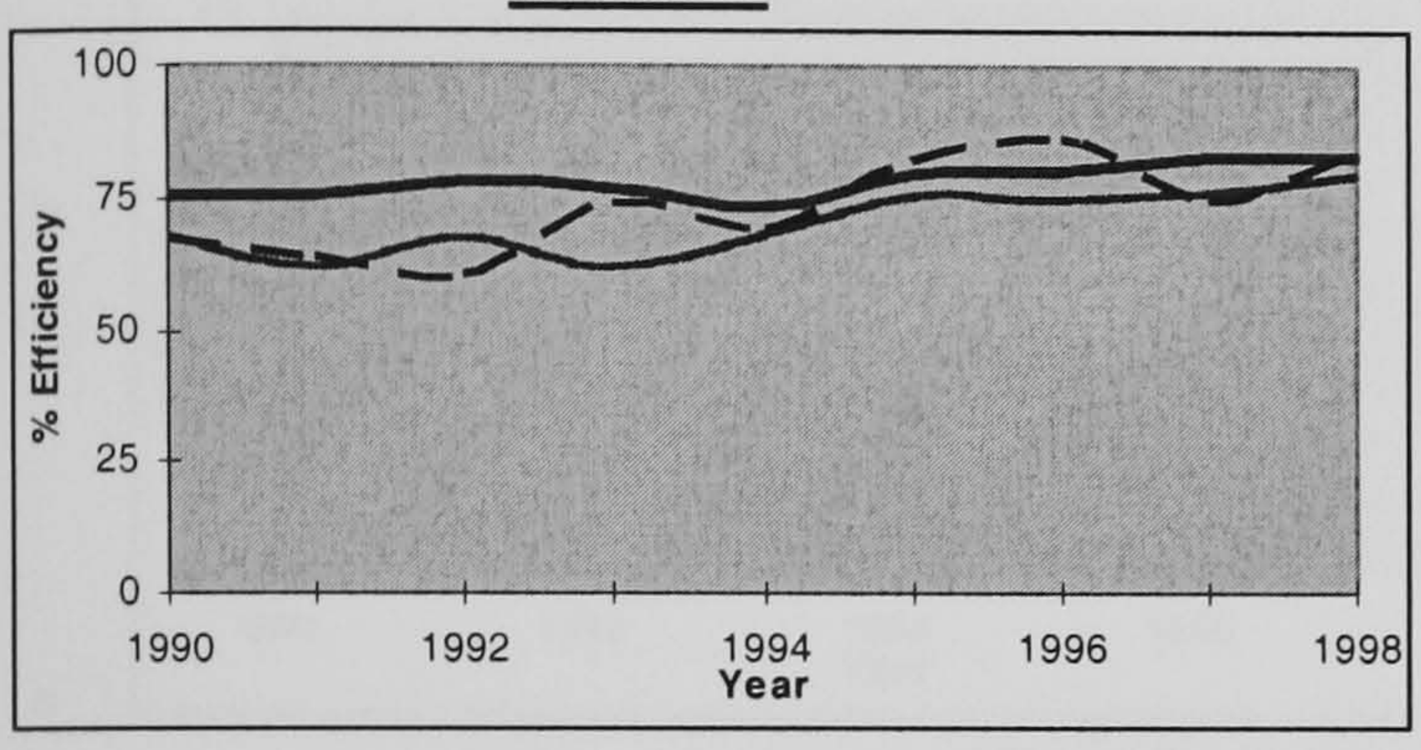
		1990	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1990-92*		*1993-95*		*1996-98*	
OTE	***PSBs***	31.60	37.30	37.40	37.70	37.20	37.30	34.50	35.30	40.90	35.43	*5.20*	37.40	*5.50*	36.90	*4.80*
	DPBs	n.a.	n.a.	61.80	55.20	45.40	60.30	80.90	82.40	79.30	61.80	*n.a.*	53.63	*n.a.*	80.87	*n.a.*
	FBs	60.30	57.50	58.80	65.40	62.60	73.10	75.90	75.50	76.60	58.87	*17.20*	67.03	*18.10*	76.00	*15.60*
PTE	***PSBs***	86.20	88.50	76.70	79.40	79.10	80.50	75.80	81.20	79.60	83.80	*15.60*	79.67	*16.40*	78.87	*14.10*
	DPBs	n.a.	n.a.	80.10	80.30	69.10	72.20	88.90	86.40	87.50	80.10	*n.a.*	73.87	*n.a.*	87.60	*n.a.*
	FBs	82.40	80.60	78.70	86.20	82.10	85.10	89.90	91.50	88.40	80.57	*17.80*	84.47	*18.90*	89.93	*16.20*
SE	***PSBs***	36.60	42.10	48.70	47.50	47.00	46.30	45.50	43.40	51.40	42.47	*19.90*	46.93	*21.00*	46.77	*18.10*
	DPBs	n.a.	n.a.	77.10	68.70	65.70	83.50	91.00	95.40	90.60	77.10	*n.a.*	72.63	*n.a.*	92.33	*n.a.*
	FBs	73.20	71.40	74.70	75.90	76.30	85.90	84.40	82.50	86.60	73.10	*9.10*	79.37	*9.60*	84.50	*8.30*

PSBs= Public Sector Banks; DPBs= Domestic Private Banks ; Foreign Banks; OTE = Overall Technical Efficiency; PTE = Pure Technical Efficiency; SE= Scale Efficiency; Figures in shaded columns are standard deviations; n.a. refers to the time period when domestic private banks were not allowed to operate in Pakistan.

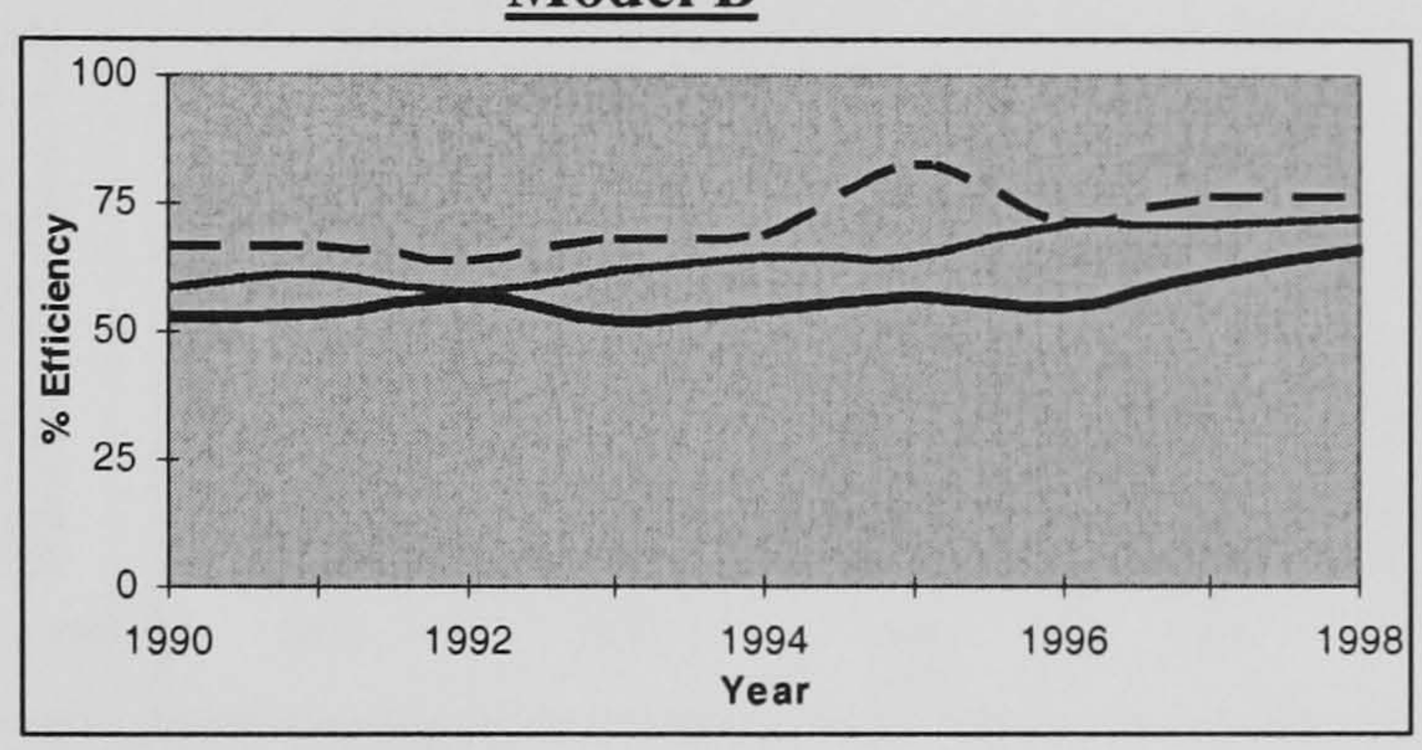
Figure 5.5 – Efficiency of banks in India according to ownership groups

Overall Technical Efficiency (OTE)

Model A

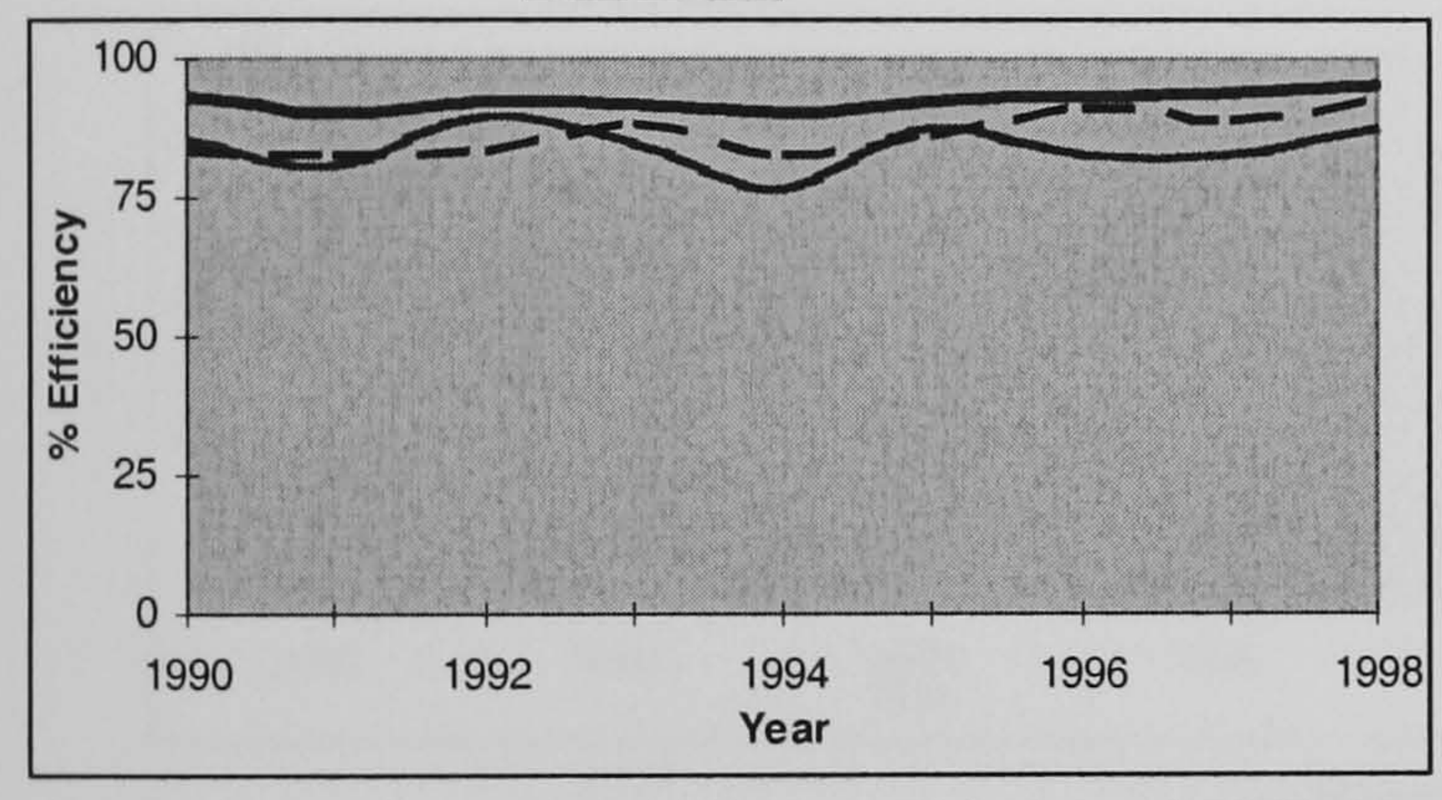


Model B

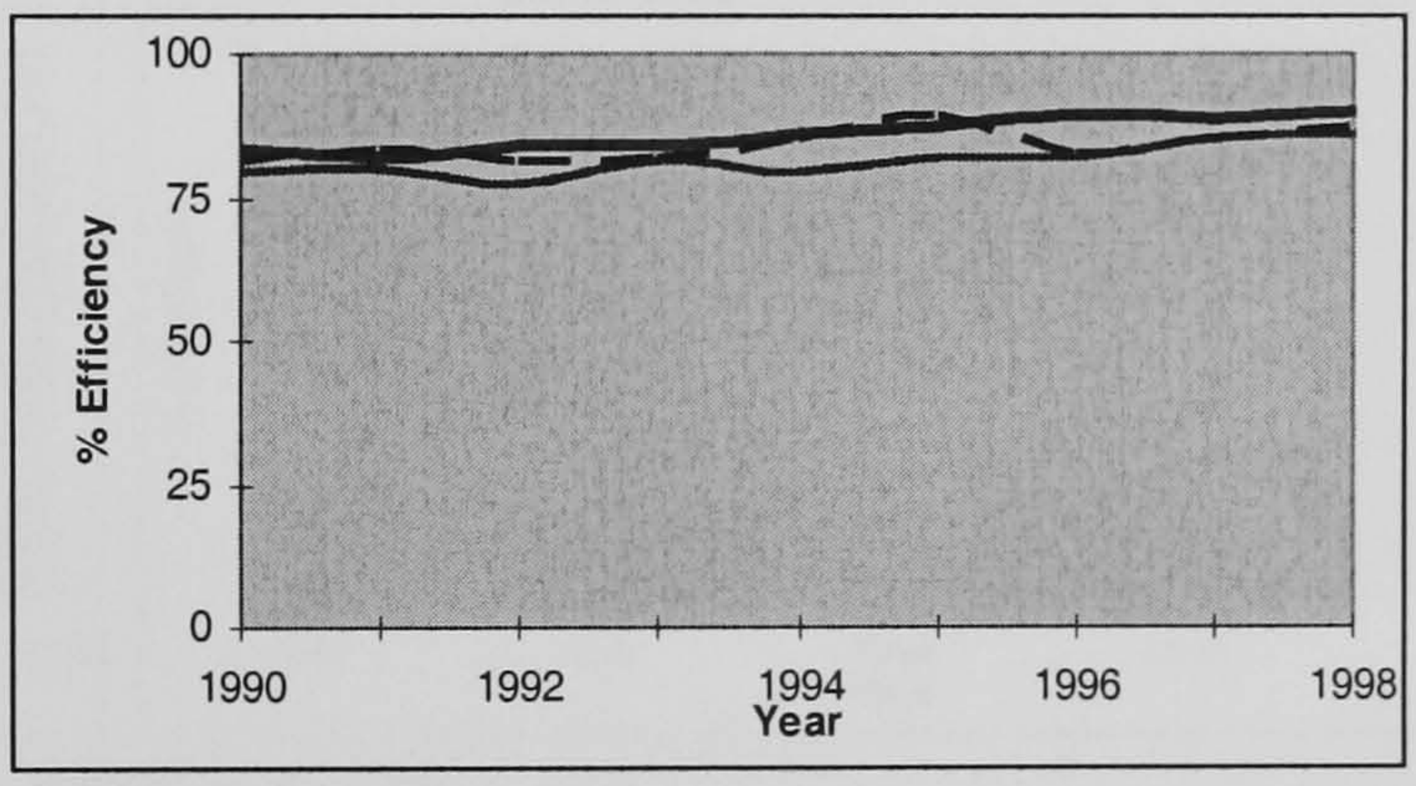


Pure Technical Efficiency (PTE)

Model A

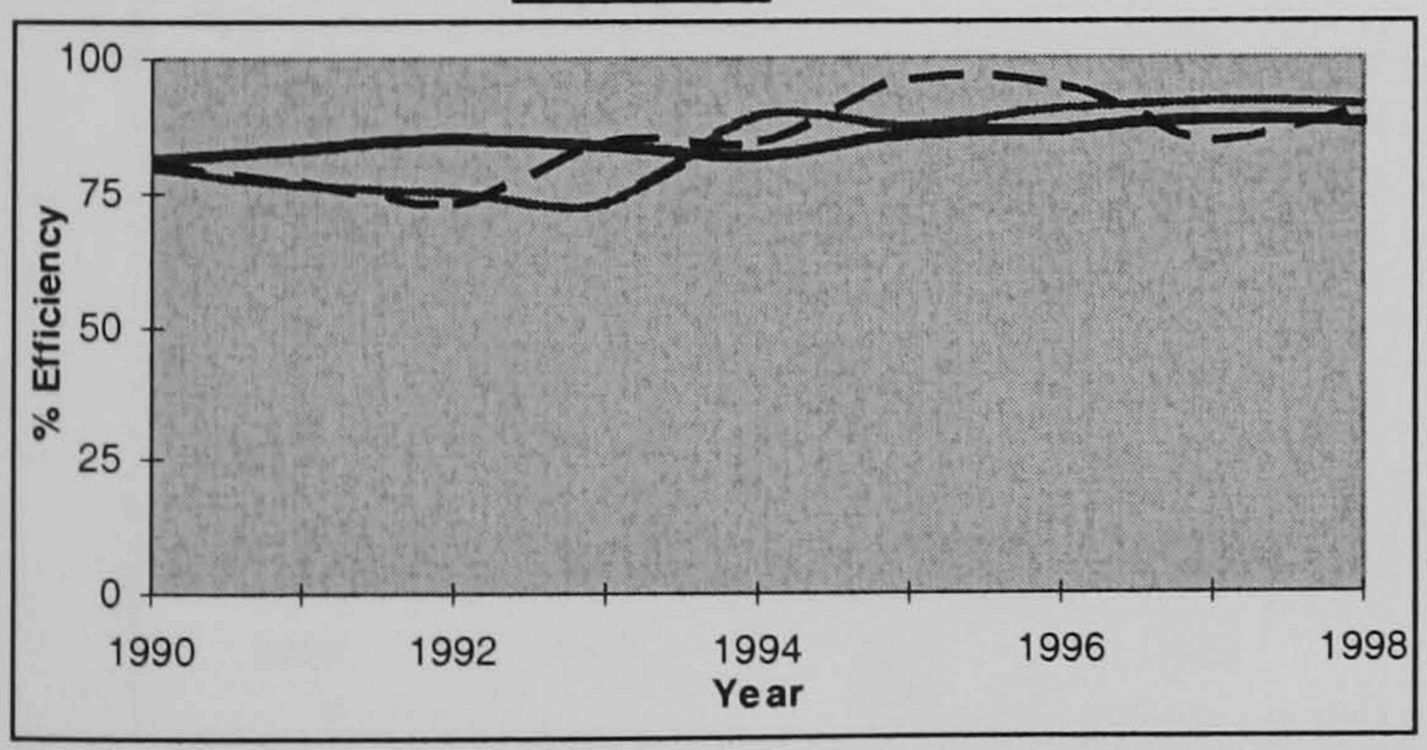


Model B

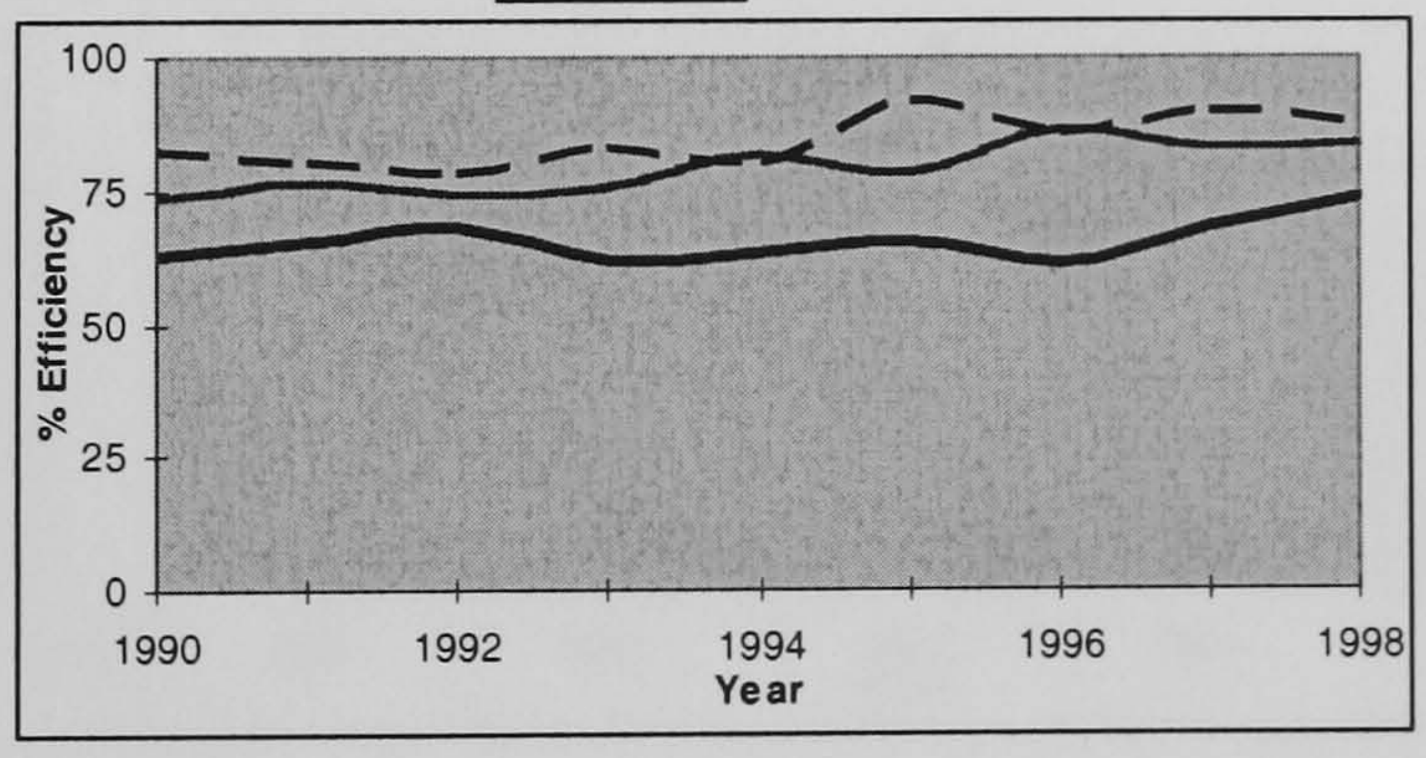


Scale Efficiency (SE)

Model A

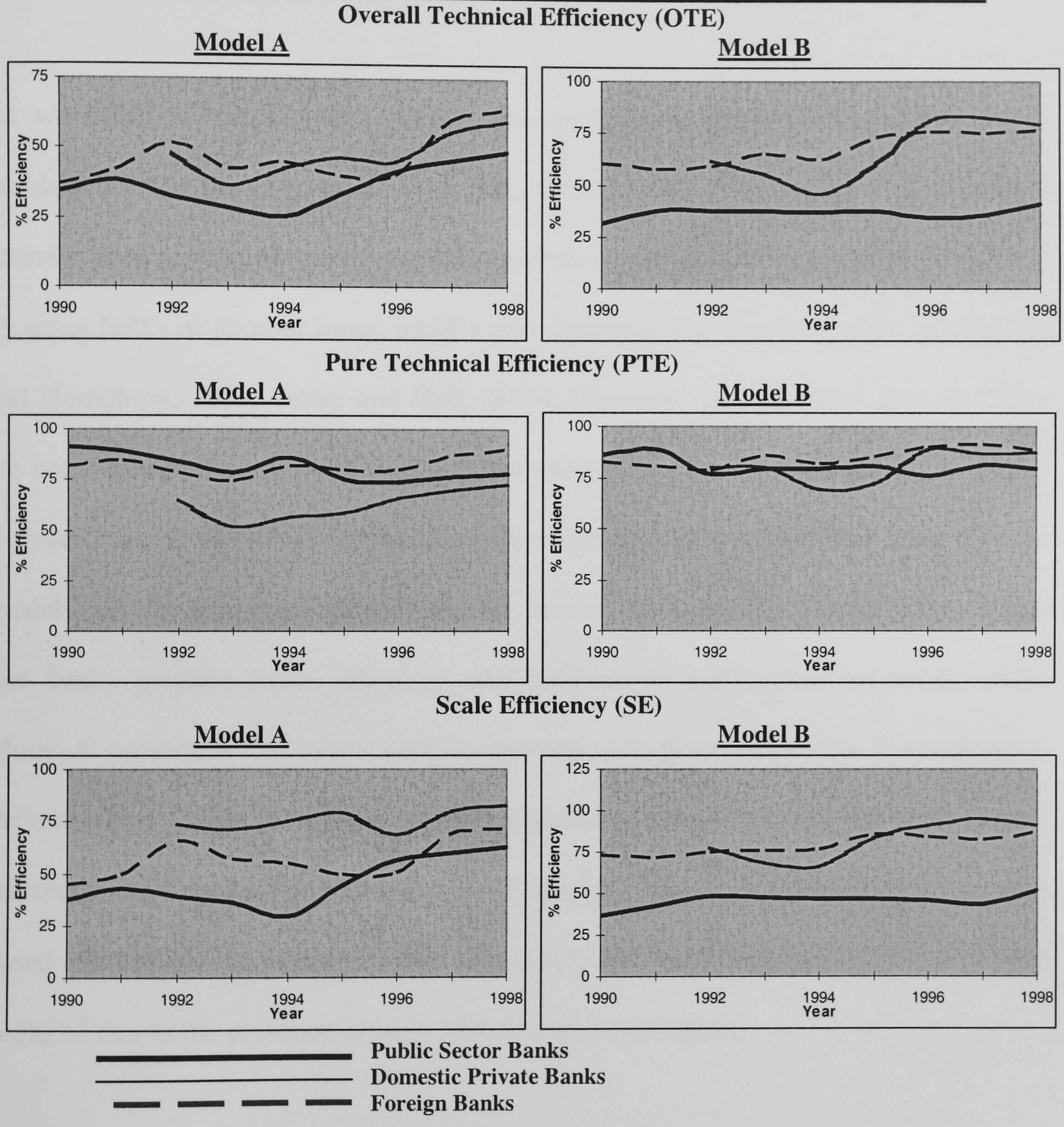


Model B



Public Sector Banks
Domestic Private Banks
Foreign Banks

Figure 5.6 – Efficiency of banks in Pakistan according to ownership groups



It should be noted, however, that after 1995-1996, public sector banks did exhibit more improvement in their efficiency. It could be argued that the liberalisation programme took sometime to increase the level of competition by encouraging private sector banks, especially foreign banks, to adopt new financial technology (e.g. computerisation of bank branches and Automated Teller Machines) and the introduction of new financial products (e.g. credit cards and car financing schemes). This, in turn, put more pressure on public sector banks to enhance their resource utilisation.

As we noted in the previous chapter, non-performing loans (NPLs) are a major problem for the banking industry in India and Pakistan. Therefore, it is crucial to examine their impact on the evolution of technical efficiency. This could be achieved by using NPLs as another input, usually non-discretionary, that banks use (see Berger and Humphrey, 1997; Drake and Hall, 2003). However, as bank-level data on NPLs are not available for India and Pakistan, we attempt to examine their impact by taking a closer look at the difference between the efficiency scores obtained from the two models, i.e. the loan-based model and the income-based model. Model A postulates that banks produce loans, advances and investments with given resources, while Model B postulates that banks produce income with given resources. Consequently, the outputs of Model B (income) depend primarily on the outputs of Model A (loans, advances and investments). However, if banks are unable to enhance their income-based efficiency even when they are able to improve their loan-based efficiency, this could be due to the presence of high NPLs in their portfolios.

In the case of the Indian public sector banks, at the start of the financial liberalisation in 1991-1992, the NPLs as a percentage of total advances were around 24% (see Bhide et al., 2002). This percentage, however, gradually declined to 16% in 1997-1998. The gap between the efficiency scores obtained from two input-output models follows a similar trend: during the early years, public sector banks were much more efficient in generating loans, advances and investments than in generating income. During the post-liberalisation era, however, this gap gradually declined. In the case of the public sector banks in Pakistan, the level of NPLs increased after the implementation of the financial liberalisation from around 18% of total advances to around 26% (see SBP, 2000). The gap in the efficiency scores of Pakistani public sector banks also increased over the years.

A similar gap between the efficiency scores of private sector banks also exists in the two countries. However, as the level of NPLs of private banks is much lower than in the public sector banks, the gap between the efficiency scores obtained from the two models is also lower. This gap in the efficiency scores from the two models may reflect the impact of the presence of high NPLs. That is, over the years, the presence of NPLs impeded banks' ability to generate income even when they were relatively more efficient in generating earning assets. It could be argued that if the liberalisation programme fails to enhance the efficiency of banks to generate income from their resources, it could, in the medium- and long-run, impede their ability to intermediate between savers and borrowers and to enhance the quality of their services, which, in turn, may negatively influence the process of economic growth[10]. As we shall see

[10] Another possible explanation for this gap between the efficiency scores obtained from the two models could be that banks transferred the benefits of improvement in their efficiency to their customers because though banks produced more loans, advances and investments (i.e. intermediated more funds) with given inputs, they did not extract more income from this intermediation process. However, increasing interest margins in both the countries, coupled with constant criticism in the domestic media about the quality of customer services provided by banks, especially by public sector banks, may cast some doubt on this interpretation.

below in the section on TFP change using the Malmquist index, a similar divergence appears in the TFP change obtained from the two input-output models.

5.3.3 – Efficient frontier banks

Table 5.5 reports the number of banks forming the annual efficient frontiers with both CRS and VRS assumptions. In both the countries, foreign banks were the ones that determined the efficient frontier, especially in the case of the income-based model. This may suggest that this group places more emphasis on generating assets that could contribute towards their earning. Domestic banks, especially public sector banks, were influenced by governments' objectives to promote socially equitable economic growth. Also, the public sector banks' extensive branch network in rural and suburban areas was there to mobilise deposits, which are not included as banks' outputs. These rural and suburban branches had little opportunity to generate loans and advances, which are the key output in our models. Foreign banks, on the other hand, had their branches in large metropolitan areas that provided relatively more opportunities to attract borrowers.

Table 5.5 – Banks forming the efficient frontiers in each year (by ownership group)

Panel I – Number of efficient banks per year

	Loan-based model						Income-based model					
	CRS			*VRS*			*CRS*			*VRS*		
	PSBs	DPBs	FBs	PSBs	DPBs	FBs	PSBs	DPBs	FBs	PSBs	DPBs	FBs
INDIA												
1990	1	0	6	10	5	9	0	0	7	2	1	10
1991	1	1	5	9	4	9	0	0	7	2	1	9
1992	1	1	6	10	6	11	0	0	8	2	2	11
1993	0	1	6	7	5	10	0	0	6	2	1	9
1994	0	0	5	7	3	10	0	0	4	2	1	7
1995	0	3	4	9	5	8	0	1	4	3	1	9
1996	0	2	6	8	6	10	0	1	6	4	3	10
1997	0	2	7	7	6	13	0	0	7	3	2	14
1998	0	3	9	7	7	13	0	1	7	6	2	15
PAKISTAN												
1990	0	n.a.	2	2	n.a.	6	0	n.a.	5	2	n.a.	5
1991	0	n.a.	2	2	n.a.	5	0	n.a.	5	2	n.a.	4
1992	0	2	2	2	2	5	0	2	4	0	1	4
1993	0	3	5	2	3	9	0	2	6	1	2	6
1994	1	3	2	1	8	12	0	3	5	0	2	5
1995	1	4	2	1	7	7	0	1	3	0	3	7
1996	0	3	8	1	5	10	1	2	5	1	2	6
1997	0	6	7	2	7	11	1	2	6	1	3	8
1998	0	5	4	2	6	8	0	1	2	1	3	9

Panel II – Proportion of efficient banks per year (in percentages)

	Loan-based model						Income-based model					
	CRS			*VRS*			*CRS*			*VRS*		
	PSBs	DPBs	FBs	PSBs	DPBs	FBs	PSBs	DPBs	FBs	PSBs	DPBs	FBs
INDIA												
1990	3.6	0.0	21.4	35.7	17.9	32.1	0.0	0.0	25.0	7.1	3.6	35.7
1991	3.6	3.6	17.9	32.1	14.3	32.1	0.0	0.0	25.0	7.1	3.6	32.1
1992	3.6	3.6	21.4	35.7	21.4	39.3	0.0	0.0	28.6	7.1	7.1	39.3
1993	0.0	3.6	21.4	25.0	17.9	35.7	0.0	0.0	21.4	7.1	3.6	32.1
1994	0.0	0.0	17.9	25.0	10.7	35.7	0.0	0.0	14.3	7.1	3.6	25.0
1995	0.0	10.7	14.3	32.1	17.9	28.6	0.0	3.6	14.3	10.7	3.6	32.1
1996	0.0	7.1	21.4	28.6	21.4	35.7	0.0	3.6	21.4	14.3	10.7	35.7
1997	0.0	7.1	25.0	25.0	21.4	46.4	0.0	0.0	25.0	10.7	7.1	50.0
1998	0.0	10.7	32.1	25.0	25.0	46.4	0.0	3.6	25.0	21.4	7.1	53.6
PAKISTAN												
1990	0.0	n.a.	17.0	7.1	n.a.	21.4	0.0	n.a.	17.9	7.1	n.a.	17.9
1991	0.0	n.a.	18.0	7.1	n.a.	17.9	0.0	n.a.	17.9	7.1	n.a.	14.3
1992	0.0	7.1	18.0	7.1	7.1	17.9	0.0	7.1	14.3	0.0	3.6	14.3
1993	0.0	10.7	18.0	7.1	10.7	32.1	0.0	7.1	21.4	3.6	7.1	21.4
1994	3.6	10.7	18.0	3.6	28.6	42.9	0.0	10.7	17.9	0.0	7.1	17.9
1995	3.6	14.3	18.0	3.6	25.0	25.0	0.0	3.6	10.7	0.0	10.7	25.0
1996	0.0	10.7	19.0	3.6	17.9	35.7	3.6	7.1	17.9	3.6	7.1	21.4
1997	0.0	21.4	18.0	7.1	25.0	39.3	3.6	7.1	21.4	3.6	10.7	28.6
1998	0.0	17.9	19.0	7.1	21.4	28.6	0.0	3.6	7.1	3.6	10.7	32.1

PSBs= Public Sector Banks; DPBs= Domestic Private Banks; FBs= Foreign Banks; n.a. refers to the years when DPBs were not allowed to operate.

5.3.4 – DEA efficiency scores and non-frontier based ratios

As suggested by Bauer et al. (1998), for the frontier-based efficiency scores to be useful, the estimated scores should be positively correlated with the traditional non-frontier based measures of performance used by regulators, managers, and industry consultants: 'Positive rank-order correlations with these measures would give assurance that the frontier measures are not simply artificial products of the assumptions made regarding the underlying optimisation concept' (Bauer et al. 1998, p.108)[11].

Table 5.6 presents the Spearman Rank correlations between the PTE and SE of the banking industry in India and Pakistan generated by the DEA and three non-frontier based measures of bank performance, namely return on assets (ROA), total operating and interest cost per rupee of assets (TC/TA), and total cost per rupee of revenue (TC/TR). The first measure is expected to have a positive correlation with the frontier-based efficiency scores, while the latter two are expected to have a negative correlation. That is, it is assumed that ROA of banks should be positively related to their efficiency, while TCTA should be negatively related to the efficiency since better production efficiency should lower banks' costs. The results in Table 3 suggest that most of the DEA-based efficiency scores are consistent with the three non-frontier based performance measures. Only in case of Pakistan,

[11] It could be argued that if the non-frontier based ratios determine whether a frontier technique is robust or not, then there may be no need to conduct frontier based analysis.

Table 5.6 – Correlation between frontier and non-frontier based measures

	India				Pakistan			
	Model A		Model B		Model A		Model B	
	PTE	*SE*	*PTE*	*SE*	*PTE*	*SE*	*PTE*	*SE*
ROA	0.0795*	0.040*	0.314**	0.060*	-0.020*	0.010	0.011**	0.092*
TC/TA	-0.171*	-0.063**	-0.087*	-0.049	-0.011*	-0.027**	-0.089	-0.037
TC/TR	-0.071**	-0.051	-0.301**	-0.097**	-0.091**	-0.051*	-0.259**	-0.077**

PTE= Pure Technical Efficiency; SE= Scale Efficiency; ROA= Return on Assets; TC/TA= Total Costs/Total Assets; TC/TR= Total Costs/Total Revenue
*** Spearman Rank Correlation is statistically significant at 5% level**
**** Spearman Rank Correlation is statistically significant at 1% level**

ROA is not consistent with the loan-based PTE of banks. That is, there is an unexpected negative correlation between loan-based PTE and ROA of banks. This could be due to the increasing NPLs of public sector banks in Pakistan, which suggests that even when banks were becoming more efficient in generating loans and advances, the profitability of banks (i.e. their ROA) was deteriorating.

5.3.5 – Resti's (1997) test of robustness

This section examines the robustness of our results by using Resti's (1997) approach, which has been employed by some more recent studies like Casu and Molyneux (2003). Following Resti, after solving the VRS DEA problems using all the observations composing the sample, all banks presenting an efficiency score equal to unity were deleted, and DEA problems were solved once more with the remaining sample. The correlation between the efficiency scores obtained on the original sample and on the reduced sample is then considered as an indicator of the robustness of the results. Table 5.7 suggests that there is a strong significant positive correlation between the original efficiency scores and the efficiency scores obtained from the reduced sample. Only in case of Pakistan, there is a weak statistically insignificant positive correlation during the years 1990 and 1991. This could be due to a very small sample left after deleting the efficient observation from the original sample. Due to the small sample, almost all banks became 100% efficient.

Table 5.7 – Pearson moment order correlation test

	1990	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*
India									
Model A	0.59	0.56	0.57	0.52	0.61	0.67	0.63	0.81	0.71
	*(4.02)**	*(3.97)**	*(4.81)**	*(4.43)**	*(5.22)**	*(7.03)**	*(6.44)**	*(11.3)**	*(8.61)**
Model B	0.79	0.81	0.87	0.84	0.85	0.69	0.36	0.80	0.83
	*(7.81)**	*(7.9)**	*(12.9)**	*(10.3)**	*(12.2)**	*(7.17)**	*(3.42)**	*(11.6)**	*(11.9)**
Pakistan									
Model A	0.20	0.21	0.56	0.795	0.75	0.80	0.72	0.77	0.83
	(1.00)	*(1.05)*	*(3.21)**	*(5.09)**	*(4.20)**	*(4.92)**	*(3.99)**	*(5.16)**	*(5.87)**
Model B	0.65	0.67	0.81	0.75	0.79	0.84	0.82	0.74	0.79
	*(3.19)**	*(3.64)**	*(5.21)**	*(4.21)**	*(4.87)**	*(6.21)**	*(6.01)**	*(4.32)**	*(4.98)**

Figures in parenthesis are t-statistic (where t is distributed with *n-2* degrees of freedom and *n* is the number of banks in the sample);
*** suggests that we can reject the null hypothesis that the correlation coefficient is 0 at 1%**

5.3.6 – Comparison with the SFA results

As highlighted in chapter 3, one major criticism against the DEA is that it does not take into account random factors – such as strikes, weather – that may make actual output deviate from the best-practice output, and all the deviation is attributed to the inefficiency of managers. Therefore, to check the robustness of our DEA scores, in this section we follow Battese and Coelli (1992) to measure the technical efficiency of banks in India and Pakistan using stochastic frontier analysis[12].

Battese and Coelli (1992) proposed a stochastic production function for panel data that has firm effects, which follow a truncated normal probability distribution. These firm effects are permitted to vary systematically with time. This time-varying measure of efficiency is suitable as the frontier may shift over the years. Also, as we have

[12] Some technical details of the stochastic frontier analysis are presented in Appendix 5.

measured the efficiency using annual frontier DEA model, it is logical to compare the results with time varying SFA results.

To calculate the technical efficiency of banks in India and Pakistan, we estimate the following Translog production function:

$$\ln(Q_{it}) = \beta_0 + \beta_1 \ln(O_{it}) + \beta_2 \ln(I_{it}) + \beta_3 \ln(O_{it})^2 + \beta_4 \ln(I_{it})^2 + \beta_5 \ln(O_{it}) \ln(I_{it}) + (V_i - U_i)$$

where I_{it} represents interest expenses of the i^{th} firm in time t; O_{it} represents operating expenses of the i^{th} firm in time t; Q_{it} is the output for the i^{th} firm in time t (for Model A the output is the sum of loans, advance, and investments, and for Model B the output is the sum of interest income and other income); V_{it} are random variables which are assumed to be identically and independently normally distributed with mean 0 and variance σ_v; and these Vs are assumed to be independent of U_{it}s that are non-negative random variables which are assumed to account for technical inefficiency in production and assumed to be independently and identically distributed and follow a truncated normal distribution (see Kumbhakar and Lovell, 2000). The efficiency results for India and Pakistan are presented in Table 5.8 and 5.9, respectively.

Table 5.8 – The efficiency of banks in India according to SFA

Panel I – Loan-based model

	ABs		PSBs		DPBs		FBs	
	Mean	StDev.	Mean	StDev.	Mean	StDev.	Mean	StDev.
1990	91.35	2.92	95.61	1.78	93.47	3.68	85.31	4.17
1991	89.51	3.13	95.34	1.73	90.31	3.65	83.28	4.48
1992	90.29	3.57	95.98	1.72	91.39	3.56	83.91	5.09
1993	87.50	3.53	95.34	1.72	86.46	3.62	81.26	5.03
1994	89.75	3.56	95.41	1.51	86.32	3.60	87.79	4.95
1995	89.80	3.62	96.23	1.51	90.15	3.45	83.48	5.14
1996	93.17	4.59	95.97	1.50	89.97	3.73	93.68	6.99
1997	94.82	4.57	96.18	1.50	93.85	3.72	94.45	6.51
1998	94.99	4.55	96.47	1.48	94.61	3.23	93.90	6.30
1990-1992	***90.38***	***3.19***	***95.64***	***1.74***	***91.71***	***3.63***	***84.16***	***4.57***
1993-1995	***89.01***	***3.57***	***95.66***	***1.58***	***87.63***	***3.56***	***84.13***	***5.04***
1996-1998	***94.32***	***4.57***	***96.21***	***1.49***	***92.79***	***3.55***	***94.01***	***6.59***

Panel II – Income-based Model

	ABs		PSBs		DPBs		FBs	
	Mean	StDev.	Mean	StDev.	Mean	StDev.	Mean	StDev.
1990	77.17	11.28	75.08	7.45	70.21	6.11	87.20	5.43
1991	76.42	10.62	76.61	7.03	68.93	5.71	84.50	5.18
1992	79.64	9.96	78.15	6.61	70.66	5.31	91.47	4.36
1993	80.80	9.29	79.69	6.19	72.35	4.91	91.51	4.91
1994	82.03	8.72	81.41	5.72	74.10	4.59	91.49	5.37
1995	84.46	8.09	82.75	5.34	78.30	6.71	92.97	3.56
1996	86.07	7.61	84.01	4.98	81.41	7.35	93.24	4.05
1997	86.97	7.02	85.18	4.64	82.75	6.86	93.31	3.81
1998	87.82	6.59	87.06	4.11	82.55	5.20	94.24	3.20
1990-1992	***77.73***	***10.61***	***76.60***	***7.02***	***69.93***	***5.70***	***87.68***	***4.97***
1993-1995	***82.42***	***8.69***	***81.28***	***5.74***	***74.87***	***5.33***	***91.99***	***4.54***
1996-1998	***86.95***	***7.06***	***85.41***	***4.56***	***82.24***	***6.40***	***93.60***	***3.67***

ABs= All Banks; PSBS= Public Sector Banks; DPBs=Domestic Private Banks; FBs= Foreign Banks

The SFA results for India are consistent with the DEA results for the Indian banking industry presented above. Like the DEA results, the SFA results suggest that the efficiency of the banking industry in India gradually improved over the years. In the case of Model A, the efficiency of the Indian banking industry improved from 90.38% in the pre-ESRs period to 94.32% in the post-ESRs period. In case of Model B, the efficiency improved from 77.73% to 86.95%. Although the magnitude of the SFA efficiency is higher than that of DEA efficiency, both the technique suggests similar trends over the years.

Like the DEA results, the SFA results also suggest that public sector banks were more efficient than private sector banks in generating loans and advances, and investment from their given inputs. The gap between the efficiency of public and private sector banks declined during the post-ESRs era. It is also found that in the case of the income-based model, foreign banks were much more efficient than public sector banks. This may substantiate our conclusion that due to high non-performing loans, public sector banks are more efficient in generating earning assets. However, this efficiency is not translated into generating income from their earning assets.

The SFA results for Pakistan are also consistent with the DEA results. We find that the efficiency of the banking industry in Pakistan according to the SFA improved from 88.72% (Model A) and 90.16% (Model B) during the pre-ESRs era to 91.39% (Model A) and 91.37% (Model B) in the post-ESRs period. Again, like DEA results, public sector banks are found to be more efficient than private sector banks in generating earning assets, but less efficient in generating income.

Table 5.9 – The efficiency of banks in Pakistan according to SFA

Panel I – Loan-based model

	ABs		PSBs		DPBs		FBs	
	Mean	StDev.	Mean	StDev.	Mean	StDev.	Mean	StDev.
1990	88.04	9.21	90.41	11.47	n.a.	n.a.	85.74	5.24
1991	90.29	10.69	93.54	10.23	n.a.	n.a.	87.15	6.85
1992	87.86	9.87	90.37	15.58	87.31	9.48	85.96	6.10
1993	87.84	10.58	89.19	11.53	89.34	10.23	85.06	6.92
1994	90.10	10.91	91.91	13.59	90.61	9.31	87.84	7.35
1995	90.04	11.24	90.86	14.14	90.94	9.50	88.34	7.78
1996	90.13	11.57	90.01	14.70	89.70	9.42	90.69	8.21
1997	91.69	11.90	92.41	15.25	93.12	9.33	89.57	8.64
1998	92.37	12.23	89.45	15.80	93.83	9.25	93.90	9.07
1990-1992	*88.72*	*9.90*	*91.43*	*12.23*	*87.31*	*9.48*	*86.28*	*6.02*
1993-1995	*89.32*	*10.91*	*90.65*	*13.04*	*90.29*	*9.67*	*87.07*	*7.34*
1996-1998	*91.39*	*11.90*	*90.61*	*15.24*	*92.20*	*9.33*	*91.37*	*8.64*

Panel II – Income-based model

	ABs		PSBs		DPBs		FBs	
	Mean	StDev.	Mean	StDev.	Mean	StDev.	Mean	StDev.
1990	88.89	11.28	88.24	7.45	n.a.	n.a.	89.54	5.43
1991	91.44	10.62	90.52	7.03	n.a.	n.a.	92.36	5.18
1992	90.18	9.96	89.65	6.61	90.35	5.31	90.53	4.36
1993	89.35	9.29	87.58	6.19	91.37	4.91	89.15	4.91
1994	89.90	8.72	87.92	5.72	89.94	4.59	91.87	5.37
1995	90.78	8.09	87.24	5.34	93.64	6.71	91.58	3.56
1996	91.31	7.61	89.81	4.98	93.44	7.35	90.74	4.05
1997	90.67	7.02	84.28	4.64	94.28	6.86	93.81	3.81
1998	92.12	6.59	86.35	4.11	95.12	5.20	95.19	3.20
1990-1992	*90.16*	*10.61*	*89.47*	*7.02*	*90.35*	*5.31*	*90.80*	*4.97*
1993-1995	*90.01*	*8.69*	*87.58*	*5.74*	*91.64*	*5.33*	*90.86*	*4.54*
1996-1998	*91.37*	*7.06*	*86.78*	*4.56*	*94.28*	*6.40*	*93.23*	*3.67*

ABs= All Banks; PSBS= Public Sector Banks; DPBs=Domestic Private Banks; FBs= Foreign Banks

To examine further whether the results from various techniques are consistent with each other, Bauer et al. (1998) suggest that even when the estimates of the *levels* of efficiency from the parametric and nonparametric frontier methods are quite different, the results from two techniques may still be consistent if they generate the similar ranking of banks by the efficiency scores. Towards this end, following Bauer et al. (1998), we calculate Spearman rank-order correlation between the efficiency scores of individual banks obtained through the DEA and through the SFA. The results are presented in Table 5.10. Like Strum and Williams (2004), the results suggest a high and significant positive correlation between the DEA and the SFA rankings. Therefore, we suggest that the conclusions reached through our DEA results are robust even if we used parametric stochastic frontier analysis.

Table 5.10– Spearman rank-order correlation between DEA and SFA

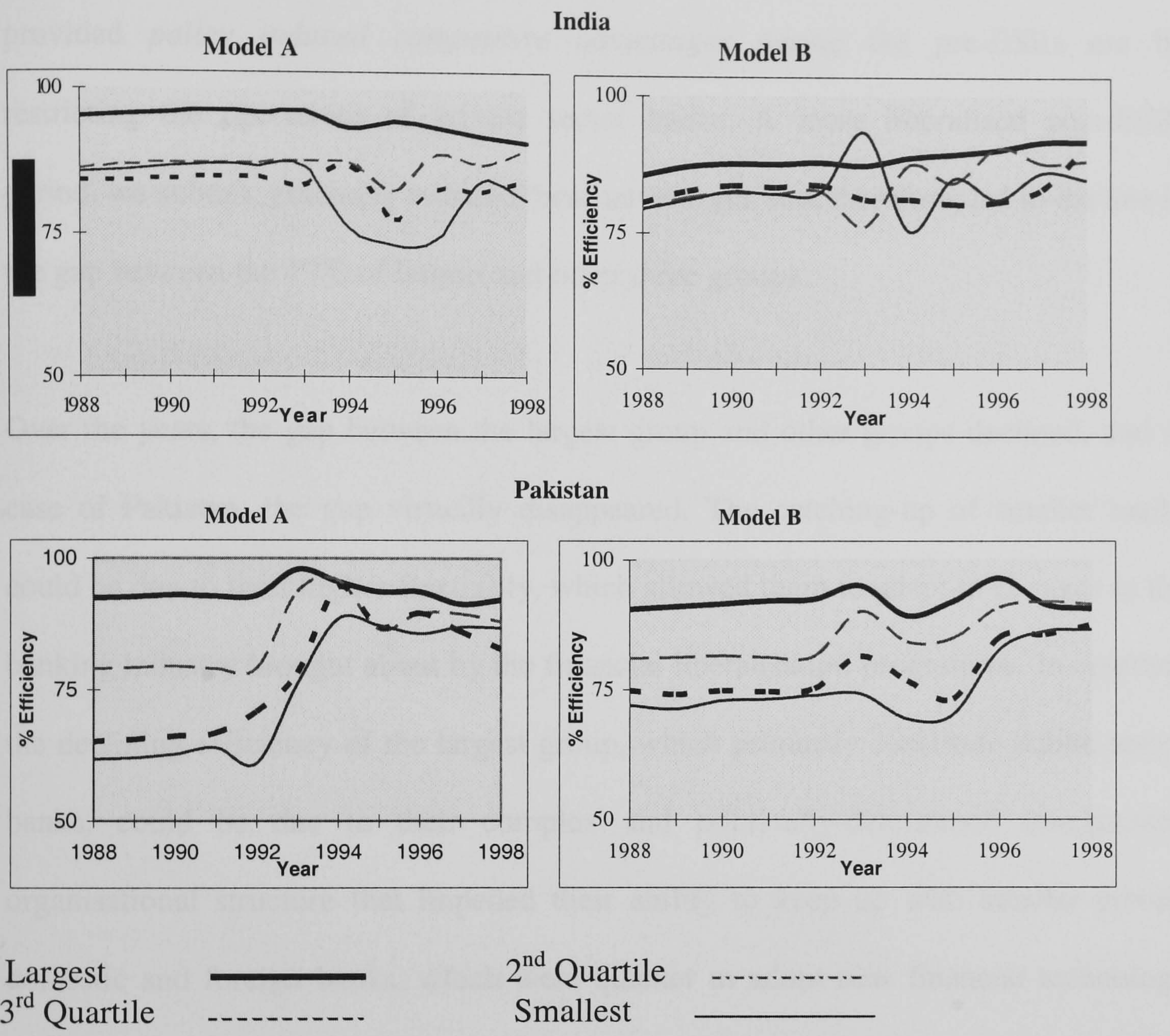
	1990	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*
India									
Model A	0.62*	0.59*	0.63*	0.66*	0.60*	0.57**	0.64*	0.69*	0.66*
Model B	0.71*	0.69*	0.65*	0.69*	0.70*	0.65*	0.68*	0.72*	0.73*
Pakistan									
Model A	0.43**	0.39**	0.52**	0.57**	0.46**	0.40**	0.57**	0.48**	0.50**
Model B	0.56**	0.52**	0.47**	0.54**	0.49**	0.42**	0.51**	0.48**	0.58**

*** , ** Rank correlation significant at 1% or 5% significance level, respectively.**

5.3.7 – Bank size and pure technical efficiency

The evidence on the relationship between size and PTE of banks in developing and emerging economies is mixed. For example, in the context of the Singaporean banking sector, Leong and Dollery (2002) find that larger banks, due to complexity of their operations, exhibit higher inefficiencies. In contrast, Yildirim (2002) finds a positive relationship between size and PTE of Turkish banks. This positive relationship is attributed to larger banks' market power and their ability to diversify credit risk in an uncertain macroeconomic environment. In the case of developed economies, Berger and Humphrey (1997) also find a positive relationship between size and efficiency for the US banking industry (see also, Altunbas et al., 2000).

Figure 5.7 – PTE scores by size quartile for commercial banks



To examine the relationship between size and PTE, we divide the banking industry in India and Pakistan into four quartiles according to their size, where the size of each bank is determined by the total assets of that bank as a percentage of the total assets of the whole commercial banking industry. We will examine this relationship again in the following chapter using regression analysis. Figure 5.6 presents the evolution of PTE of different size groups. The figure suggests that in both the countries, during the pre-liberalisation period, the largest banks outperformed the smaller ones. Following Yildirim (2002), it could be argued that large banks in India and Pakistan, were more efficient due to their market power and their ability to diversify credit risk in an uncertain macroeconomic environment. However, as the largest group is primarily composed of public sector banks, it could also be argued that these banks were provided *policy induced competitive advantages* during the pre-ESRs era by restricting the operations of private sector banks. A more liberalised post-ESRs period, we submit, gradually reduced these advantages and, therefore, led to decline in the gap between the PTE of largest and other three groups.

Over the years, the gap between the largest group and other groups declined, and in case of Pakistan, the gap virtually disappeared. The catching-up of smaller banks could be due to their higher flexibility, which allowed them to adapt to changes in the banking industry brought about by the financial liberalisation programme. In contrast, the declining efficiency of the largest group, which primarily constitute public sector banks, could be due to their complex and politically-determined bureaucratic organisational structure that impeded their ability to keep up with smaller private domestic and foreign banks, which were quicker to adopt new financial technology (e.g. Automated Teller Machines) and to introduce new financial products (e.g. car financing and credit cards) (see SBP, 2000; RBI, various issues).

5.4 – Total factor productivity change in the Indian and Pakistani banking industry

This section examines the productivity change in the Indian and Pakistani banking industry using the Malmquist total factor productivity index. As obvious from our discussion in section 5.2, the Malmquist TFP index for a time period, t, cannot be constructed without a reference production frontier or technology (i.e. a base year relative to which a change in TFP is measured). This reference frontier could be that of any time period other than ***t***. In this section, we calculate Malmquist TFP indices for the Indian and Pakistani banking industry for the period 1992 to 1998. Unlike the previous section, we do not include the year 1990 and 1991 because for these two years domestic private banks were not allowed to operate in Pakistan. For our calculations, we use the frontier of period ***t-1*** as a reference frontier for the period ***t***. For example, for the year 1994, 1993 is used the reference technology. We will also construct a cumulative TFP index that will enable us to examine the evolution of TFP over the whole sample period (i.e. 1992-1998). In addition, as mentioned previously, we will decompose TFP change (TFPCH) into its two components, namely efficiency change (EFCH) and technological change (TCH). Also, the efficiency change will be decomposed into scale efficiency change (SECH) and pure technical efficiency change (PTECH). As noted earlier, the Malmquist TFP index between two time periods is given by:

$$M_o(y_s, x_s, y_t, x_t) = \frac{D_o^t(y_t, x_t)}{D_o^s(y_s, x_s)} \left[\frac{D_o^s(y_t, x_t)}{D_o^t(y_t, x_t)} \times \frac{D_o^s(y_s, x_s)}{D_o^t(y_s, x_s)} \right]^{1/2}$$

A value of $\boldsymbol{M_o}$ greater (less) than 1 suggests an improvement (deterioration) in TFP from period ***t-1*** to ***t***. Similarly, for the constituents of TFP change (i.e. efficiency change and technological change), a value higher (lower) than 1 implies improvement (deterioration). Our primary objective in this section, like in the previous section, is to examine whether the financial liberalisation implemented in 1991-1992 enhanced the TFP of banks. Furthermore, we seek to examine whether this improvement, if any, is due to improvement in the technology that banks employ or due to improved utilisation of the existing technology.

Table 5.11 and Table 5.12 report the Malmquist TFP indices for India and Pakistan for the loan-based and income-based models, respectively. Like in the section on technical efficiency, based on ownership structure the commercial banking industry in both countries is categorised into three groups, i.e. public banks, domestic private banks and foreign banks, and the post-liberalisation period (i.e. 1992-1998) is divided into two sub-periods: 1992-1995 represents the initial period when both governments introduced the new deregulatory policies, and 1996-1998 represents the post deregulatory period when these policies should have started to realise tangible benefits in the form of greater flexibility and higher levels of competitiveness.

5.4.1 – The loan based model

The results shown in Table 5.11 indicate that over the entire sample period (1992-1998), average total factor productivity change (TFPCH) in the Indian commercial banking sector was 4.6%. The constituent parts of TFPCH, i.e. efficiency change (EFCH) and technical change (TCH), were 4.2% and 0.3%, respectively. The most interesting feature of these results, however, was the mere 0.3 % improvement in technology. An examination of the individual years shows that this small improvement was primarily due to technological regress during 1995 (10%) and 1996 (6.7%). However, these two years also revealed the highest improvement in efficiency. It could be argued that initially the Indian banks invested heavily in new technology with the expectation that it would allow them to take full advantage of the competitive opportunities in the recently liberalised markets (see Isik and Hassan, 2003). However, it was only in subsequent years that this investment translated into increased efficiency and improved productivity.

Table 5.11 – Total factor productivity change during 1992-1998 (loan-based model)

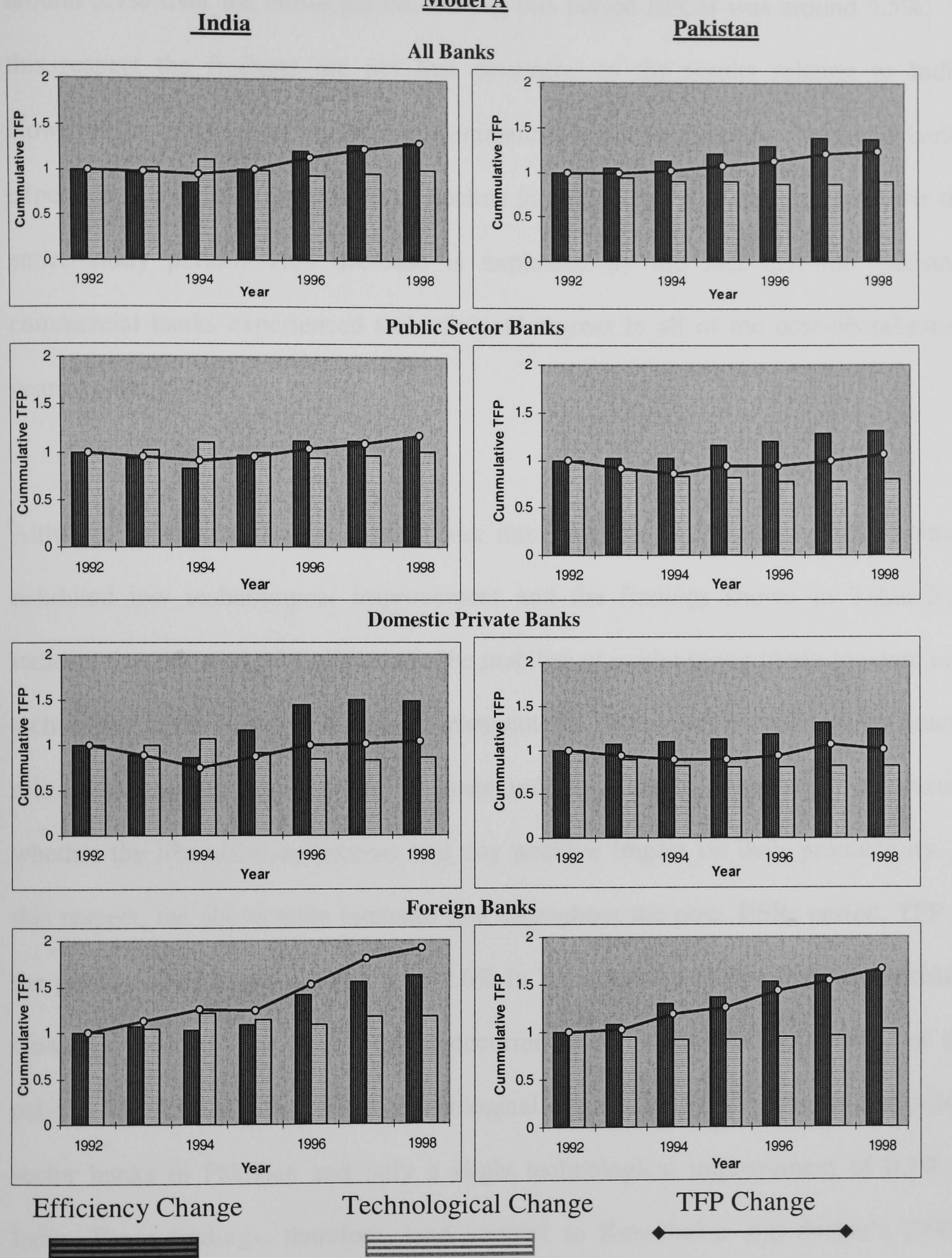
	India					Pakistan				
	EFCH	PTECH	SECH	TCH	TFPCH	EFCH	PTECH	SECH	TCH	TFPCH
All Banks										
1993	0.964	0.991	0.971	1.022	0.985	1.053	1.030	1.021	0.943	0.994
1994	0.888	0.969	0.921	1.087	0.965	1.076	1.054	1.023	0.959	1.031
1995	1.171	1.039	1.135	0.900	1.054	1.066	0.990	1.078	0.988	1.054
1996	1.212	1.088	1.115	0.943	1.143	1.067	1.018	1.049	0.978	1.044
1997	1.052	1.013	1.037	1.029	1.082	1.073	1.030	1.041	0.999	1.073
1998	1.021	0.976	1.047	1.035	1.057	0.998	0.999	0.992	1.027	1.025
Public Sector Banks										
1993	0.934	1.000	0.935	1.019	0.951	1.015	1.018	0.997	0.892	0.906
1994	0.886	0.984	0.901	1.083	0.960	1.007	1.009	0.999	0.936	0.942
1995	1.161	1.041	1.115	0.898	1.042	1.129	1.003	1.126	0.978	1.104
1996	1.157	1.004	1.153	0.942	1.089	1.033	0.997	1.036	0.958	0.990
1997	1.011	1.008	1.003	1.040	1.051	1.072	1.013	1.058	0.989	1.060
1998	1.026	1.014	1.012	1.044	1.071	1.022	0.998	1.025	1.045	1.068
Domestic Private Banks										
1993	0.889	0.949	0.937	1.003	0.892	1.058	1.054	1.004	0.887	0.939
1994	0.975	0.997	0.975	1.062	0.844	1.040	1.029	1.010	0.919	0.955
1995	1.348	1.144	1.178	0.858	1.156	1.017	0.979	1.039	0.981	0.998
1996	1.240	1.130	1.091	0.927	1.150	1.051	1.031	1.020	0.999	1.050
1997	1.035	1.011	1.023	0.980	1.014	1.108	1.088	1.018	1.020	1.129
1998	0.987	0.988	0.999	1.044	1.031	0.949	0.953	0.995	1.002	0.951
Foreign Banks										
1993	1.075	1.088	0.988	1.047	1.126	1.087	1.051	1.035	0.943	1.025
1994	0.959	1.011	0.949	1.155	1.108	1.189	1.101	1.080	0.977	1.162
1995	1.050	0.991	1.060	0.948	0.996	1.056	0.985	1.072	1.003	1.059
1996	1.295	1.155	1.122	0.947	1.226	1.118	1.034	1.082	1.018	1.138
1997	1.105	1.020	1.084	1.071	1.184	1.042	1.017	1.025	1.026	1.069
1998	1.050	0.936	1.122	1.010	1.061	1.026	1.017	1.007	1.060	1.087

	EFCH	PTECH	SECH	TCH	TFPCH	EFCH	PTECH	SECH	TCH	TFPCH
All Banks										
1992-98	1.042	1.012	1.035	1.003	1.046	1.055	1.020	1.034	0.982	1.037
1992-95	1.001	0.999	1.005	1.000	1.001	1.065	1.024	1.040	0.963	1.026
1996-98	1.092	1.024	1.066	1.001	1.093	1.046	1.016	1.027	1.001	1.047
Public Sector Banks										
1992-98	1.024	1.008	1.016	1.002	1.026	1.046	1.006	1.039	0.965	1.009
1992-95	0.987	1.008	0.980	0.997	0.984	1.049	1.010	1.039	0.935	0.981
1996-98	1.063	1.009	1.054	1.007	1.070	1.042	1.003	1.039	0.997	1.039
Domestic Private Banks										
1992-98	1.032	1.034	1.031	0.976	1.008	1.036	1.022	1.014	0.967	1.001
1992-95	0.984	1.027	1.025	0.970	0.955	1.038	1.020	1.017	0.928	0.964
1996-98	1.082	1.042	1.037	0.983	1.063	1.034	1.023	1.011	1.007	1.041
Foreign Banks										
1992-98	1.084	1.031	1.052	1.027	1.114	1.085	1.034	1.050	1.004	1.089
1992-95	1.027	1.029	0.998	1.047	1.075	1.110	1.045	1.062	0.974	1.081
1996-98	1.146	1.033	1.109	1.008	1.155	1.061	1.023	1.037	1.034	1.098

EFCH = Efficiency Change; TCH = Technical Change; PTECH = Pure Technical Efficiency Change; SECH = Scale Efficiency Change; TFPCH = Total Factor Productivity Change

Figure 5.8 – Cumulative TFP change for banks in India and Pakistan (1992=1)

Model A



The commercial banking industry in Pakistan had an average improvement in TFP of around 3.7% over the entire period. During this period EFCH was around 5.5%. In this respect the findings are not that dissimilar to the results relating to India. However, in contrast to the Indian commercial banking industry, Pakistani banks experienced a technological regress: decline in technology was around 1.8% over the entire study period. This decrease is explained by the fact that the Pakistani commercial banks experienced technological regress in all of the post-liberalisation years except in 1998.

Although this technological regress was more evident in Pakistan, both countries exhibited low technological improvement and the findings shown in Table 5.11 indicate that this was primarily due to the inability of public sector banks to adopt new technology in the new liberalised environment. As public sector banks play a crucial role in the creation and dispersal of loans and advances, it is important to ascertain whether the liberalisation process had any positive impact on their productivity. In this respect, the above table indicates that throughout the post- ESRs period, TFP of the public sector banks improved by 2.6% in India and by a mere 0.9% in Pakistan. However, most of this improvement occurred in the second half (1996-98) of the period. The results also reveal technological regress of 3.5% amongst the public sector banks in Pakistan and only a slight technological improvement of 0.7% in India. These findings, therefore, lend support to Kumbhakar and Sarkar's (2003) conclusions that the benefits of the financial liberalisation are essentially long term and that the large size of public sector banks in developing countries makes them impervious to change. As noted above, public sector banks controlled around 88% of the assets of the banking industry in India and Pakistan. It could be argued, therefore, that the large market share of public sector banks makes them less responsive to new competition from the emerging private sector.

The results also show that foreign banks in both countries witnessed the highest improvement in TFP. These improvements were attributable to both technological improvements (TCH) and efficiency increases (EFCH). This trend is consistent with other developing countries, where recent foreign bank entrants typically introduce new financial products such as credit cards, automated teller machines (ATMs) and consumer credit, etc. In contrast, and again in common with the experiences of other developing countries, domestic banks in India and Pakistan, especially the public sector banks, were slow to adopt and emulate these new technologies. For example, a recent study by the 'Off-Site Monitoring and Surveillance Division' of the Department of Banking Supervision in India shows that average IT expenditures as a percentage of total expenses during 1996-2000 in public sector banks, domestic private banks, and foreign banks were 4.5%, 7%, and 8.6%, respectively[1].

5.4.2 – The Income-Based Model

The income-based model postulates that banks seek to generate income from their financial activities and could be seen as consistent with banks' profit maximisation objective (Leightner and Lovell, 1998). The results based on the income-based model are shown in Table 5.12, which shows an improvement in commercial banks' TFP in both India and Pakistan. However, the income-based model generally reveals lower

[1] Available at www.rbi.org.in

improvements in TFP than the loan-based model. For example, over the entire period, income-based TFPCH in the Indian commercial banks was on average 4.2% (4.6% Loan based model) and mean EFCH was 2.8% (4.2% in the income-based model). Technological improvement was the only exception to this trend being slightly higher at 1.4% (0.3% in loan-based model). However, like the loan-based model, it regressed by 0.8% in 1995 and 1.8% in 1996. Similarly, in Pakistan, TFP improved by 2.9% (3.7%) throughout the period, with EFCH increasing by 3.4% (5.5%) and TCH regressing by 0.5% (1.8%).

The biggest disparity between the two models was revealed by the changes in TFP in the public sector banks. In India, for example, the loan-based model indicates a 2.6% increase in TFP, where as the income-based model reveals a mere 0.4% increase. Likewise, the loan-based model reveals a 0.9% increase in TFP for public sector banks in Pakistan, compared to a decline of 2.5% in the income–based model. This divergence between the two models is consistent with our results in section 5.2 where we calculated CRS and VRS technical efficiency of banks in India and Pakistan.

In the section on technical efficiency, we attributed the divergence in the efficiency obtained from the two input-output models to the presence of non-performing loans. Similar reasons could be forwarded for the divergence in the TFP changes from the two models. For example, following Hardi and de Pati (2001), it could be argued that the banks transferred productivity gains to their customers, i.e. borrowers and depositors. In other words, with a given level of resources the banks generated higher volumes of loans but reduced net interest income by paying higher interest to depositors and levying lower interest for loans and related services.

Table 5.12 – Total factor productivity change during 1992-1998 (income-based model)

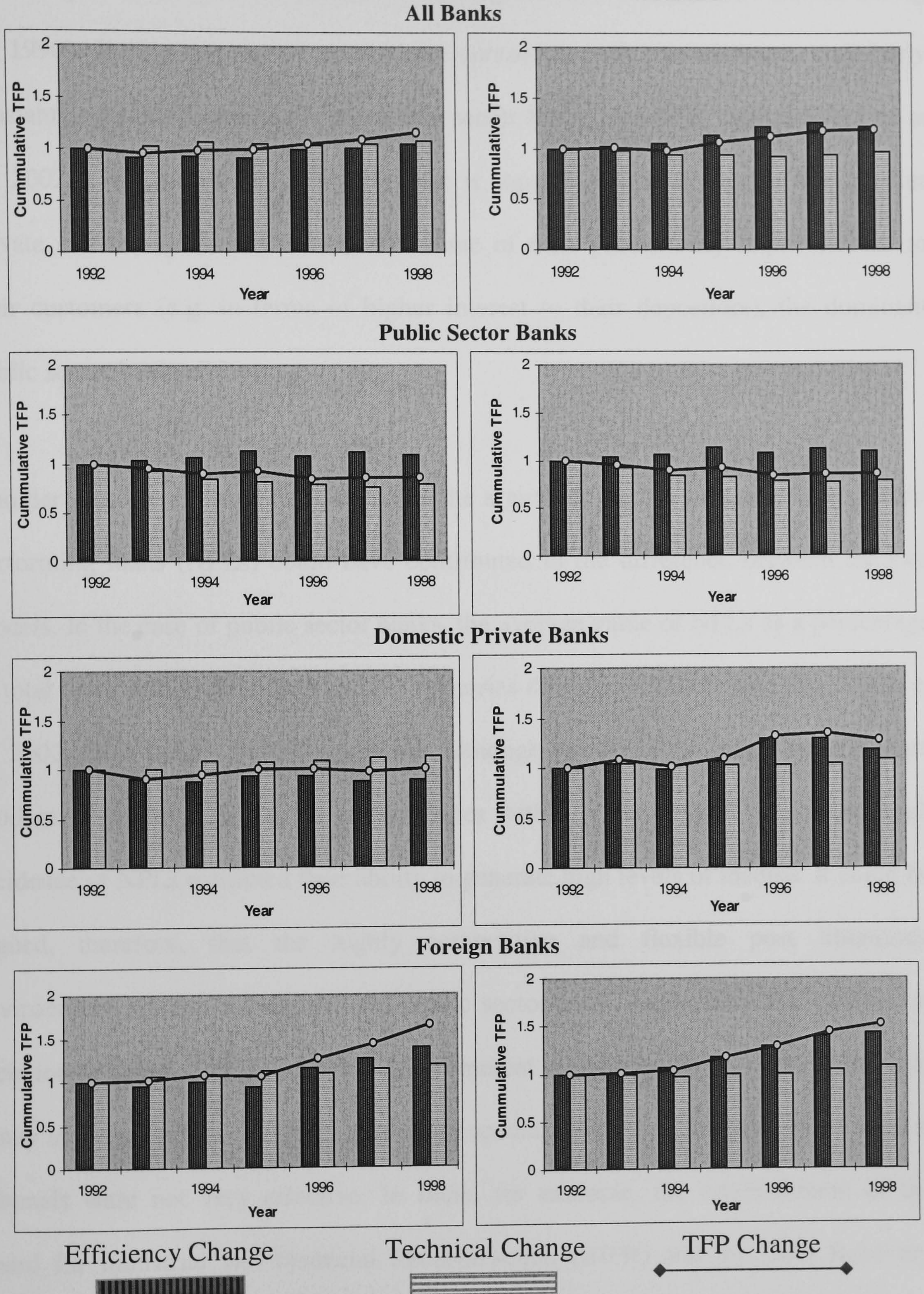
	India					Pakistan				
	EFCH	PTECH	SECH	TCH	TFPCH	EFCH	PTECH	SECH	TCH	TFPCH
All Banks										
1993	0.922	0.990	0.939	1.033	0.952	1.026	1.026	1.000	0.986	1.012
1994	1.007	1.003	1.004	1.033	1.041	1.016	1.009	1.008	0.955	0.969
1995	0.994	1.002	0.992	0.992	1.003	1.082	1.043	1.038	1.000	1.082
1996	1.078	1.067	1.010	0.982	1.059	1.078	1.049	1.028	0.984	1.061
1997	1.021	1.003	1.017	1.021	1.042	1.038	1.015	1.022	1.009	1.047
1998	1.040	1.019	1.027	1.025	1.066	0.969	0.998	0.970	1.039	1.007
Public Sector Banks										
1993	0.907	0.981	0.925	1.042	0.945	1.028	0.990	1.039	0.923	0.949
1994	1.003	1.000	1.003	1.006	1.008	1.036	0.997	1.040	0.908	0.940
1995	0.994	0.990	1.005	0.987	0.981	1.065	1.039	1.026	0.978	1.041
1996	1.020	1.004	1.019	0.973	0.993	0.954	0.952	1.010	0.952	0.908
1997	1.019	1.009	1.010	0.993	1.012	1.033	1.002	1.031	0.980	1.012
1998	1.005	1.003	1.003	1.021	1.027	0.974	1.016	0.962	1.032	1.005
Domestic Private Banks										
1993	0.900	0.970	0.997	1.004	0.903	1.036	1.015	1.020	1.047	1.084
1994	0.973	0.909	1.070	1.080	1.051	0.958	1.003	0.955	0.980	0.938
1995	1.055	1.086	0.972	0.993	1.049	1.083	1.081	1.002	0.998	1.081
1996	1.001	1.001	1.001	1.001	1.002	1.197	1.093	1.096	1.003	1.201
1997	0.951	0.957	1.001	1.031	0.980	1.000	1.002	0.998	1.011	1.012
1998	1.016	1.009	1.008	1.013	1.030	0.920	0.949	0.972	1.041	0.958
Foreign Banks										
1993	0.959	0.961	0.992	1.054	1.010	1.012	1.012	1.000	0.994	1.006
1994	1.047	1.000	1.048	1.016	1.064	1.055	1.045	1.010	0.978	1.033
1995	0.937	0.961	0.975	1.048	0.982	1.100	1.034	1.072	1.024	1.126
1996	1.226	1.142	1.073	0.973	1.192	1.097	1.108	0.990	0.998	1.095
1997	1.097	1.101	0.996	1.039	1.139	1.082	1.078	1.005	1.036	1.121
1998	1.100	1.025	1.079	1.040	1.145	1.017	1.014	1.005	1.043	1.060
	EFCH	PTECH	SECH	TCH	TFPCH	EFCH	PTECH	SECH	TCH	TFPCH
All Banks										
1992-98	1.028	1.014	0.998	1.014	1.042	1.034	1.023	1.011	0.995	1.029
1992-95	1.026	0.998	0.978	1.008	1.034	1.041	1.026	1.015	0.980	1.020
1996-98	1.030	1.029	1.018	1.023	1.054	1.027	1.021	1.006	1.010	1.038
Public Sector Banks										
1992-98	1.008	0.998	0.994	0.996	1.004	1.014	0.999	1.018	0.961	0.975
1992-95	1.006	0.990	0.977	0.988	0.994	1.043	1.009	1.035	0.936	0.976
1996-98	1.012	1.005	1.011	1.007	1.020	0.987	0.989	1.001	0.987	0.974
Domestic Private Banks										
1992-98	0.999	0.987	1.008	1.023	1.022	1.028	1.023	1.006	1.013	1.042
1992-95	1.009	0.986	1.012	1.024	1.034	1.024	1.033	0.992	1.008	1.032
1996-98	0.983	0.989	1.003	1.022	1.005	1.033	1.013	1.021	1.018	1.052
Foreign Banks										
1992-98	1.077	1.029	1.026	1.023	1.102	1.060	1.048	1.013	1.012	1.073
1992-95	1.063	0.974	1.005	1.012	1.076	1.055	1.030	1.027	0.999	1.054
1996-98	1.099	1.088	1.049	1.039	1.142	1.065	1.066	1.000	1.026	1.092

EFCH = Efficiency Change; TCH = Technical Change; PTECH = Pure Technical Efficiency Change; SECH = Scale Efficiency Change; TFPCH = Total Factor Productivity Change

Figure 5.9 – Cumulative TFP change for banks in India and Pakistan (1992=1)

Model B

India **Pakistan**



As we argued in section 5.3, this explanation, however, may not be consistent with the prevailing conditions in the commercial banking industry of India and Pakistan during the 1990s. During this period interest rate spreads in both countries remained fairly constant and even increased for the public sector banks (see SBP, 2000, and Bhide et al., 2002). This means that although there is some evidence to suggest that smaller private and foreign banks did transfer some of their productivity improvements to their customers (e.g. in terms of higher interest to their depositors), the dominant public sector banks did not.

Another possible explanation is based on the argument that the presence of high non-performing loans (NPLs) could have contributed to the difference between the two models. In the case of public sector banks, the average value of NPLs as a percentage of total loans was around 20% in both countries throughout this period (see Bhide et al. 2002, SBP, 2001). This suggests that although public sector banks became more productive in generating loans and advances with a given level of inputs, the high incidence of NPLs restricted their ability to generate high levels of income. It could be argued, therefore, that the highly competitive and flexible post liberalised environment, merely encouraged the public sector banks to increase the quantity of their loans rather than the quality. Government in both countries pledged to help banks to recover their NPLs by setting up special tribunals. However, these special tribunals were not very effective. In India, for example, the establishment of the Board for Industrial and Financial Reconstruction (BIFR) and the Debt Recovery Tribunals (DRTs) had only modest success until 1999 (see Bhide et al., 2002).

5.5 – Summary and conclusion

This chapter provides a comparative analysis of the evolution of the technical efficiency of the banking industry in India and Pakistan before and after the implementation of the financial liberalisation programme in the early 1990s. Using non-parametric DEA, we find that the overall technical efficiency of the banking industry improved following the financial liberalisation, especially after 1995-1996. In the case of India, efficiency increased due to improvement in both pure technical efficiency and scale efficiency. In Pakistan, however, the increase in overall technical efficiency was due primarily to an improvement in scale efficiency.

The results indicate that total factor productivity in both the countries improved slowly and, therefore, they reflect the gradual or long term impact of the financial liberalisation. In India, the loan-based model revealed an improvement in TFP of around 4.6% for the entire study period and the income-based model showed a comparable improvement of 4.2%. In Pakistan, the improvement was less marked with TFP improving by 3.7% in the loan-based model, and 2.9% in the income-based model. The study also revealed that TFP in both countries was adversely affected by the slow improvement, or lack of improvement, in the TFP of public sector banks. In contrast, however, foreign banks in both the countries witnessed the highest productivity gains.

Our results suggest that the efficiency of commercial banks is much higher in Model A, which uses earning assets as outputs, than in Model B, which uses income as output. This gap in efficiency scores obtained from the two models could be due to the presence of high non-performing loans in the asset portfolios of banks in the two countries. We argue that even when banks are becoming more efficient in increasing the quantity of loans, advances and investments, this efficiency is not being translated into higher efficiency in generating income. The results also suggest that the implementation of the financial liberalisation closed the efficiency gap between large and small banks.

In the following chapter, we augment our analysis by employing grand-frontier DEA, and by using regression analysis to examine the external environmental and internal banks specific factors that may explain inter-temporal and intra-temporal variations in the efficiency of banks in India and Pakistan during the post-ESRs period.

Chapter 6 – Factors Explaining the Variations in the Efficiency of Banks during the post-ESRs Period[1]

6.1 – Introduction

The preceding chapter measured the technical efficiency of banks in India and Pakistan during 1990-1998. The DEA was employed to construct a best-practice frontier for each year in the sample, and then the efficiency of each bank in each year was measured relative to the best-practice frontier for that year[2]. We found that in the case of India, all three groups (i.e. public, domestic private, and foreign) witnessed improvement in both their scale and pure technical efficiencies. On the other hand, only foreign and domestic private banks in Pakistan achieved improvement in their scale and pure technical efficiencies; public sector banks witnessed some improvement in the scale efficiency only.

This chapter extends the analysis of the preceding chapter in two ways. *First*, following Bhattacharyya et al. (1997) we employ the DEA to construct a single 'grand-frontier' that envelops the pooled input-output data of all banks in the sample for all the post-ESRs years, i.e. 1992-1998. This grand-frontier provides a best-practice benchmark against which the efficiency of each bank in each year is calculated. The key advantage of the grand-frontier approach is that it will provide a trend in the efficiency of banks, which was not available in the previous chapter when we calculated the efficiency of banks using a separate frontier for each year.

[1] A paper on the factors explaining the efficiency of banks in India during 1992-1998 based on this chapter has been circulated for comments and criticism.

[2] Stochastic frontier analysis was also employed to check the robustness of our DEA results.

This approach, therefore, provides variations in the efficiency of banks over both time and space.

An additional benefit of using the grand-frontier rather than annual frontiers is 'an increase in the number of observations' that are crucial for the calculation of efficiency using the DEA (Bhattacharyya et al., 1997; p.335). Furthermore, this approach could enable us to capture the impact of the implementation of the economic and structural reforms (ESRs) by examining the number of banks forming the best-practice grand-frontier. If a large number of efficient observations are of recent vintage, then we could argue that the implementation of the ESRs has created an environment that enabled banks to improve their resource utilisation. In addition, this grand-frontier technique will enable us to check the robustness of the annual frontier results.

Second, in the previous chapter, we attributed variations in the efficiency of banks to the changes brought about by the ESRs, particularly by the financial liberalisation programme. In this chapter, we adopt a more systematic approach to examine the possibility of a relationship between the efficiency of banks and various macroeconomic and industry-specific variables that are directly related to the ESRs in India and Pakistan. Specifically, we use the two-step procedure outlined in chapter 3 in which we regress the efficiency scores obtained from the grand-frontier DEA on various external environmental factors, as well as, bank-specific characteristics. This two-step procedure will enable us to test the hypotheses regarding the possibility of a relationship between bank efficiency and various elements of the ESRs in India and Pakistan.

The rest of the chapter is structured as follows. Section 6.2 outlines the hypothesis regarding a relationship between bank efficiency and four factors, namely fiscal deficits, investment liberalisation, competition, and the presence of foreign banks. Section 6.3 outlines the techniques used in this chapter. Section 6.4 presents the empirical results. Section 6.5 summarises and concludes the chapter.

6.2 – Factors explaining variations in the efficiency of banks in India and Pakistan

As we noted in chapter 3, the traditional theory of the firm reveals little curiosity regarding the factors explaining variations in the efficiency of firms over space and time because, by assumption, the firm *always* produces according to a known relationship between inputs and outputs (i.e. the production function). We also reviewed more recent approaches that extend this simplistic view by considering the firm as a nexus of contracts among various 'opportunistic' individuals who may not be 'rational' utility maximisers (March and Simon, 1958; Cyert and March, 1963; Leibenstein, 1979; Alchian and Demsetz, 1972; Williamson, 1975). The ability of firms to transform inputs into outputs (i.e. their efficiency) in these frameworks varies, over time and space, due to internal firm-specific characteristics (e.g. ownership) and/or external environmental factors (e.g. the level of competition and government regulations). These internal and external factors affect the firm's efficiency by influencing the ability/motivation of individual agents associated with the firm.

In the context of banking firms, a large number of recent empirical studies have found substantial inter-temporal and intra-temporal variations in the efficiency of banks in both developed and developing countries (see, Berger and Humphrey, 1997; Isik and Hassan, 2003; Hasan and Marton, 2003). In the previous chapter, we also found considerable variations in the efficiency of banks in India and Pakistan. As Berger and Mester (1997) point out, the next useful step for public policy and academic research is to explore factors that could explain these measured variations.

In the case of developed countries, some recent studies have empirically investigated the factors that may explain the variations in the efficiency of banks (see, for example, Mester, 1996; Berger and Mester, 1997; Casu and Molyneux, 2003; Akhigbe and McNulty, 2003; Girardone et al., 2004; Altunbas et al., 2001; Dietsch and Lozano-Vivas, 2000). These studies have found various bank-specific characteristics (e.g. ownership and size) and external environmental factors (e.g. the level of competition, demand for financial services, and government regulations) to have a significant relationship with banks' efficiency. While this research on developed countries may be instructive, there is a strong case for investigating factors that could explain variations in the efficiency of banks in developing countries, which have implemented the financial liberalisation programme to enhance the resource utilisation in the banking industry (see chapter 4).

Although some recent studies have attempted to address this issue, these studies have only investigated the possibility of a relationship between banks' efficiency and a handful of internal bank-specific factors – such as ownership and size (see, for example, Hao et al., 2001; Yildirim, 2002; Hasan and Marton, 2003); the importance of changes due to the ESRs, though recognised, has not been explicitly investigated. The present chapter contributes to this recent empirical literature by presenting a relatively more comprehensive analysis of a relationship between banks' efficiency and factors associated with the three elements of the ESRs, namely, the financial liberalisation, fiscal reforms, and investment liberalisation.

More specifically, we first present hypotheses regarding the possibility of a relationship between the efficiency of banks in India and Pakistan and fiscal deficits, private investment, competition, and the presence of foreign banks. The first two factors are associated with the on-going fiscal reforms and investment liberalisation, respectively; while the last two factors are associated with the financial liberalisation programme. We test these hypotheses using two predominant econometric techniques, namely, the Ordinary Least Squares estimation and the Generalised Method of Moments estimation. Besides these factors, we also include bank-specific variables in our model. Although our empirical analysis is based on the banking industry in India and Pakistan, insights from this chapter could be useful for other developing countries, which have followed similar ESRs during the 1990s.

6.2.1 – The ESRs and bank efficiency in India and Pakistan

a – Fiscal deficits, fiscal reforms and banks' efficiency

In this study, we hypothesise that there is a negative relationship between government's fiscal deficits and the efficiency of commercial banks in developing countries like India and Pakistan. At least three reasons could be forwarded for this negative relationship. *First*, due to an undeveloped debt market, governments in developing countries finance their fiscal deficits by making it mandatory for commercial banks to hold a large amount of government securities (Fry, 1995). For example, to finance its high fiscal deficits, the government of India required commercial banks to invest more than 30% of their loanable funds in the low earning government securities (see chapter 4). As the interest rate on government securities is deliberately kept lower than the market clearing rate, it could be argued that such a requirement negatively influences banks' efficiency to channel their investible funds to higher earning assets.

Second, the presence of high fiscal deficits acts as a key constraint on the government's ability to lower the high cash reserve requirement imposed on banks. For example, in the case of India and Pakistan, banks were required to maintain the cash reserve ratio of 15% before the implementation of the ESRs (see chapter 4). Once again, the key reason behind this high reserve requirement was the government's high fiscal deficits. This high reserve requirement, in turn, may act as a cost imposed on banks because it restricts their capacity to produce maximum earning assets with their mobilised funds.

Finally, high fiscal deficits lead governments in many developing countries to draw on domestic savings by launching government sponsored saving schemes, which act as a substitute to banks' deposits (see, for example, Feltenstein and Iwata, 2002). In the presence of these saving schemes, banks may find it more expensive to acquire the scarce investible funds in the economy. This, in turn, could hamper banks' ability to produce the quantity of earning assets and, hence, income. In this context, it could be argued that the implementation of fiscal reforms that endeavour to lower governments' fiscal deficits may lead to an environment that enables and encourages banks to enhance their ability to mobilise investible funds and to generate earning assets from these funds.

b – Banks' efficiency and investment liberalisation

A growth in demand for the products/services of an industry has been pointed out as an important factor that may affect the efficiency of firms in that industry. For example, Perelman (1995) suggests that the expansion of the market can be seen as an economic opportunity for firms that leads to investment in new products or production processes, which would improve their efficiency. A growth in demand may also influence the efficiency of firms by making the higher utilisation of installed productive capacity possible. In the context of banking firms, some recent empirical studies have examined the relationship between banks' efficiency and demand for services provided by banks. For example, Berger and Mester (1997) examine this relationship for 6000 banks in United States during 1990-1995. They find a significant positive relationship between demand for banking services and the efficiency of banks.

Prior to the implementation of the ESRs, when governments imposed restrictions on private investment, besides government securities and loans to a few large state-owned enterprises (usually inefficient and loss-making[3]), banks had limited options to transform their loanable funds into earning assets due to the lack of demand for bank credit. For example, as we noted in chapter 4 (p. 116), Bhaumik and Mukhopadhyay (1997) suggest that the high proportion of government securities in the assets portfolios of banks in India was due to the lack of adequate demand for

[3] See, for example, Omran (2004).

bank credit in the Indian economy. In this study, we postulate that, in the case of the banking industry in developing countries, the liberalisation of private investment that enlarges the real sector augments the demand for financial services (e.g. loans and advances) provided by banks. Following Perelman (1995), this increase in the demand could create economic opportunities for banks to transform their loanable assets into earning assets more efficiently. In addition, with an anticipation of growth in the demand for their loans and advances, brought about by the liberalised regime, banks may engage in investing in new technologies (e.g. investment in information technology) that, in turn, could enhance their efficiency[4].

c – The financial liberalisation, competition, and banks' efficiency

The financial liberalisation attempts to enhance the level of competition in the banking industry in order to encourage banks to exert greater effort to utilise their resources. This is based on economic theories that suggest a positive relationship between competition and efficiency (see, for example, Leibenstein, 1979). Recent empirical studies on banks in developed countries provide some support for a positive relationship between banks' efficiency and the level of competition (see, Berger and Mester, 1997). However, in the context of developing countries, no empirical study has explicitly evaluated the relationship between banks' efficiency and the level of competition. We fill this gap by examining whether the increased level of competition, brought about by the implementation of the financial liberalisation programme, is associated with the higher level of efficiency of banks in India and Pakistan during 1992-1998.

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[4] Another channel through which the liberalisation of private investment can have positive impacts is entry of foreign firms that bring new technical skills that can be spilled over to other sector including banking sector.

d – The financial liberalisation, foreign banks' participation, and banks' efficiency

Finally, an important component of the financial liberalisation in India and Pakistan, like in other developing countries, is reduced restrictions on the entry and operations of foreign banks (see, RBI, various issues; SBP, 2000). Again like in other developing countries, the reduced restrictions have led to an increase in the scale and scope of the operations of foreign banks in India and Pakistan (see chapter 4). In this chapter, we hypothesise that this increase in the presence of foreign banks enhances the efficiency of banks in India and Pakistan. Besides making the banking industry more competitive, an increase in the presence of foreign banks can positively influence the efficiency of banks in two ways.

First, foreign banks operating in developing countries, especially those from developed economies, may introduce modern and more efficient banking techniques, which may be copied by domestic banks (Lensink and Hermes, 2004). *Second*, as Lensink and Hermes (2004, p. 556) point out, foreign banks may increase the quality of human capital in the domestic banking industry by (a) importing high-skilled bank managers to work in their foreign branches in developing countries, and (b) investing in the training of local employees. The improved quality of human capital enables banks to enhance their ability to transform inputs into outputs.

However, Lensink and Hermes (2004) add, the realisation of this positive relationship between the presence of foreign banks and the efficiency of banks may depend on the level of economic development of the host developing country: at a lower level of economic development, banking markets are generally less developed, which means implementing new techniques (introduced by foreign banks) raises costs in the short-run. In this context, therefore, we seek to examine whether the increased presence of foreign banks has a positive or negative impact on the efficiency of banks in India and Pakistan during the post-ESRs period.

6.3 – Methodology and Data

In this chapter, we employ the two-step procedure. In the first step, we use the grand-frontier DEA to measure the efficiency of banks in India and Pakistan during 1992-1998. The measured efficiency scores are then regressed on external and internal factors using the Ordinary Least Squares (OLS) estimation and the Generalised Method of Moments (GMM) estimation.

6.3.1 – The two-step procedure

Step I – The estimation of efficiency using grand-frontier DEA

As highlighted earlier, following Bhattacharyya et al. (1997), we employ the DEA to construct a single 'grand frontier' that envelops the pooled input-output data for all the years (i.e. separately for each of the two countries.) This grand frontier would provide a benchmark against which the efficiency of each bank in each year is calculated. Following the notations used by Bhattacharyya et al. (1997; p. 335), let the input data for commercial banks be represented by $x^{ft} = (x_1^{ft},\dots,x_r^{ft},\dots,x_R^{ft}) \geq 0$; where $f = 1,2,\dots, F$ indexes banks, $t = 1,2,\dots, T$ indexes time periods, and $r = 1, 2, \dots, R$ indexes inputs that banks use. Let the output data be represented by $y^{ft} = (y_1^{ft},\dots,y_p^{ft},\dots,y_P^{ft}) \geq 0$; where $p = 1, 2,\dots, P$ indexes outputs that banks produce. The pooled production possibility set for all the years for all the banks in the sample can be expressed as:

$$
\begin{aligned}
S = \{ (y_p , x_r) : \\
y_p \leq \sum_{f=1}^{F} \sum_{t=1}^{T} \lambda^{ft} y_p^{ft} \quad , \qquad & p = 1,2,\ldots,P \\
x_r \geq \sum_{f=1}^{F} \sum_{t=1}^{T} \lambda^{ft} x_r^{ft} \quad , \qquad & r = 1,2,\ldots,R \\
\lambda^{ft} \geq 0 \quad , \qquad f = 1,2,\ldots,F ; \quad & t = 1,2,\ldots,T \\
\sum_{f=1}^{F} \sum_{t=1}^{T} \lambda^{ft} = 1 \}
\end{aligned}
\tag{6.1}
$$

where the λ^{ft} are intensity variables allowing the creation of convex combinations of observed (y^{ft}, x^{ft}). The production technology represented by S is assumed to display variable returns to scale. Like in chapter 5, we postulate that banks seek to maximise their outputs, given the inputs at their disposal. An output-oriented efficiency of each bank f in year t, EFF_{ft}, is calculated as the reciprocal of the solution to the DEA problem:

$$
\begin{aligned}
& Max\ \theta = [EFF_{ft}]^{-1} \\
& subject \quad to \\
& \theta y_p^{ft} \leq \sum_{f=1}^{F} \sum_{t=1}^{T} \lambda^{ft} y_p^{ft} \quad , \qquad p = 1,2,\ldots,P; \\
& \sum_{f=1}^{F} \sum_{t=1}^{T} \lambda^{ft} x_r^{ft} \quad \leq \ x_r^{ft} \ , \qquad r = 1,2,\ldots,R; \\
& \lambda^{ft} \geq 0 \quad , \qquad f = 1,2,\ldots,F \ ; \qquad t = 1,2,\ldots,T; \\
& \sum_{f=1}^{F} \sum_{t=1}^{T} \lambda^{ft} = 1
\end{aligned}
\tag{6.2}
$$

The above problem is solved once for each bank in each year. The optimal value of θ is the factor by which y^{ft} must be scaled up in order for a bank with data (x^{ft}, y^{ft}) to reach the grand frontier. Since $\theta \geq 1$, $0 \leq EFF_{ft} \leq 1$ (see Bhattacharyya et al., 1997; p. 335 and Thanassoulis, 2001). Like before, a bank with an efficiency score of 0.9, for instance, is considered as producing only 90% of the output that it should be producing if it were achieving the best-practice in the industry.

Step II - Regression analysis using the OLS and the GMM estimation

Once the efficiency of banks is measured during the post-ESRs period, our next step is to explore factors, including those associated with the ESRs, which may explain the variations in the measured efficiency using the following model:

$$EFF_{ft} = f(B_{Qft}, M_{Kt}) \qquad (6.3)$$

Where EFF_{ft} is the output-oriented technical efficiency of f-th banks in t-th time period; B_{Qft} is the set of Q bank-specific variables; M_{Kt} is the set of K macroeconomic variables. One feature of this model needs some explanation. Since EFF_{ft} is a variable ranging from 0 to 1 (1 being fully efficient), it is necessary to use a non-linear functional form for the above model that captures this characteristic of the efficiency scores (see Mester, 1993, 1996). In this regards, the logistical functional form has been used by the existing empirical studies[5]. Following Gumbau-Albert and Maudos (2002), we use the logistic functional form for (6.3):

[5] See Appendix 6.1 for a brief summary of the logistical functional form.

$$EFF_{ft} = \frac{e^{\gamma B_{Qft} + \varphi M_{Kt} + \mu_f + \upsilon_{ft}}}{1 + e^{\gamma B_{Qft} + \varphi M_{Kt} + \mu_f + \upsilon_{ft}}} \tag{6.4}$$

where γ and φ are the vectors of parameters to be estimated; μ_f are the individual bank effects; and υ_{ft} are white-noise error term. We can rewrite (6.4) as follows:

$$\ln \frac{EFF_{ft}}{1 - EFF_{ft}} = \Phi_{ft} = \gamma B_{Qft} + \varphi M_{Kt} + \mu_f + \upsilon_{ft} \tag{6.5}$$

where the term $\Phi_{ft} = (\ln \frac{EFF_{ft}}{1 - EFF_{ft}})$ is called the log-odds and could be used as a proxy for output-oriented technical efficiency (see Gumbau-Albert and Maudos, 2002).

As we mentioned above, our primary aim is to examine the impacts of fiscal deficits, investment liberalisation, competition, and foreign banks' presence on the efficiency of banks. Towards this end, the external environmental factors in our model include: fiscal deficits as a percentage of GDP (DEF), private investment as a percentage of GDP (PI); the Herfindahl index of concentration (HERF) representing the level of competition; and the share of foreign banks in total credit (FOR) representing the presence of foreign banks. In the case of Pakistan, domestic investment as a percentage of GDP (DI) is used because data on private investment are not available.

Besides the external environmental factors, the efficiency of banks may also vary due to internal bank-specific factors (see Berger and Mester, 1997; Hao et al., 2001; Casu and Molyneux, 2003; Hasan and Marton, 2003; Girardone et al., 2004). Based on the existing empirical studies, we specify the following four internal bank-specific factors (see Berger and Mester, 1997; Hao et al., 2001; Hasan and Marton, 2003): logarithm of total assets (TA) of each bank representing bank size; operating expenses as a ratio of total income (OE/TI); investments as a share of total assets (INVEST/TA); and return on assets (ROA). These internal bank-specific factors could enable us to determine the characteristics that distinguish efficient banks from the inefficient ones.

It should be noted here that we are not proposing any hypothesis regarding the direction of the relationship between the efficiency of banks and these bank-specific variables. For example, as we noted in chapter 5, size may have either a positive relationship (due possibly to larger banks' market power and ability to diversify risk) or a negative relationship (due possibly to complexity of the operation of larger banks) with the efficiency.

Besides these bank-specific variables, we also include the efficiency of the previous year (EFF1) as an independent variable. By including the lagged value of bank efficiency, we attempt to capture the dynamic nature of the efficiency of banks. That is, the efficiency of the previous year indicates a certain level of accumulated knowledge and technological endowment that may help banks to generate higher outputs with their inputs by adapting relatively quickly to the changes brought about by the ESRs. We, therefore, expect a positive relationship between the efficiency of the previous year and the efficiency of the present year.

We estimate the parameters of equation (6.5) using the OLS and the GMM estimation[6]. The use of the GMM is appropriate due to the possibility of endogenity in the above model. That is, as we noted in chapter 3, it is likely that the bank-specific factors that are used to explain variations in the efficiency of banks are endogenous (see Mester, 1993, 1996; Berger and Mester, 1997). The endogeneity of explanatory variables can make the coefficient estimates obtained through the traditional OLS estimation biased and inconsistent (see Berger and Mester, 1997; Judge et al., 1988; Greene 2000).

To take into account the possibility of endogeneity, following Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998), we apply the GMM framework to obtain first-differenced and system-GMM estimators[7]. Using the previous observations of variables, i.e. the time-series dimension of panel data, as instruments, the GMM framework takes into account the fact that explanatory variables may be endogenous or at least weakly exogenous, and provides unbiased coefficient estimates. This, therefore, makes our analysis about the impacts of bank-specific and macroeconomic variables on bank efficiency more reliable.

In the first-differenced GMM procedure, we treat bank-specific variables as endogenous, and, therefore, values of these variables lagged two periods or more are valid instruments. Macroeconomic variables are treated as at least weakly exogenous, and thus values of these variables lagged one period or more are valid instruments. The first-differenced GMM estimator, however, can suffer from serious efficiency loss, small sample biases and imprecision for there are potentially

[6] See Judge et al. (1988) for OLS and Greene (2000) for GMM.

[7] See Appendix 6.2

informative moment restrictions that are ignored (see Blundell and Bond, 1998). To improve the properties of the first-differenced GMM estimator, we use the system-GMM estimator. This estimator, in addition to the first-differenced instruments, employs lagged differences of bank-specific variables and differences of macroeconomic variables as instruments. It should be noted that time dummies are usually included in the GMM estimation to account for time-variant but individual-invariant factors. The inclusion of macroeconomic variables allows such dummies to be dropped from our estimation.

6.3.2 – Data

Like in chapter 5, we measure the efficiency of banks in India and Pakistan based on two input-output models. In Model A (Loan-based model), we postulate that banks incur operating and interest expenses to produce loans and advances, and investments. In Model B (Income-based model), banks incur operating and interest expenses to produce interest and non-interest income. The same data sets that were used in chapter 5 are used for the measurement of efficiency using the grand-frontier DEA. The data on the Herfindhal index and the share of foreign banks in total credit are from the chapter 4 of the present study. The data on fiscal deficits are obtained from the Key Indicator of the Asian Development Bank (2003). In the case of India, data on private investment are obtained from the Economic Surveys published by the Indian Ministry of Finance[8]. In the case of Pakistan, the data on domestic investment were obtained from the World Development Indicators (2003) published by the World Bank.

[8] Available at http://finmin.nic.in/

6.4 – Empirical findings

6.4.1 – The technical efficiency of Indian banks during 1992-1998

Table 6.1 presents the average variable returns to scale (VRS) technical efficiency scores for the banking industry in India during 1992-1998. Similar to the DEA results in the previous chapter, the grand-frontier DEA results suggest that the efficiency of the banking industry improved during the post-ESRs period. According to the results of Model A, the average efficiency of the whole banking industry improved from 60.69% in 1992 to 67.68% in 1998. Similarly, according to the results of Model B, the average efficiency of the whole banking industry improved from 75.56% in 1992 to 87.62% in 1998. The standard deviations for both the models suggest high variations in each of the sample year.

As in the previous chapter, the results in Table 6.1 suggest that on average the public sector banks were more efficient than private banks, according to the loan-based model (i.e. Model A), especially during the early years. This could be due to the fact that during the pre-ESRs era, the government of India imposed restrictions on the operations and entry of private sector banks. However, the results also suggest that this gap between the loan-based efficiency of public sector banks and private sector banks declined during the post-ESRs era. For example, in 1992, the loan-based efficiency gap between public sector banks and foreign banks was around 26%. This gap declined to around 14% in 1998. It could be argued that the changes in the economic environment brought about by the ESRs enabled private sector banks to enhance their resource utilisation in terms of the production of earning assets (i.e. loans and advances, and investments).

Table 6.1 – Technical efficiency of banks in India during 1992-1998

Panel I – VRS efficiency according to the loan-based model

	ABs		**PSBs**		**DPBs**		**FBs**	
	Mean	***StDev.***	***Mean***	***StDev.***	***Mean***	***StDev.***	***Mean***	***StDev.***
1992	60.69	22.65	79.48	11.65	46.80	20.30	52.92	20.05
1993	60.67	21.03	76.45	11.37	45.46	17.48	52.92	20.05
1994	70.50	21.40	83.62	10.18	58.59	23.00	75.02	19.84
1995	74.73	21.44	90.51	7.18	67.28	24.08	70.72	20.81
1996	67.08	21.36	84.03	8.24	62.89	21.51	66.98	23.67
1997	67.94	21.74	85.04	8.38	74.59	18.07	68.88	25.49
1998	67.68	25.27	87.38	7.21	80.36	19.50	73.82	25.19
1992-1994	***63.79***	***21.68***	***79.80***	***11.05***	***49.95***	***20.13***	***59.45***	***19.98***
1995-1998	***69.29***	***22.40***	***86.71***	***7.73***	***70.97***	***20.67***	***70.06***	***23.71***
1992-1998	***66.88***	***22.09***	***83.67***	***9.01***	***61.05***	***20.44***	***65.30***	***22.04***

Panel II – Panel I – VRS efficiency according to the income-based model

	ABs		**PSBs**		**DPBs**		**FBs**	
	Mean	***StDev.***	***Mean***	***StDev.***	***Mean***	***StDev.***	***Mean***	***StDev.***
1992	75.56	15.80	81.83	10.81	62.54	15.76	83.05	11.26
1993	70.82	14.63	74.51	12.13	57.90	9.72	81.15	11.52
1994	73.54	13.52	77.03	8.99	60.77	10.54	83.19	10.25
1995	75.87	14.65	78.23	13.39	65.22	14.02	82.35	11.90
1996	78.18	15.06	85.67	8.62	69.20	12.81	82.67	17.53
1997	78.74	13.80	86.87	7.45	69.60	11.80	84.00	14.66
1998	87.62	6.93	86.87	6.93	71.37	12.05	86.72	14.56
1992-1994	***73.28***	***14.62***	***76.78***	***10.57***	***60.37***	***11.73***	***82.46***	***11.00***
1995-1998	***79.98***	***12.05***	***84.34***	***8.79***	***68.81***	***12.64***	***83.92***	***14.53***
1992-1998	***77.04***	***13.09***	***81.01***	***9.51***	***65.06***	***12.24***	***83.29***	***12.89***

ABs= All Banks; PSBs= Public Sector Banks; DPBs= Domestic Private Banks; FBs= Foreign Banks
StDev.= standard deviation

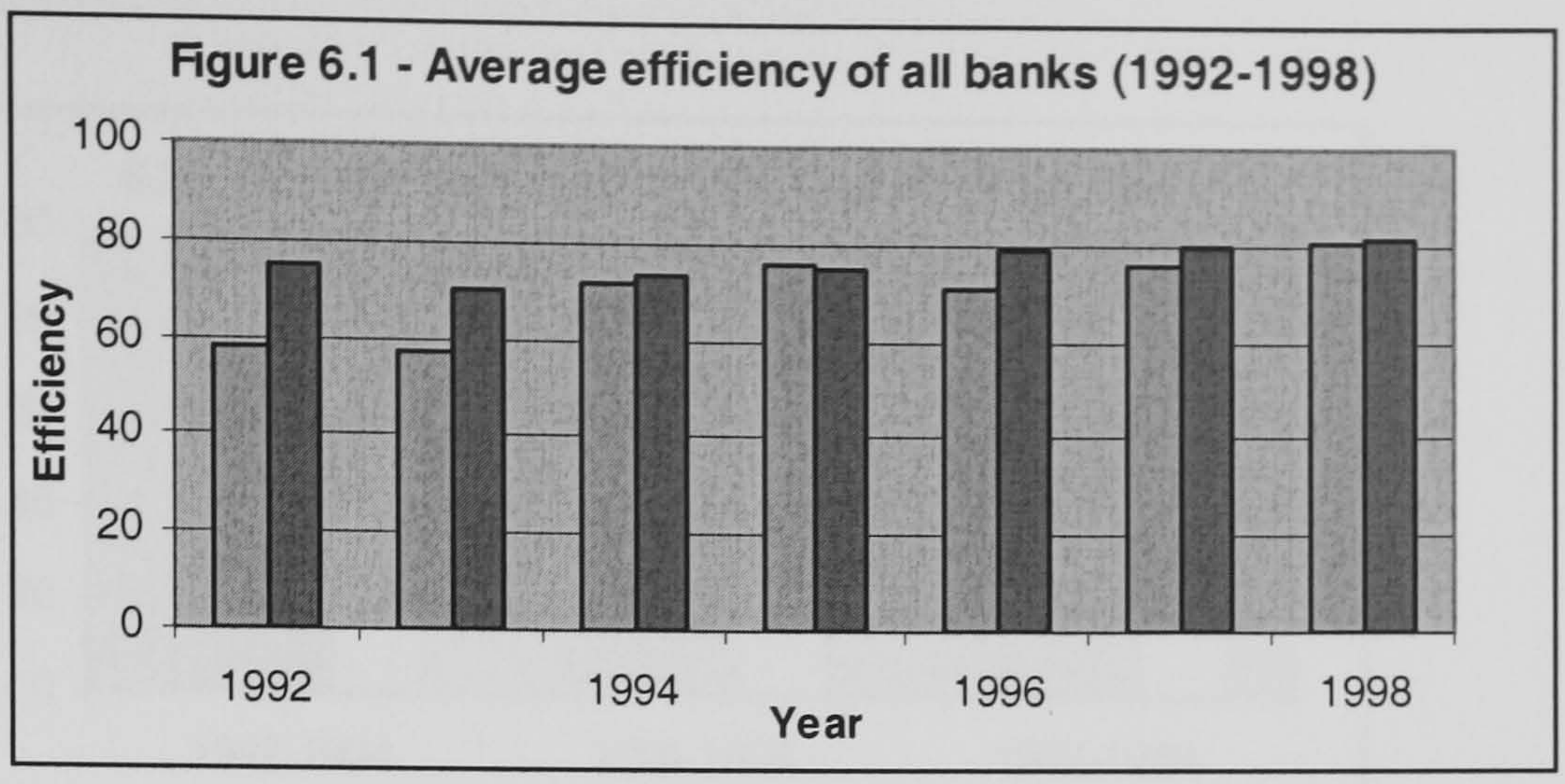


Figure 6.1 - Average efficiency of all banks (1992-1998)

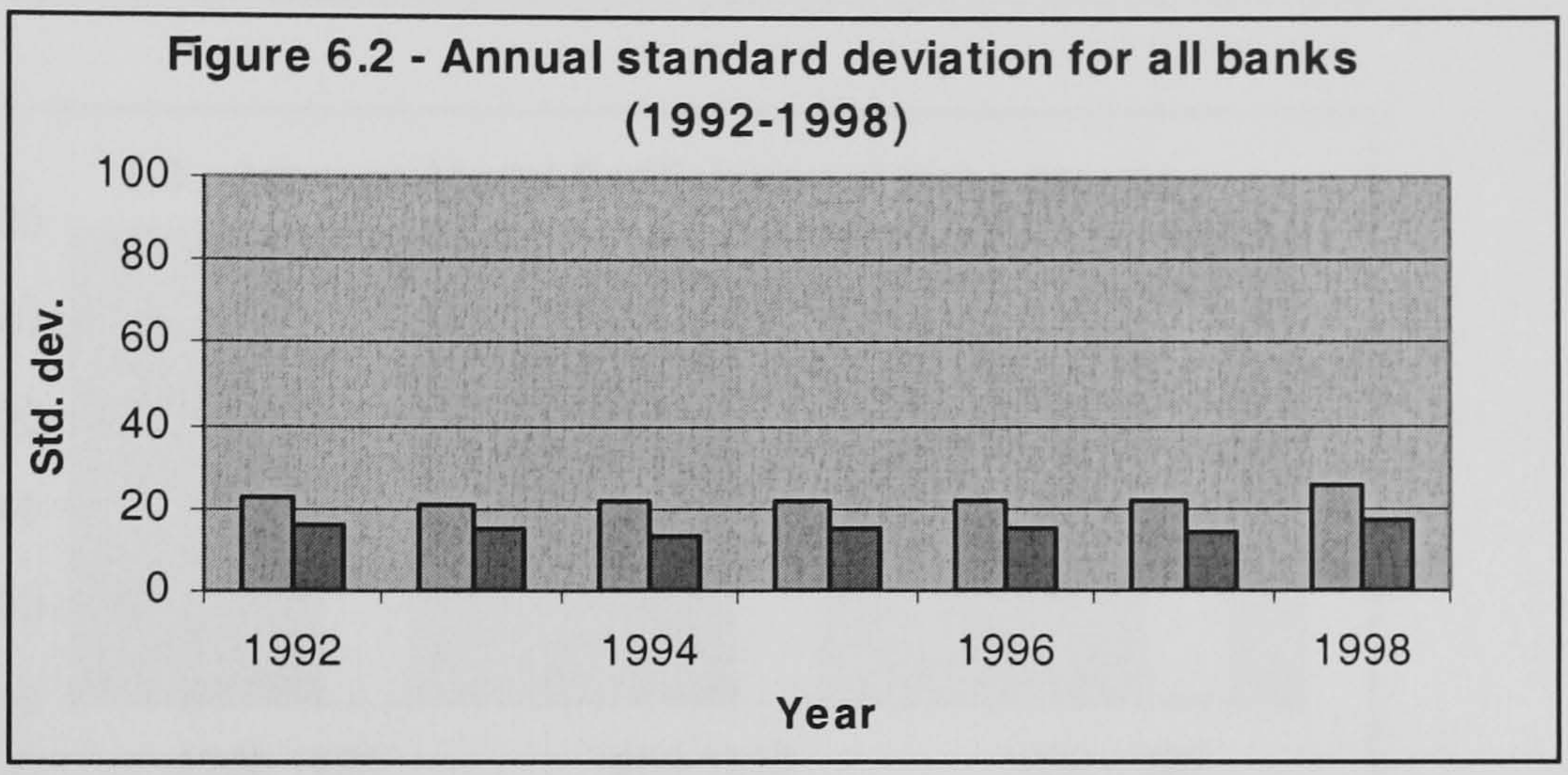
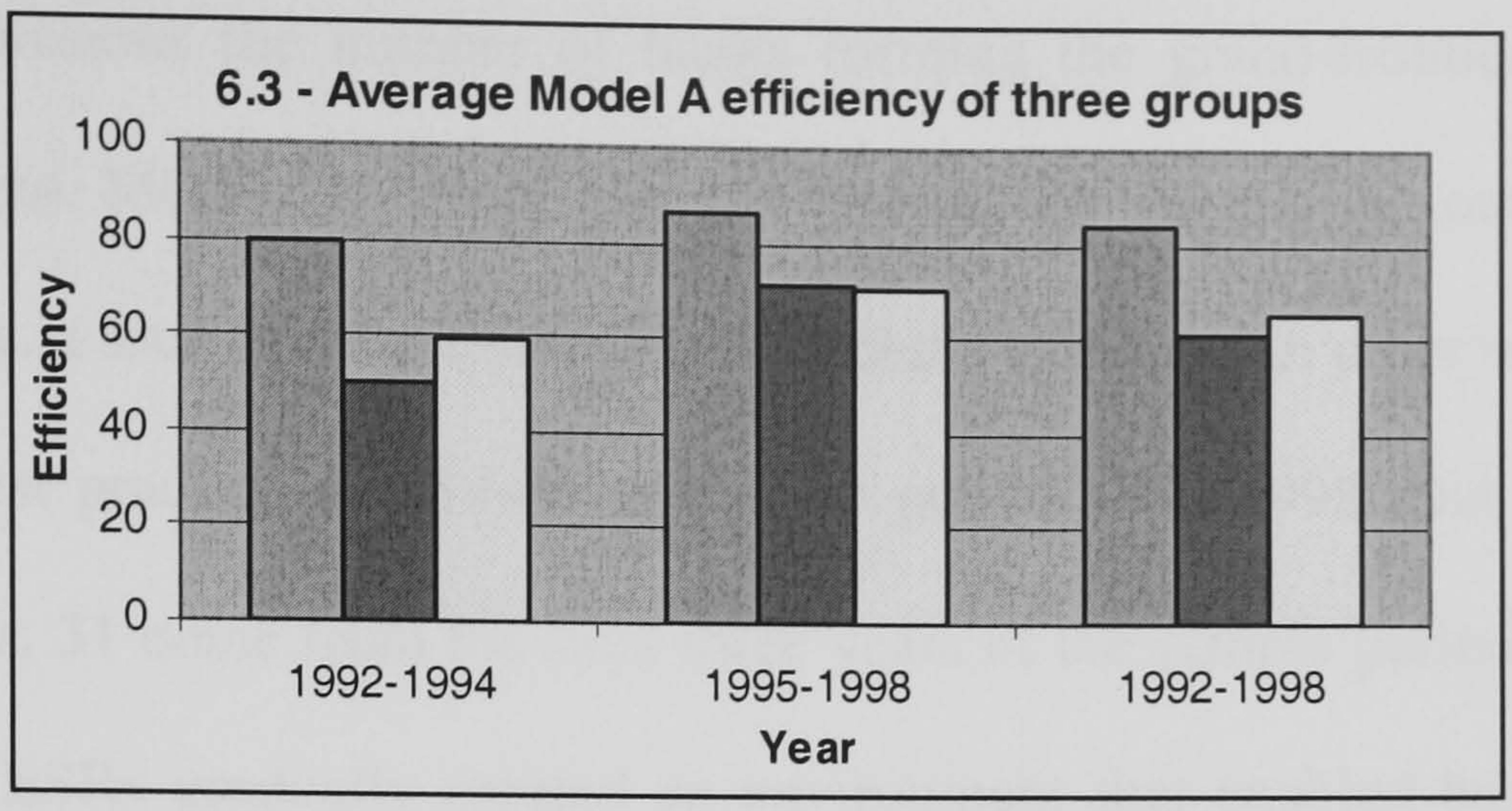
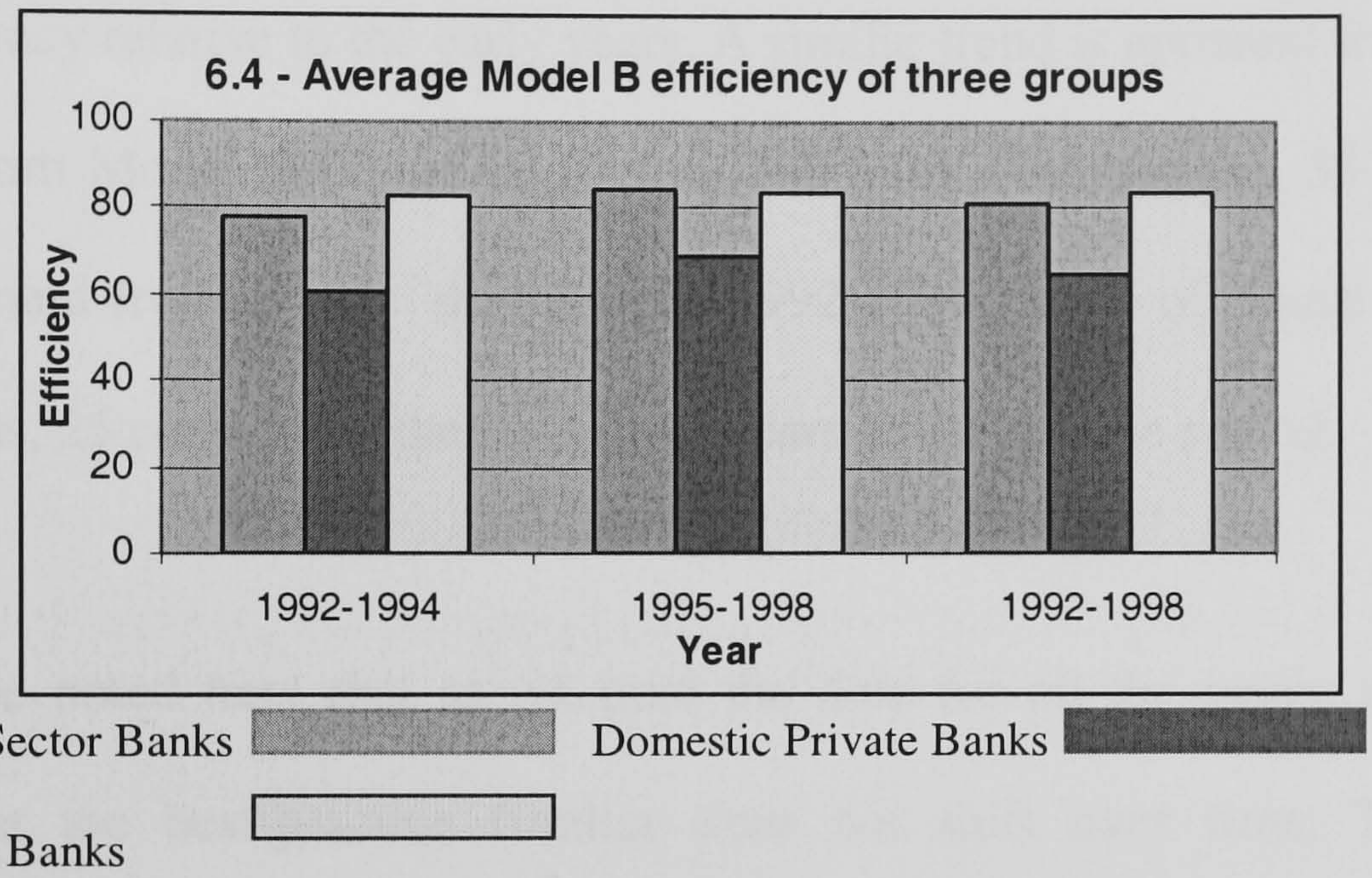


Figure 6.2 - Annual standard deviation for all banks (1992-1998)

DEA Model A ***DEA Model B***

The results of Model B are also consistent with our results in the previous chapter. We find that the efficiency of public sector banks is lower according to the income based-model as compared to the efficiency according to the loan-based model. On the other hand, the converse is true for private sector banks. As in the previous chapter, we argue that although public sector banks were relatively more efficient in generating loans and advances, due to higher ratio of non-performing loans, they were less successful in generating income from their earning assets. This is consistent with the condition prevailing in the Indian banking industry prior to the implementation of the ESRs when the key objective of public sector banks was not to produce revenues but to channel funds to the so-called priority sectors in the economy.





According to the results from both the models, public sector banks exhibit less variability in their performance than do domestic private and foreign banks. This finding is not surprising given the fact that public sector banks have similar organisational structures and managerial philosophies that are devised by the government. Private sector banks, both foreign and domestic, are expected to exhibit greater variability due to different ownership, and different management practices. This is specially the case for foreign banks, which exhibit the highest variability, perhaps due to the fact that they come from different countries that may lead to different management practices.

6.4.2 – Bhattacharyya et al. (1997) frontier bank approach

Table 6.2 presents the number of banks forming the grand-frontier for Model A (Panel I) and Model B (Panel II). In the case of Model A, out of 566 bank observations, a total of 42 are found to be radially efficient. In other words, 42 banks form the best practice grand-frontier for the period 1992-1998. Out of 42 efficient observations, 31 come from the final three years of the sample period. This suggests that as the ESRs gradually created an environment that enabled banks to improve their efficiency relative to the early years. A similar trend is apparent from the results obtained from Model B (Panel II). Out of 566 bank observations, 38 form the best practice grand-frontier for the period 1992-1998. Out of these 38 efficient observations, 25 come from the final three years of the sample period.

It should be noted here that as we pool the data for all the years, effectively we assume that the best-practice frontier does not shift over time. Therefore, the improvement in the efficiency – suggested by both improvements in average efficiency and identity of final years' observation forming the frontier – could be due to improvement in efficiency and/or improvement in the banking technology. Therefore, these results should be seen in conjunction with our Malmquist TFP indices (chapter 5), which suggest that the improvement in banks' performance was due to a mix of efficiency improvement (catching-up) and technological improvements.

Panel I in Table 6.2 reveals that during the initial years, public sector banks dominate the other two groups. However, during the last three years, all the three groups have almost equal participation in the best practice frontier. The results for Model B tell a different story. According to the results of Model B, foreign banks determine the best practices in the banking industry, especially during the last three years. This is consistent with the fact that foreign banks in India were relatively more successful in generating profits from their operation as compared to their domestic counterparts (see Chapter 4).

Table 6.2 – Frontier banks by ownership (1992-1998)

Panel I – Model A

Number of efficient banks

	1992	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*Total*
PSBs	-	2	2	2	3	3	5	17
DPBs	-	-	1		1	4	4	10
FBs	1	-	1	2	4	3	4	15
Total	1	2	4	4	8	10	13	42

Proportion of efficient banks % (number of efficient banks/total number of banks)

	1992	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*
PSBs	-	7.1	7.4	7.4	11.1	11.1	18.5
DPBs	-	-	4.2	0.0	3.0	11.8	11.8
FBs	4.3	-	4.5	8.0	15.4	10.7	14.3

Panel II – Model B

Number of efficient banks

	1992	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*Total*
PSBs	-	1	1	1	1	1	1	6
DPBs	1	-	-	1	2	-	1	5
FBs	1	3	2	2	6	6	7	27
Total	2	4	3	4	9	7	9	38

Proportion of efficient banks % (number of efficient banks/total number of banks)

	1992	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*
PSBs	-	3.6	3.7	3.7	3.7	3.7	3.7
DPBs	4.0	-	-	3.8	6.1	-	2.9
FBs	4.3	13.0	9.1	8.0	23.1	21.4	25.0

ABs= All Banks; PSBs= Public Sector Banks; DPBs= Domestic Private Banks; FBs= Foreign Banks

6.4.3 – Technical efficiency of Pakistani banks during 1992-1998

Table 6.3 presents the average VRS technical efficiency scores for the banking industry in Pakistan during 1992-1998. Similar to the DEA results in the previous chapter, the grand-frontier DEA results suggest that the efficiency of the banking industry improves during the post-ESRs period. According to the results of Model A, the average efficiency of the whole banking industry improved from 67.68% in 1992 to 73.40% in 1998. It should be noted, however, most of this improvement occurred in the last two years of the sample period. Similarly, according to the results of Model B, the average efficiency of the whole banking industry improved from 57.64% in 1992 to 70.22% in 1998.

Table 6.3 – Technical efficiency of banks in Pakistan during 1992-1998

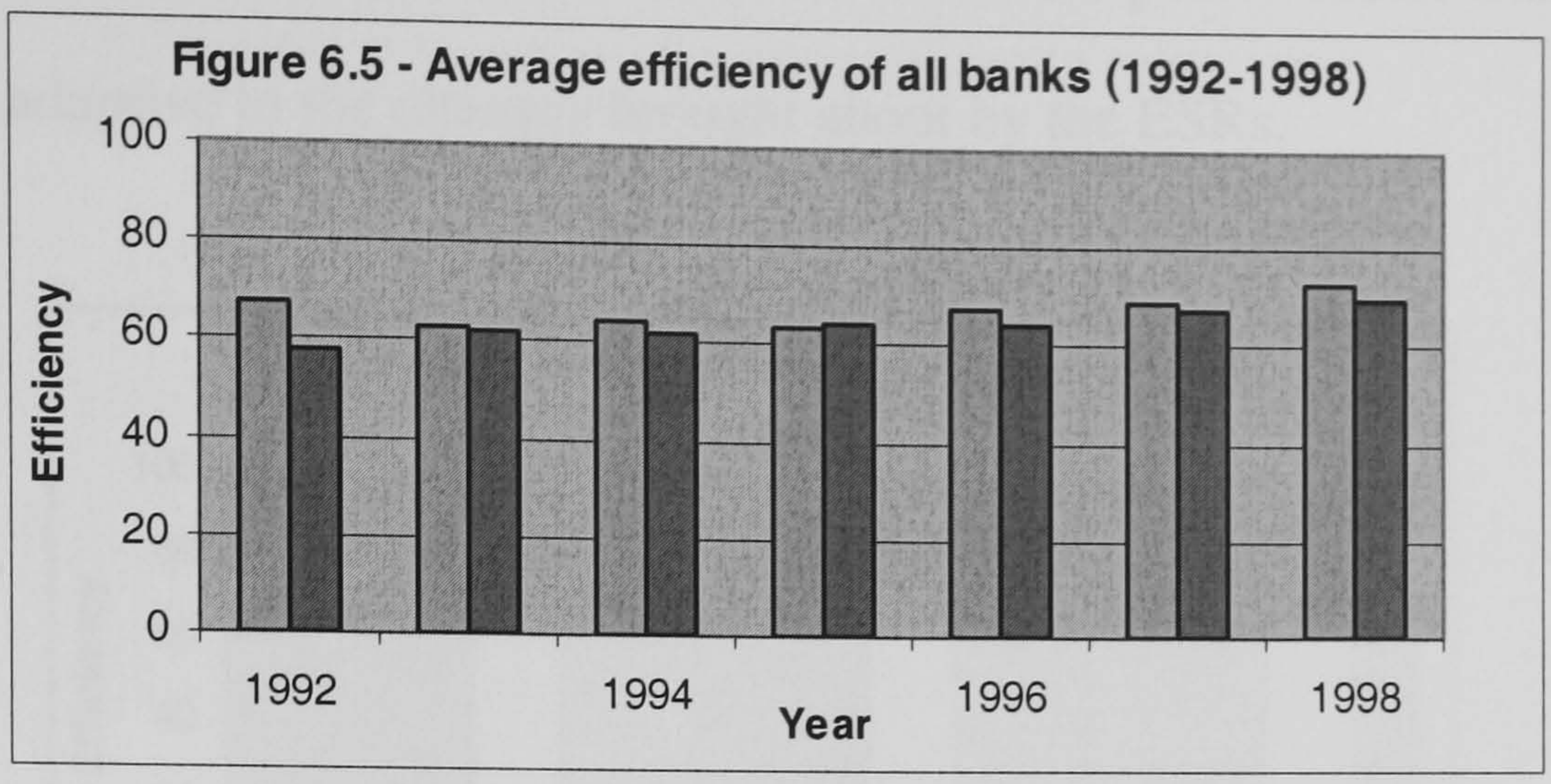
Panel I – VRS efficiency according to the loan-based model

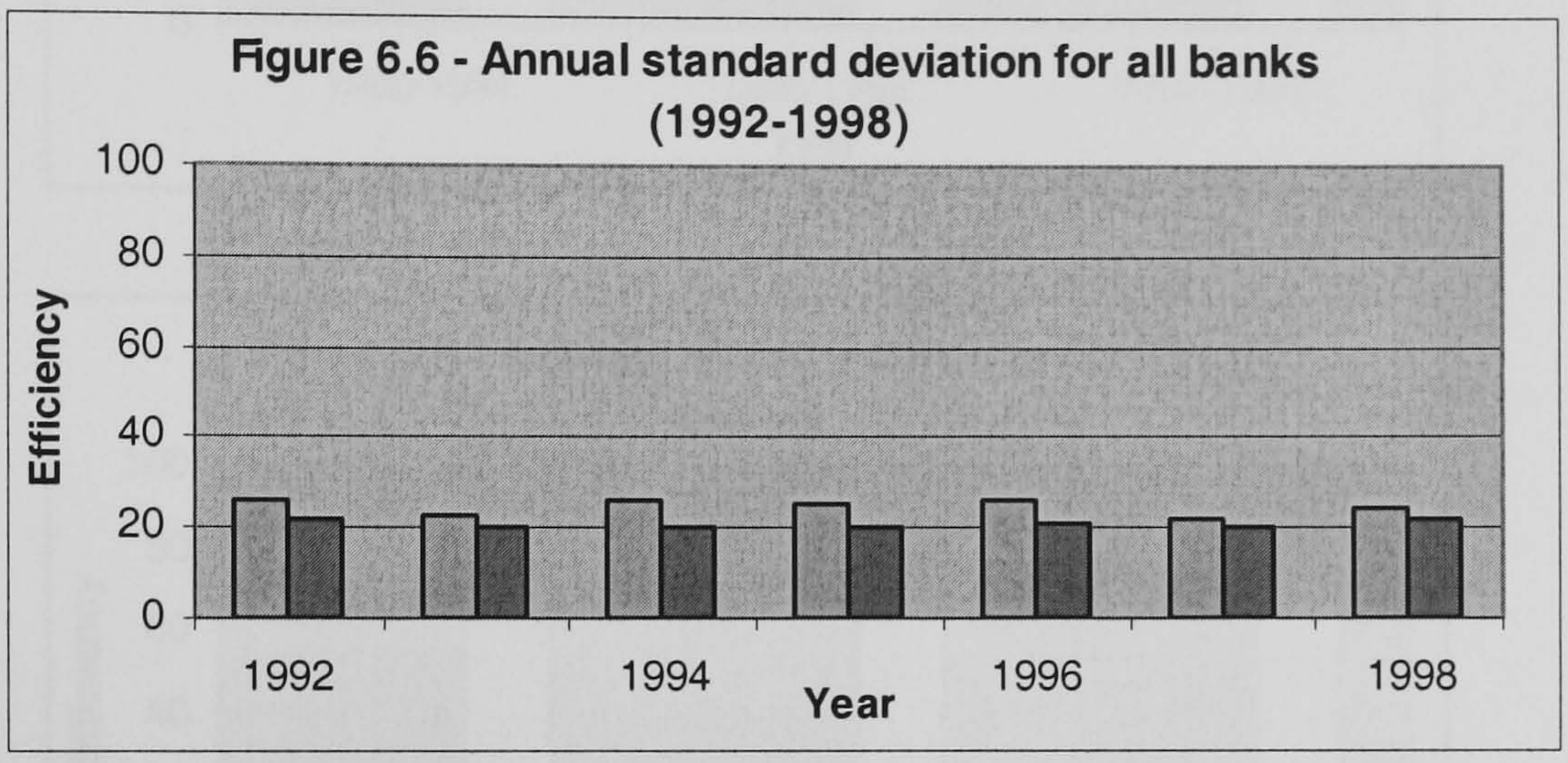
	ABs		PSBs		DPBs		FBs	
	Mean	*StDev.*	*Mean*	*StDev.*	*Mean*	*StDev.*	*Mean*	*StDev.*
1992	67.68	25.75	76.88	36.63	69.10	27.18	58.37	21.89
1993	63.05	22.89	71.78	37.85	54.63	17.14	63.93	22.33
1994	63.92	26.13	72.88	34.25	57.22	26.73	62.64	20.15
1995	63.74	24.93	64.65	40.85	57.92	24.88	69.16	19.95
1996	67.77	26.41	64.78	41.60	62.99	22.80	76.28	19.13
1997	68.99	21.92	60.88	29.50	72.32	18.05	74.59	20.11
1998	73.40	24.02	71.10	34.37	72.78	21.41	76.41	20.36
1992-1994	***64.89***	***24.92***	***73.84***	***36.24***	***60.31***	***23.68***	***61.65***	***21.46***
1995-1998	***68.48***	***24.32***	***65.35***	***36.58***	***66.51***	***21.79***	***74.11***	***19.89***
1992-1998	***66.94***	***24.58***	***68.99***	***36.44***	***63.85***	***22.60***	***68.77***	***20.56***

Panel II – Panel I – VRS efficiency according to the income-based model

	ABs		PSBs		DPBs		FBs	
	Mean	*StDev.*	*Mean*	*StDev.*	*Mean*	*StDev.*	*Mean*	*StDev.*
1992	57.64	21.68	55.28	14.36	48.12	18.61	72.01	20.13
1993	62.02	20.31	56.33	15.38	57.57	17.26	73.56	20.76
1994	62.21	20.43	55.30	17.81	59.97	20.82	72.58	19.11
1995	63.95	20.09	59.70	21.60	59.22	17.26	73.96	21.13
1996	64.07	20.65	57.35	31.56	61.39	17.48	74.69	19.98
1997	67.57	20.36	66.15	27.73	60.88	17.04	76.62	21.70
1998	70.22	21.86	68.85	27.93	63.52	18.95	79.17	20.54
1992-1994	***60.62***	***20.81***	***55.63***	***15.85***	***55.22***	***18.90***	***72.72***	***20.00***
1995-1998	***66.45***	***20.74***	***63.01***	***27.21***	***61.25***	***17.68***	***76.11***	***20.83***
1992-1998	***63.95***	***20.77***	***59.85***	***22.34***	***58.67***	***18.20***	***74.66***	***20.48***

ABs= All Banks; PSBs= Public Sector Banks; DPBs= Domestic Private Banks; FBs= Foreign Banks
StDev.= standard deviation





DEA Model A *DEA Model B*

As in the previous chapter, the results from Model A in Table 6.3 suggest that during the initial years, on average public sector banks were more efficient than the other two groups, i.e. foreign banks and domestic private banks. However, over the years, this gap between the loan-based efficiency of public sector banks and private sector banks declined during the post-ESRs era. For example, in 1992, the loan-based efficiency gap between public sector banks and foreign banks was around 18%. This gap virtually disappeared in 1998 when foreign banks attained higher efficiency than public sector banks. This should be compared with the experience in the Indian banking industry where although the gap between public and private sector banks gradually declined, the former maintained relatively higher efficiency in generating loans and advances with given operating and interest expenses. It could be argued that, compared with public sector banks in Pakistan, public sector banks in India were more adaptive to the changes brought about by the ESRs.

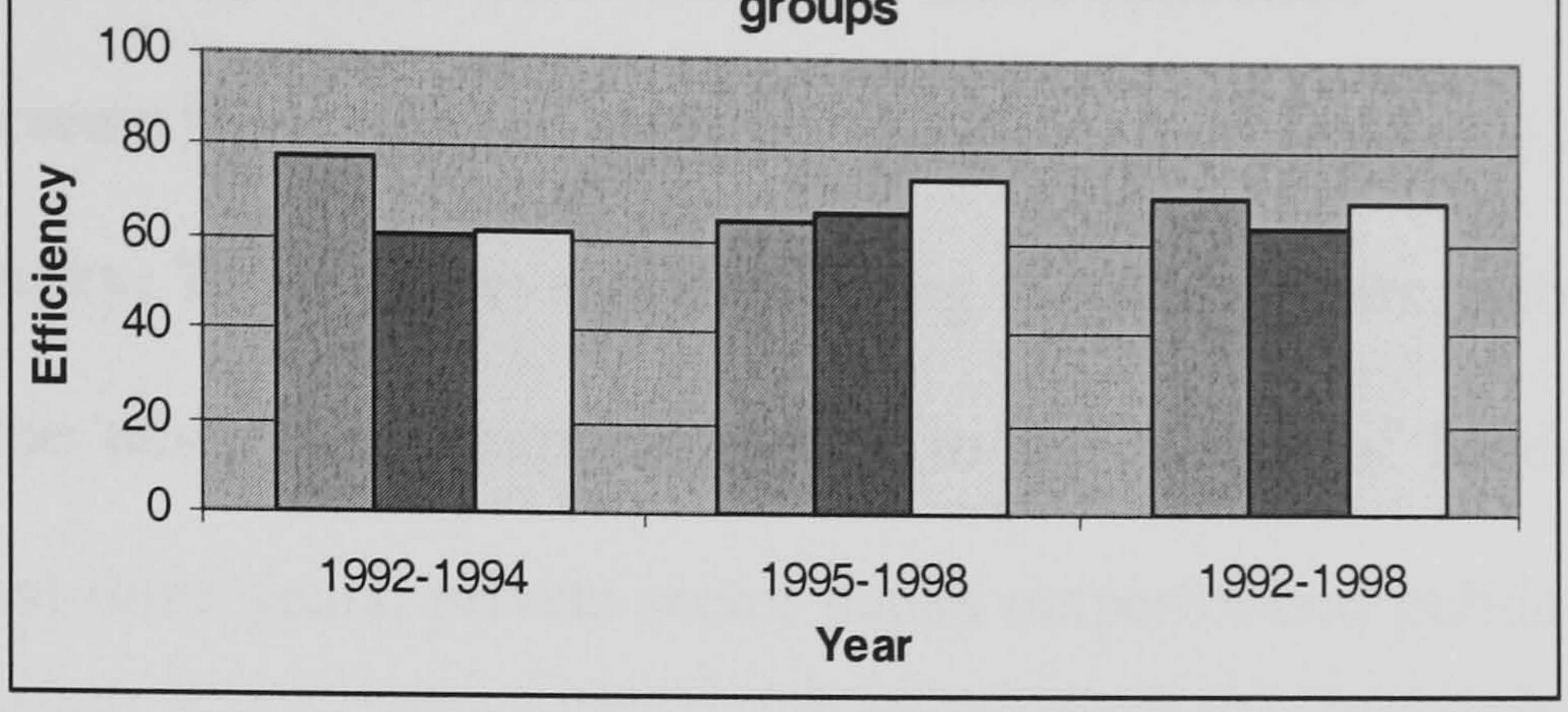


Figure 6.7 - Average Model A efficiency of three groups

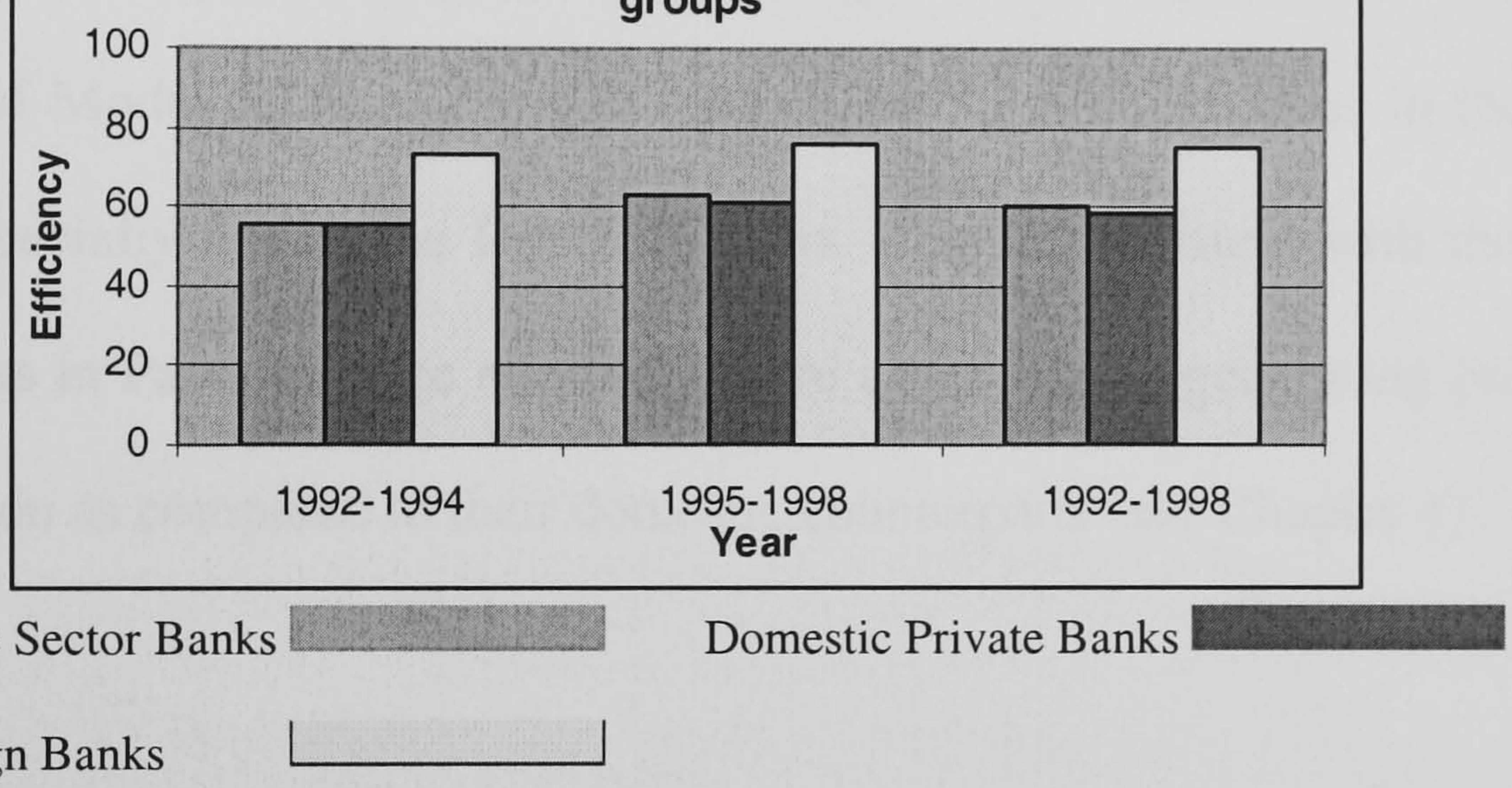


Figure 6.8 - Average Model B efficiency of three groups

The results of Model B in Table 6.3 are also consistent with our results in the previous chapter. We find that the efficiency of public sector banks was lower according to the income based-model as compared to the efficiency according to the loan-based model. As in the previous chapter, we argue that although public sector banks were relatively more efficient in generating loans and advances, the presence of large non-performing loans hindered their ability to translate this into generating higher income from their earning assets. As in the case of public sector banks in India, this is consistent with the condition prevailing in Pakistan prior to the implementation of the ESRs when the key objective of public sector banks was not to produce revenues but to channel funds to the so-called priority sectors in the economy.

6.4.4 – Bhattacharyya et al. (1997) frontier bank approach

Table 6.4 presents the number of banks forming the grand-frontier. Like in the Indian banking industry, Table 6.4 reveals that during the initial years, public sector banks dominated the other two groups according to the results of Model A. However, during the last three years, private sector banks outperformed public sector banks in terms of defining the best-practice frontier. The results for Model B reveal that public sector banks failed to produce according to the best-practices. According to the results of Model B, foreign banks determined the best practices in the banking industry, especially during the last three years. This is consistent with the fact that foreign banks in Pakistan were relatively more successful in generating profits from their operation as compared to their domestic counterparts (see Chapter 4).

Table 6.4 – Frontier banks by ownership (1992-1998)

Panel I – Model A

Number of efficient banks

	1992	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*Total*
PSBs		1	2	2	1	1	2	9
DPBs						2	3	5
FBs	1		1	1	3	3	3	12
Total	1	1	3	3	4	6	8	26

Proportion of efficient banks % (number of efficient banks/total number of banks)

	1992	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*Total*
PSBs		25.0	50.0	50.0	25.0	25.0	50.0	
DPBs						11.8	17.6	
FBs	5.6	0.0	5.6	5.6	15.8	16.7	16.7	

Panel II – Model B

Number of efficient banks

	1992	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*Total*
PSBs					1	1	1	3
DPBs		1	1		1	3	3	9
FBs	1	2	1	2	4	5	4	19
Total	1	3	2	2	6	9	8	31

Proportion of efficient banks % (number of efficient banks/total number of banks)

	1992	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*
PSBs					25.0	25.0	
DPBs		9.1	7.1	0.0	5.9	17.6	17.6
FBs	5.6	11.1	5.6	11.1	21.1	27.8	22.2

ABs= All Banks; PSBs= Public Sector Banks; DPBs= Domestic Private Banks; FBs= Foreign Banks

6.4.5 – Correlates of banks efficiency in India and Pakistan during 1992-1998

Table 6.5 and Table 6.6 report the estimation results for India and Pakistan, respectively, using the methods of pooled OLS, first-differenced GMM and system-GMM. Compared to the first-differenced and system-GMM estimates, there is a serious upward bias in the OLS estimates of the efficiency of the previous period, i.e. EFF1. This suggests the presence of bank-specific effects and endogeneity, which are not taken into account by the OLS method[9]. The results of the specification tests, i.e. Sargan test and m_1 and m_2 statistics, for the first-differenced and system-GMM estimators confirm the possibility of endogeneity of bank-specific variables and

[9] See Arellano and Bond (1991)

weak exogeneity of macroeconomic variables. Furthermore, these statistics also validate the use of instruments and thus the consistency of the GMM estimators. Results from the Sargan difference test justify the additional instruments, and, thus, the advantage of the system-GMM estimator over the first-differenced GMM estimator. Comparing the first-differenced- and the system-GMM estimates, we find a substantial improvement in precision in the latter (i.e. lower standard errors), which is the reason why the system GMM method is recommended by Blundell and Bond (1998). The inference in this section, therefore, is based upon the system-GMM estimates.

It should be noted again that the two input-output models (Model A and Model B) used to measure the efficiency of banks might represent different objectives of banks. Model A postulates that banks seek to mobilise financial resources to funds to borrowers, including those in the so-called priority sectors. Model B, on the other hand, could represent the profit maximisation objective of banks (see Leightner and Lovell, 1998). Also, it is important to note that outputs of Model B (i.e. income) depend largely on the outputs of Model A (i.e. loans and investment).

Table 6.5 – Regression analysis for India using OLS and GMM estimation

	Model A			Model B		
	OLS	GMM (Level)	GMM (System)	OLS	GMM (Level)	GMM (System)
EFF1	0.540 (0.063)***	0.326 (0.113)***	0.396 (0.105)***	0.610 (0.057)***	0.091 (0.119)	0.376 (0.085)***
TA	0.045 (0.008)***	0.122 (0.055)**	0.053 (0.017)***	0.022 (0.005)***	-0.044 (0.081)	0.029 (0.010)***
OE/TI	-0.035 (0.025)	-0.003 (0.116)	-0.189 (0.103)*	-0.173 (0.116)	0.132 (0.266)	-0.302 (0.104)***
INVEST/TA	0.284 (0.097)***	0.735 (0.211)***	0.520 (0.182)***	0.004 (0.084)	-0.112 (0.171)	-0.220 (0.180)
ROA	-0.927 (0.293)***	-2.657 (0.958)***	-1.306 (0.637)**	0.861 (0.304)***	0.809 (0.733)	0.498 (0.437)
DEF	0.017 (0.019)	0.00008 (0.062)	-0.094 (0.054)*	-0.129 (0.070)*	0.048 (0.147)	-0.182 (0.057)***
PI	0.021 (0.006)***	0.014 (0.023)	-0.011 (0.012)	-0.018 (0.017)	0.024 (0.039)	-0.031 (0.013)**
HERF	0.0007 (0.0002)**	0.0008 (0.001)	-0.0004 (0.0004)	-0.0007 (0.0006)	0.001 (0.001)	-0.001 (0.0004)**
FOR	2.038 (2.080)	-0.391 (5.915)	-9.686 (5.764)*	-11.628 (7.502)	5.139 (14.39)	-17.372 (5.999)***
Sargan test		$\chi^2(76) =$ 51.19	$\chi^2(125) =$ 63.47		$\chi^2(76) =$ 50.10	$\chi^2(125) =$ 69.62
m_1		-2.542**	-2.913***		-2.137*	-2.734***
m_2		-1.386	-1.347		-0.386	0.537
Sargan Difference			$\chi^2(49) =$ 12.28			$\chi^2(49) =$ 19.52

Note: Asymptotic standard errors, asymptotically robust to heteroskedasticity, are reported in parentheses. Sargan is a test of the over-identifying restrictions, asymptotically distributed as χ^2 under the null of instrument validity, with degrees of freedom reported in parentheses. m_1 and m_2 are tests for first-order and second-order serial correlation in the first-differenced residuals, asymptotically distributed as N(0,1) under the null hypothesis of no serial correlation. Sargan Difference is a test for the validity of the additional moment restrictions, asymptotically distributed as χ^2 under the null of instrument validity, with degrees of freedom reported in parentheses.

* ,** ,*** suggests the coefficients are significant at 10%, 5%, and 1%, respectively.

Table 6.6 – Regression analysis for Pakistan using OLS and GMM estimation

	Model A			Model B		
	OLS	**GMM (Level)**	**GMM (System)**	**OLS**	**GMM (Level)**	**GMM (System)**
EFF1	-0.556 (0.070)***	-1.170 (0.893)	-0.808 (0.473)*	0.810 (0.058)***	-0.252 (1.097)	0.767 (0.337)**
TA	-0.093 (0.048)**	0.028 (0.031)	-0.035 (0.020)*	0.161 (0.092)**	-0.082 (0.096)	-0.086 (0.041)**
OE/TI	0.006 (0.007)	0.447 (1.04)	0.453 (0.329)	-0.0006 (0.017)	-0.131 (0.159)	-0.108 (0.087)
INVEST/TA	0.045 (0.156)	-4.407 (5.486)	-0.357 (0.955)	0.165 (0.092)*	1.286 (1.522)	-0.463 (0.309)
ROA	0.254 (0.297)	-2.166 (5.176)	-3.045 (1.011)***	0.508 (0.340)	-0.876 (1.434)	0.064 (1.026)
DEF	-0.012 (0.030)	-0.068 (0.115)	-0.039 (0.022)*	0.008 (0.019)	-0.024 (0.043)	-0.023 (0.012)**
DI	0.022 (0.062)	-0.935 (1.064)	0.093 (0.104)	-0.009 (0.030)	0.171 (0.239)	-0.054 (0.041)
HERF	0.00003 (0.0002)	-0.009 (0.011)	0.0004 (0.001)	0.0001 (0.0001)	0.002 (0.002)	-0.00016 (0.0001)
FOR	0.011 (0.009)	-0.469 (0.540)	-0.038 (0.019)**	0.002 (0.009)	0.093 (0.113)	-0.020 (0.011)**
Sargan test		χ^2 (76) = 31.05	χ^2 (125) = 34.31		χ^2 (76) = 24.24	χ^2 (125) = 28.98
m_1		-1.820*	-2.179**		-1.606	-2.494**
m_2		0.429	0.836		-1.641	-1.927*
Sargan Difference			χ^2 (49) = 3.26			χ^2 (49) = 4.74

Note: Asymptotic standard errors, asymptotically robust to heteroskedasticity, are reported in parentheses. Sargan is a test of the over-identifying restrictions, asymptotically distributed as χ^2 under the null of instrument validity, with degrees of freedom reported in parentheses. m_1 and m_2 are tests for first-order and second-order serial correlation in the first-differenced residuals, asymptotically distributed as N(0,1) under the null hypothesis of no serial correlation. Sargan Difference is a test for the validity of the additional moment restrictions, asymptotically distributed as χ^2 under the null of instrument validity, with degrees of freedom reported in parentheses.
* ,** ,*** suggests the coefficients are significant at 10%, 5%, and 1%, respectively.

Table 6.5 and Table 6.6 show that some of the bank-specific factors could explain the variations in the efficiency of the Indian and Pakistani commercial banking industry. That is, some bank-specific factors describe the characteristics of relatively more efficient banks during the sample period. In the case of India, the efficiency of the previous period is significantly and positively related to the efficiency of the current year in both the models. This suggests that banks that were more efficient in making loans and investment and generating income in the past tend to be relatively more efficient in the current period. As mentioned above, the efficiency of the previous year may represent a certain level of accumulated knowledge and technological endowment that may help banks to generate higher outputs with their inputs by adapting relatively quickly to the changes brought about by the ESRs. Therefore, in the case of India, it could be argued that more efficient banks in the previous year are more likely to adapt to the changes in the present year. This result could also be seen in conjunction with the fourth consistency condition proposed by Bauer et al. (1998) outlined in chapter 3 (p. 66) of the present study. Bauer et al. (1998) suggest that a useful approach of measuring the efficiency of banks should demonstrate reasonable stability over time. That is, an efficient bank this year should exhibit higher efficiency in the following year.

On the other hand, in the case of Model A for the Pakistani banking industry, we find a negative relationship between the efficiency of the previous year and the efficiency of this year. It could be argued that our results do not meet the above consistency condition of Bauer et al. (1998). However, we argue that this negative relationship exhibits the prevailing situation in the Pakistani banking industry. As our results suggest, at the start of the ESRs, public sector banks were relatively more efficient than private sector banks in generating earning assets. With government's restrictions on private sector banks, these banks were able to generate higher earning assets with their given inputs especially when private sector banks were not allowed to hold government securities (a key output in Model A) during the pre-ESRs period. After the implementation of the ESRs, these banks gradually became less efficient than private sector banks. In the case of Pakistan, therefore, it could be argued that the knowledge that these banks accumulated was not very useful to adapt to a more market-oriented environment in the post-ESRs period. In Model B (i.e. income-base model), the efficiency of the previous year does have the expected positive relationship. This is consistent with our results that suggest that foreign banks have consistently outperformed the other two groups in terms of the income-based efficiency.

We find different results in the two countries regarding the relationship between bank size and bank efficiency. In the case of India, we find a positive relationship between the size and efficiency of banks in both the input-output models. On the other hand, a negative relationship between bank size and efficiency is found in Pakistan. Recent empirical studies have also found different size-efficiency relationship for different countries. Berger and Mester (1997) note that no consistent picture emerges about the relationship between size and efficiency. For example, as we mentioned in chapter 5, some studies on developing countries such as Turkey and Taiwan (see Yildirim, 2000 and Huang, 2000) find a positive relationship, while other (e.g. Leong and Dollery, 2002) find a negative relationship between size and efficiency. In both India and Pakistan, the larger bank group primarily constitutes public sector banks. In the case of India, where there were twenty eight public sector banks dominating the market at the start of the ESRs, it could be argued that their size was not too big to hamper their ability to adapt. On the other hand, in Pakistan there were only five large public sector banks dominating the market at the start of the ESRs. It could be argued that these banks became too large and complex to quickly adapt to the changing environment. That could be the reason why the negative relationship between size and efficiency is found in Pakistan.

We find that investments as a ratio of total assets does not have a significant relationship with bank efficiency in Pakistan. In the case of India, on the other hand, higher investments as a ratio of total assets is associated with higher efficiency in Model A and lower efficiency in Model B (although in model B this variable is insignificant). This is consistent with the analysis of Chapter 4 that there is an increase in investment in riskless government securities in the banking industry. This enabled banks to generate more earning assets. However, the negative impact on the income-based efficiency might be because an increase in investments substitutes banks' resources away from higher-earning, albeit riskier, loans and advances.

In the case of India, a negative relationship between the ratio of operating expenses to income is found. Regarding the return on asset, in the case of Model A, high ROA is negatively related to bank efficiency, while a positive relationship is found between ROA and bank efficiency in Model A. These results suggest that more profitable banks are better able to generate revenues from their operations than less profitable banks.

As mentioned earlier, the primary aim of this chapter is to examine the relationship between the efficiency of banks and four external environmental factors associated with the ESRs in India and Pakistan. As we hypothesised in section 6.2, we find that fiscal deficits as a percentage of GDP have a negative relationship with bank efficiency in both the models in India and Pakistan. Therefore, as we outlined earlier, it could be argued that the government needs to implement fiscal reforms that curtail the level of fiscal deficits so that it can lower its reliance on the loanable funds mobilised by the banking industry. This, in turn, may have a positive impact on banks' ability to enhance their resources utilisation in mobilising scarce financial resources in the economy and transforming these resources into high earning assets.

In the case of India, private investment as percentage of GDP does not have the hypothesised impact. It has a negative, but insignificant, coefficient in Model A, and a negative and significant coefficient in the case of Model B. This could be explained by the on-going problem of the non-performing loans (NPLs) of the banking industry (see Chapter 4). Although private investment could augment the demand for banking services, the volume of gross NPLs increased during the period of our study. This problem therefore undermined the loan-based and especially the income-based efficiency of banks. Furthermore, banks invested more in government securities during the pos-ESRs period perhaps to shield against the risk brought about by the changes in the economic environment due to the ESRs. Private investment, therefore, has not positively influenced banks' efficiency the way we expected.

In the case of India, we find that the coefficient of the Herfindahl index (HERF) of market concentration is negative in both Models A and B, supporting the hypothesis of a positive relationship between banks' efficiency and the level of competition. The impact of this variable is significant and stronger in Model B, suggesting that in a more competitive environment banks are not only under pressure to generate loans and investment but also to keep cost down to generate higher income. In the case of Pakistan, we do not find any significant relationship between the level of competition and bank efficiency in any of the input-output models.

In India, the presence of foreign banks in the market is found to have a negative and significant relationship with both loan-based and income-based efficiency. The negative impact of increased presence of foreign banks is stronger in the income-based model. Following Lensink and Hermes' (2004) proposition, it could be argued that the Indian banking industry is still less developed where the entry of foreign banks leads to an increase in costs in the short-run. Thus, a positive relationship between the entry of foreign banks and efficiency is not realised during the sample period examined. A similar significant negative result is found in the Pakistani banking industry.

6.5 – Summary and conclusion

This chapter augments the analysis of chapter 5 in two ways. First, instead of an annual frontier for each year, we construct a grand-frontier using the pooled input-output data for all the post-ESRs years. This approach provides us a trend in the efficiency of banks in India and Pakistan. We find that the efficiency of the banking industry in both the countries improved during the post-ESRs era. In India, this improvement was due to the improvement in the efficiency of all three ownership groups, namely, public sector banks, domestic private banks, and foreign banks. On the other hand, in the case of Pakistan, improvement in the efficiency of the banking industry was primarily due to the improvement in the efficiency of private sector banks (especially that of foreign banks).

A key objective of this chapter is to examine the relationship between bank efficiency and four factors associated with the ESRs. These factors are: fiscal deficits, private investment, competition, and the presence of foreign banks in the banking industry. We find that fiscal deficits have a negative relationship with banks' efficiency. We argue that the authorities in both India and Pakistan need to lower their fiscal deficits so that they can reduce their reliance on the mobilised funds of the banking industry.

In the case of India, we find that the increased level of competition, brought about by the financial liberalisation, has a positive relationship with banks' efficiency. In the case of Pakistan, we failed to support the proposition that increased competition positively influences banks' efficiency. Furthermore, the presence of foreign banks has a negative relationship with the efficiency of banks. Following Lensink and Hermes (2004), it could be argued that the banking industry in India and Pakistan is still underdeveloped, and, therefore, an increased participation of foreign banks has increased costs in the short-run.

Chapter 7 – Summary, Conclusions, and the Limitations of the Study

7.1 – Summary and key findings

Like many other developing countries, India and Pakistan launched a programme of economic and structural reforms (ESRs) in the early 1990s in areas including industry, trade, exchange rate, foreign investment, tax policy, government expenditures, and the financial sector. The objective of these ESRs was to reduce pervasive state-directed resource allocation and to make the economy more market friendly.

The financial liberalisation programme, a key element of the ESRs, includes: freeing up exchange and interest rates controls, reducing state-determined credit policies, privatising public sector banks, relaxing entry restrictions on new domestic private banks and non-bank financial institutions, eliminating restrictions on the entry and operations of foreign banks, lowering banks' required reserve ratio, and liberalising the capital account.

Prior to the financial liberalisation, to provide scarce financial resource to the so-called socially optimal sectors (e.g. agriculture), governments decided the *direction* and *price* of financial resources mobilised by the banking industry. However, by the end of the 1980s, the policy of excessive government interventions confronted strong criticism. It was argued that the government interventions had repressed the domestic financial system, and made this sector inefficient in mobilising and allocating scarce financial resources.

In this context, an important objective of the financial liberalisation programme is to enhance the efficiency of financial institutions, especially that of commercial banks, in utilising their resources so that these institutions can foster the process of economic growth by intermediating more efficiently between savers and borrowers. It is argued that the increased level of competition and reduced government intervention, brought about by the financial liberalisation, would encourage and enable commercial banks in India and Pakistan to enhance their efficiency. The emphasis on the commercial banking industry is due to the fact that in India and Pakistan, like in other developing countries, most of the intermediation between savers and borrowers is conducted by commercial banks; other financial institutions and markets play a relatively insignificant role in channelling financial resources to the real sector.

The ESRs, especially the financial liberalisation programme, transformed the economic environment in which commercial banks in India and Pakistan operate. For example, prior to 1992, public sector banks in India and Pakistan controlled above 92% of the total assets of the banking industry. This percentage declined gradually during the post-ESRs era after the authorities in India and Pakistan lowered the restrictions on the entry and operations of private sector banks. Also, to give banks more freedom over their asset portfolios, and to release banks' loanable funds, statutory liquidity reserves and cash reserve ratios gradually declined after 1992-

1993. Furthermore, banks were granted more flexibility in terms of determining interest rates on their loans and deposits.

With these changes in mind, the present study attempts to examine the efficiency of banks in India and Pakistan during the 1990s. The key objective is to examine whether the efficiency of banks has improved after the implementation of the financial liberalisation programme in 1990-1992. Towards this end, following the empirical literature on developed and developing economies, we employ non-parametric data envelopment analysis to measure the efficiency of banks in India and Pakistan during 1990-1998. In addition, we employ the ordinary least squares estimation and the generalised method of moments estimation to determine factors (environmental and bank-specific) that may explain variations in the measured efficiency of banks during the post-ESRs period.

Referring to the research questions outlined in chapter 1 of the present study (p. 4), we find that the banking industry in both India and Pakistan exhibits considerable technical inefficiencies. For example, according to our results in chapter 5, the average variable returns to scale efficiency of the Indian banking industry during 1990-1998 was around 87% (Model A) and 85% (Model B). In the case of Pakistan, the average variable returns to scale efficiency of the Pakistani banking industry was around 80% (Model A) and 79% (Model B). Therefore, in the case of India, an average bank could improve its efficiency by at least 11%. On the other hand, in the case of Pakistan, an average bank could improve its efficiency by at least 18%. This improvement in efficiency could lead to a more efficient intermediation as banks would be able to channel more funds from savers to borrowers with their given resources.

We find that the efficiency of banks in India improved gradually during the post-ESRs period. This may suggest that the Government of India was successful in achieving the key objective of the financial liberalisation programme. For example, referring to the grand-frontier results in chapter 6, we find that the average efficiency of the Indian banking industry improved from 60% (Model A) and 75% (Model B) in 1992 to around 67% (Model A) and 87% (Model B). This improvement in the average efficiency of the Indian banking industry was due to improvement in the efficiency of all three ownership groups, namely, public sector banks, domestic private banks, and foreign banks.

Similarly, the average efficiency of the Pakistani banking industry improved from 67% (Model A) and 57% (Model B) in 1992 to 73% (Model A) and 70% (Model B) in 1998. However, unlike in India, the improvement in the efficiency of the banking industry in Pakistan was due primarily to the improvement in the efficiency of private sector banks, especially that of foreign banks. Large public sector banks achieved insignificant improvement in their efficiency. Therefore, it could be argued that although both the countries followed very similar policies, the liberalisation regime in Pakistan was not very successful in encouraging and enabling public sector banks to enhance their resource utilisation.

In both the countries, our findings suggest that foreign banks attained the highest improvement in their efficiency. In addition, the decomposition of total factor productivity change into efficiency change and technological change using the Malmquist total factor productivity index in chapter 5 suggests that the improvements in the performance of foreign banks were due to both efficiency improvements and technological improvements. Public sector banks in India also witnessed technological improvements and efficiency improvement during the more recent years (i.e. 1996-1998). On the other hand, public sector banks in Pakistan only experienced some efficiency improvements but no technological improvements. These findings may suggest that public sector banks were slow in adopting new banking technologies (e.g. automated teller machines). In the case of India, a recent study by the Reserve Bank of India[1], substantiates our conclusion by pointing out that the average IT expenditures as a percentage of total expenses during 1996-2000 in public sector banks, domestic private banks, and foreign banks were 4.5%, 7%, and 8.6%, respectively.

Once the variations in the efficiency of banks are obtained through the data envelopment analysis, the present study then attempts to determine factors that may explain these measured variations. Using the generalised method of moments, we find a positive relationship between bank size and efficiency in the case of India. On the other hand, in the case of Pakistan, we find a negative relationship. Also, in the case of India, the efficiency of the previous year positively influences the efficiency of the present years. Again, in the case of Pakistan, a negative relationship is found. We submitted that the efficiency of the previous year could indicate a certain level of

[1] Cited on page 197 of the present study.

accumulated knowledge and technological endowment that may help banks to generate higher outputs with their inputs by adapting relatively quickly to the changes brought about by the ESRs. Following this line of reasoning, it could be argued that the knowledge that Indian banks accumulated enabled them to adapt to the changing environment. In the case of Pakistan, this was not the case.

We also proposed, and tested, hypotheses regarding the possibility of a relationship between bank efficiency and four factors associated with the ESRs. In both the countries, we find a negative relationship between the efficiency of banks and government's fiscal deficits. We proposed that high fiscal deficits negatively influence bank efficiency because they lead governments in developing countries to impose restrictions on banks (e.g. high cash reserve ratios and statutory liquidity reserves) that hamper banks' ability to mobilise funds and to transform these funds into higher earning assets.

In the case of India, we also find a positive relationship between the level of competition and bank efficiency. This substantiates the claim of the Reserve Bank of India that a more competitive banking industry due to the financial liberalisation would encourage banks to exert greater effort to enhance their resource utilisation. In the case of Pakistan, we failed to find any significant relationship between bank efficiency and competition.

In the light of the findings of the present study, it could be argued that the financial liberalisation programme in India during 1990-1998 was successful in enhancing the efficiency of banks. The implementation of the liberalisation programme enabled private sector banks to catch up with dominant public sector banks by enhancing their efficiency and by adopting new technology. Public sector banks also responded, albeit gradually, by investing in new banking technology. However, in the case of Pakistan, though private sector banks witnessed efficiency improvement, there were limited (or no) improvements in the efficiency of public sector banks. We propose that the most important issue for the banking industry in both the countries is to tackle the problem of high non-performing loans, especially in public sector banks. The huge amount of non-performing loans in Indian and Pakistani public sector banks (above 20% of their earning assets) could make it difficult for this group to adapt to the changes brought about by the ESRs, and could make this group hesitant in investing in the new banking technologies.

Also, as noted in chapter 4, tackling fiscal deficits has been a disappointing element of the ESRs in India and Pakistan. The presence of high and growing fiscal deficits may make it difficult for governments in India and Pakistan to stop appropriating banks' scarce investible funds. Therefore, more needs to be done on the fiscal front.

Perhaps the most important thing for both the countries, especially for Pakistan, is to reduce political uncertainty. In both the countries, a reduction in statutory liquidity reserves was expected to increase the proportion of credit in banks' asset portfolios. However, during the post-ESRs period, banks invested more in low earning government securities. This could be due to political uncertainty that made banks unwilling to increase the share of risky credit in their asset portfolios. Also, the lack of success of the debt recovery tribunals in India and Pakistan may explain banks' unwillingness to increase the proportion of credit in the earning assets. Therefore, reducing political uncertainty and enhancing the effectiveness of debt recovery tribunals should be a top priority. If banks keep on investing more in low earning government securities, it may not only crowd out the real sector, but also could make banks hesitant in investing in new banking technology, which, in turn, may hamper their efficiency in intermediating scarce financial resources in the economy.

7.2 – The limitations of the study

First, our conclusions are primarily based on the results from the data envelopment analysis. Though we conducted a basic stochastic frontier analysis to check the robustness of our results, more advanced parametric techniques with different functional forms and different probability distribution may give different results. This, in turn, may cast doubt upon our conclusions.

Second, a very important weakness of the present study is that it has ignored the quality of services provided by banks. In both India and Pakistan, there has been constant criticism levelled against banks, especially public sector banks, regarding the quality of their services. For example, depositors have to queue for a long period of time to deposit or withdraw money, depositors (especially foreign currency depositors) are charged fines for not making any transactions for some period of time, and so forth. If these things were taken into account, then may be the efficiency of public sector banks would not be as high as the study suggested.

7.3 – Avenues for future research

First, the study has only considered data from 1990 to 1998. This was primarily due to the fact that by the time the empirical part of the study was started, data after 1998 were not available. It could be argued that a longer time period is required to understand the impacts of the ESRs on the efficiency of banks in India and Pakistan. A more updated data set on the annual accounts of India and Pakistan is now available. Therefore, researchers can now utilise this updated data to better understand the impacts of the financial liberalisation, and other elements of the economic and structural reforms, on the efficiency of banks in India and Pakistan.

Second, parametric techniques with different production/cost/profit function specifications could be used to further enhance our understanding of the impact of the ESRs in India and Pakistan. Third, due to unavailability of data, we have not considered off-balance sheet items as banks' outputs. Future studies could utilise recent datasets to examine whether the inclusion of off-balance sheet items could change the conclusions of this study.

Appendices

APPENDIX 4.1 – Data Source

1. Macroeconomic data:

World Bank (2003) World Development Indicators 2003, CD-ROM

ADB (2003) Key Indicators of Developing Asian and Pacific Countries, www.adb.org

2. Bank data:

Reserve Bank of India, Banking Statistics, www.rbi.org.id

SBP – State Bank of Pakistan (various issues) Banking Statistics of Pakistan

APPENDIX 4.2 – The Herfindahl Index of Concentration

The Herfindahl index of concentration is a proxy about the competitive pressure in the market, containing information about the size of the largest firms. It will change, if there are shifts in market shares between the largest firms. The *Herfindahl index* can be calculated as follows:

$Herfindahl = Sum\ [_{i=1\ to\ n;}\ (S_i)^2]$

where S_i represents the market share of firm i as a fraction of 1.

For example, the *Herfindahl index* of four firms sharing the market would is

$0.40^2 + 0.30^2 + 0.2^2 + 0.1^2 = 0.3$

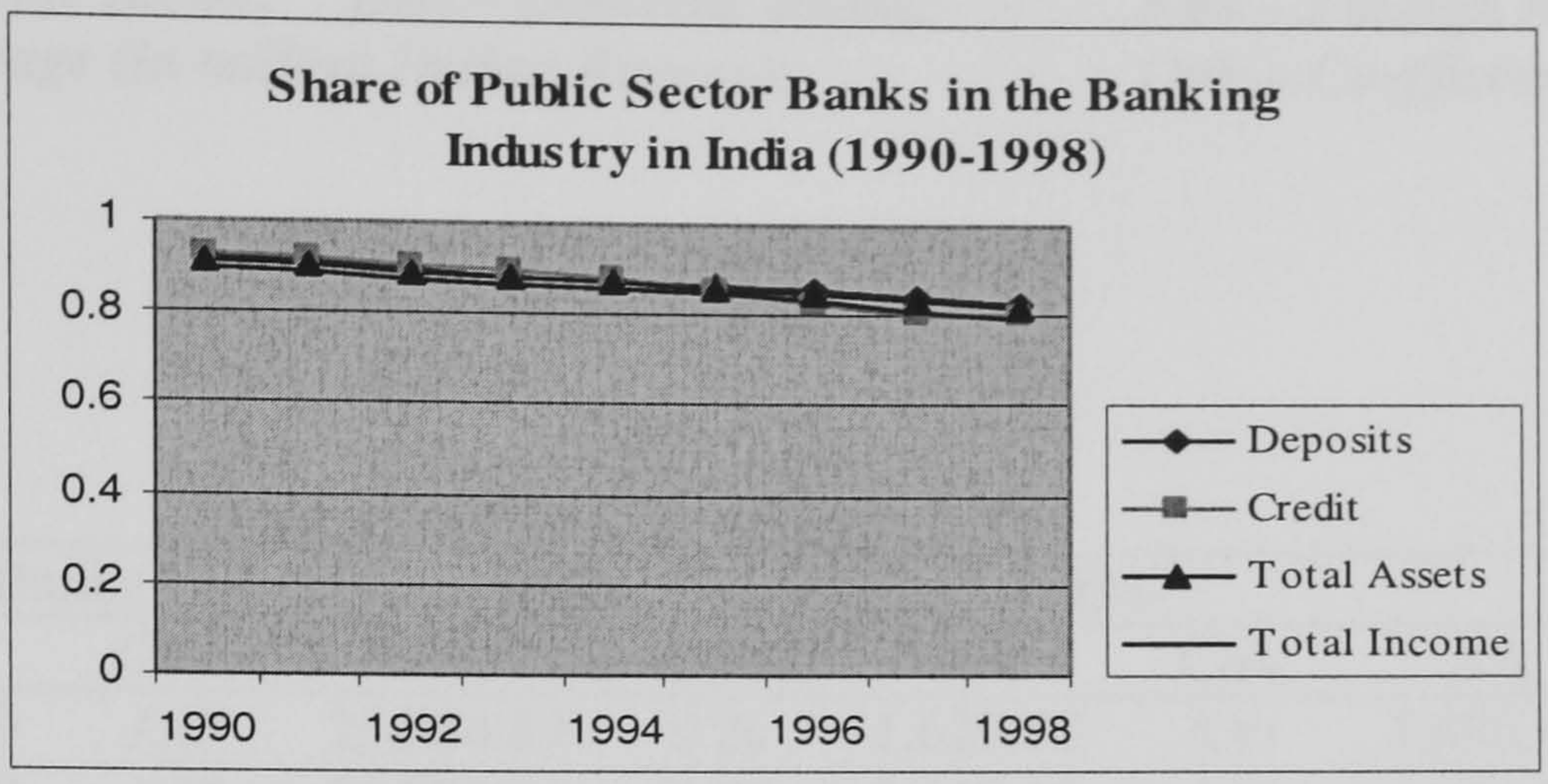
After shifting market shares between the two largest firms the new *Herfindahl index* is

$0.45^2 + 0.25^2 + 0.2^2 + 0.1^2 = 0.315$

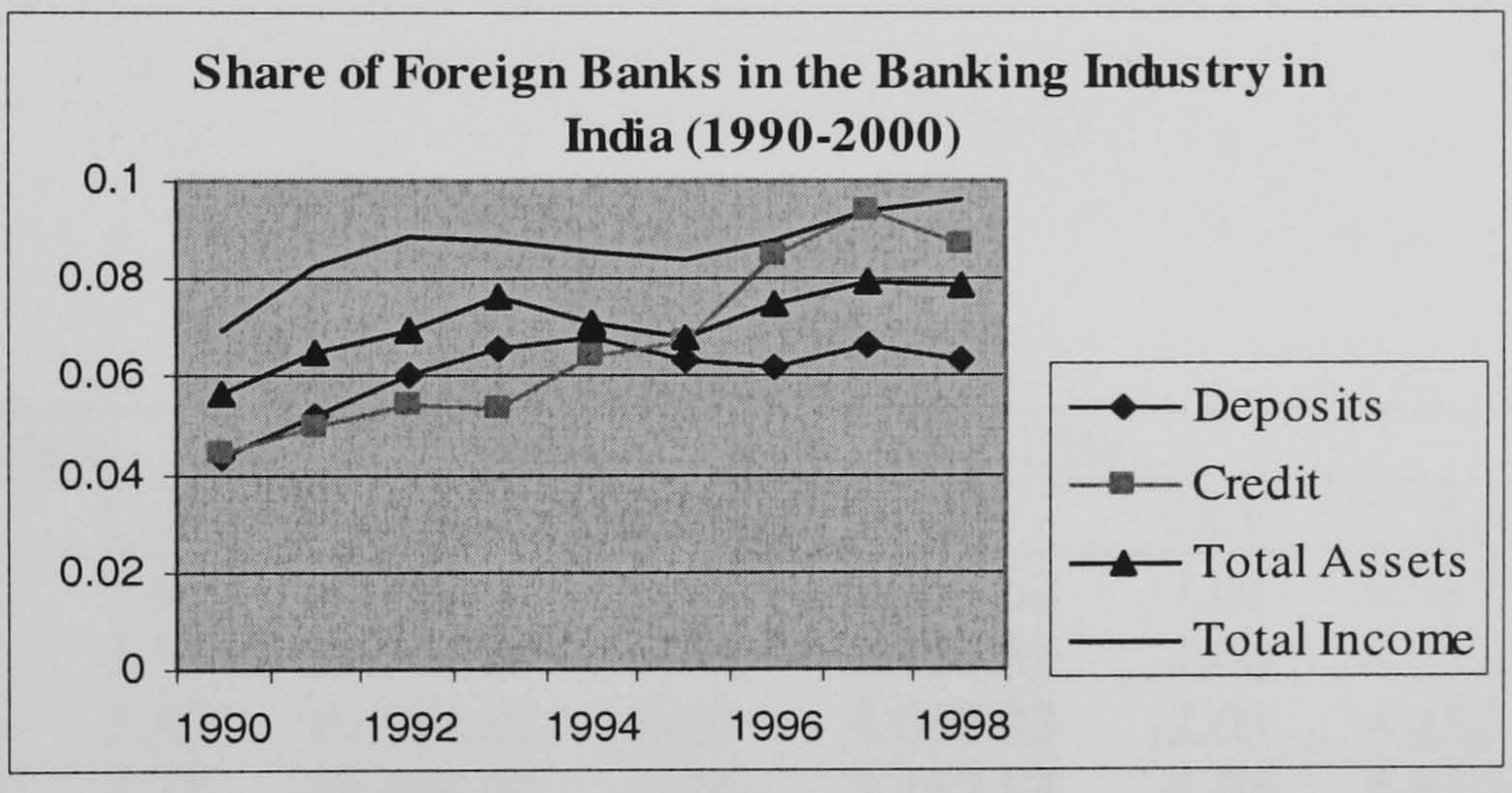
A declining index shows a declining trend of concentration or higher level of competition pressure.

Source: "Concentration Ratios in Manufacturing", 1987 Census of Manufacturing, MC 87-S-6, Washington, DC: U.S., Department of Commerce, Economics and Statistics Administration, Bureau of the Census, 1992.

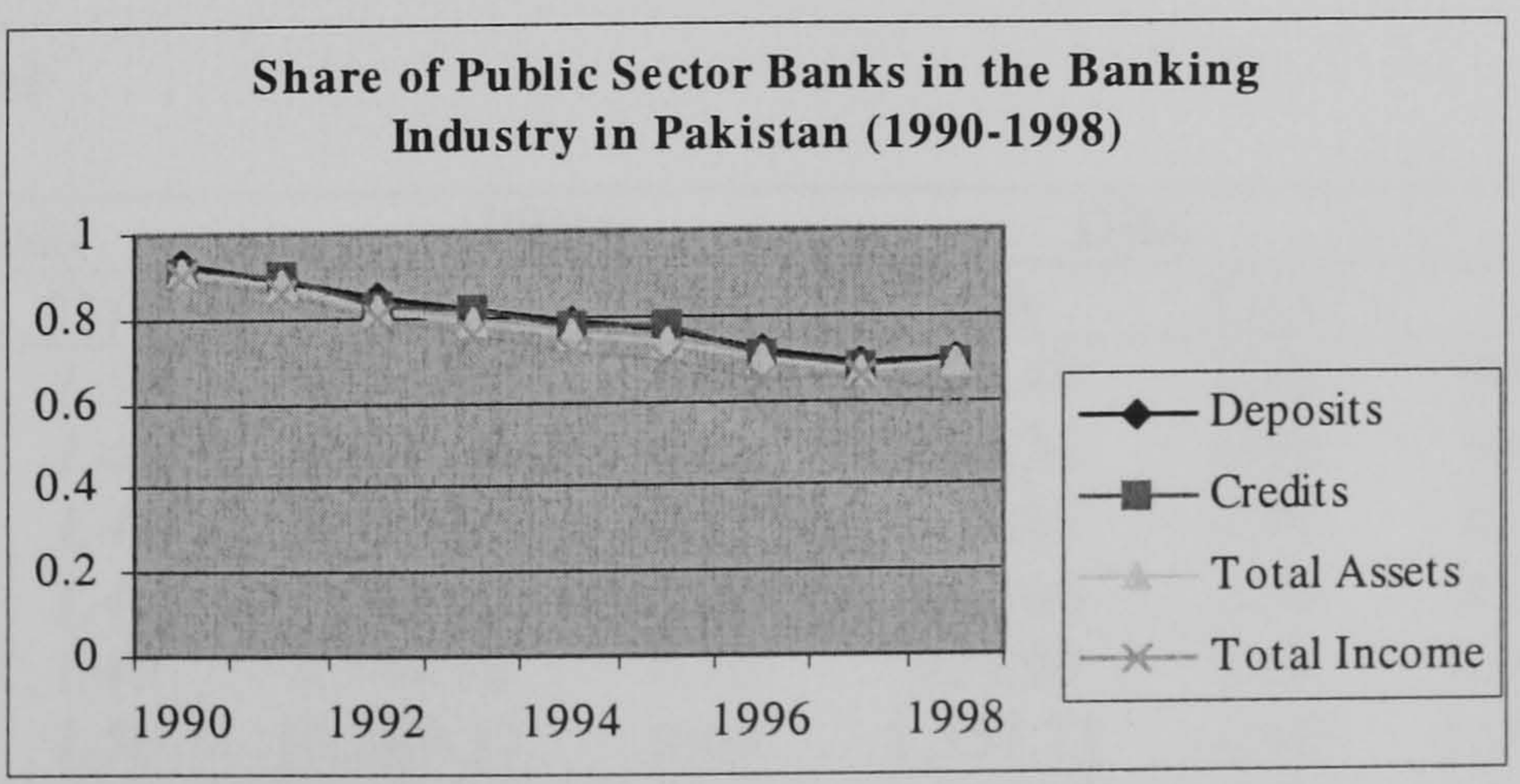
APPENDIX 4.3 – Share of Public Sector Banks in the Commercial Banking Industry in India (1990-1998)



APPENDIX 4.4 – Share of Foreign Banks in the Commercial Banking Industry in India (1990-1998)



APPENDIX 4.5 – Share of Public Sector Banks in the Commercial Banking Industry in Pakistan (1990-1998)



APPENDIX 5.1 – Inputs and Outputs Data for India (All figures in Indian Million Rupees)

PSBs – Public Sector Banks; DBs – Domestic Banks; FBs – Foreign Banks
AA - Annual Average (in million Indian Rupees); CoV – Coefficient of Variation

Investment

	All Banks		PSBs		DBs		FBs	
	AA	CoV	AA	CoV	AA	CoV	AA	CoV
1992	10,255.19	*1.47*	23,354.89	*0.76*	1,629.87	*0.91*	3,680.96	*1.66*
1993	12,160.59	*1.46*	26,887.14	*0.78*	2,110.10	*1.00*	4,340.34	*1.80*
1994	15,988.57	*1.42*	36,731.17	*0.72*	3,002.05	*1.06*	5,641.71	*1.50*
1995	16,252.61	*1.52*	41,829.84	*0.70*	3,444.25	*1.06*	4,554.40	*1.54*
1996	16,357.22	*1.60*	45,710.69	*0.69*	3,457.57	*0.97*	3,872.51	*1.57*
1997	18,924.93	*1.60*	55,471.99	*0.66*	5,408.81	*0.82*	4,055.98	*1.64*
1998	16,776.25	*1.45*	51,723.93	*0.53*	7,820.48	*0.76*	4,556.45	*1.75*

Loans

	All Banks		PSBs		DBs		FBs	
	AA	CoV	AA	CoV	AA	CoV	AA	CoV
1992	15,693.48	*1.63*	36,918.47	*0.87*	2,578.62	*1.01*	4,017.15	*1.54*
1993	17,385.47	*1.55*	39,704.99	*0.83*	3,326.59	*1.08*	4,124.78	*1.43*
1994	17,486.90	*1.50*	40,544.88	*0.80*	4,088.93	*1.03*	4,852.54	*1.22*
1995	19,874.18	*1.52*	49,705.99	*0.76*	5,252.87	*1.08*	5,833.03	*1.20*
1996	22,177.51	*1.51*	56,812.93	*0.76*	6,580.22	*0.92*	7,938.55	*1.30*
1997	22,805.99	*1.54*	60,776.07	*0.78*	8,421.08	*0.83*	7,710.97	*1.49*
1998	18,560.03	*1.25*	50,429.93	*0.48*	10,417.78	*0.81*	7,394.21	*1.72*

Interest Expenses

	All Banks		PSBs		DBs		FBs	
	AA	CoV	AA	CoV	AA	CoV	AA	CoV
1992	2,405.15	*1.57*	5,531.68	*0.85*	324.40	*0.88*	862.41	*1.48*
1993	2,875.25	*1.48*	6,439.00	*0.78*	481.34	*0.93*	936.86	*1.64*
1994	2,835.82	*1.45*	6,633.35	*0.72*	573.65	*0.98*	815.64	*1.50*
1995	2,774.78	*1.49*	7,047.42	*0.70*	631.66	*1.18*	825.00	*1.36*
1996	3,341.27	*1.49*	8,744.18	*0.70*	919.90	*1.02*	1,104.76	*1.31*
1997	3,762.38	*1.50*	10,287.37	*0.69*	1,357.71	*0.90*	1,099.00	*1.55*
1998	3,048.25	*1.29*	8,525.28	*0.51*	1,736.69	*0.79*	1,050.85	*1.67*

Operating Expenses

	All Banks		PSBs		DBs		FBs	
	AA	CoV	AA	CoV	AA	CoV	AA	CoV
1992	898.66	*1.43*	2,084.26	*0.69*	169.68	*0.77*	242.15	*1.59*
1993	1,053.50	*1.39*	2,345.29	*0.68*	200.99	*0.74*	332.61	*2.09*
1994	1,175.88	*1.41*	2,724.73	*0.68*	236.69	*0.76*	370.00	*1.77*
1995	1,314.62	*1.51*	3,386.53	*0.69*	258.06	*0.90*	390.75	*1.68*
1996	1,512.40	*1.52*	4,106.11	*0.66*	331.08	*0.81*	463.51	*1.69*
1997	1,550.53	*1.55*	4,396.18	*0.66*	418.42	*0.70*	474.91	*1.90*
1998	1,244.13	*1.42*	3,714.43	*0.53*	508.16	*0.67*	472.44	*1.94*

Interest Income

	All Banks		PSBs		DBs		FBs	
	AA	CoV	AA	CoV	AA	CoV	AA	CoV
1992	3,462.39	*1.51*	7,858.43	*0.81*	552.75	*0.92*	1,274.22	*1.46*
1993	3,799.66	*1.47*	8,301.10	*0.81*	698.26	*0.92*	1,444.40	*1.57*
1994	3,941.42	*1.42*	8,954.45	*0.74*	859.45	*0.96*	1,379.08	*1.39*
1995	4,193.40	*1.49*	10,459.24	*0.73*	975.38	*1.10*	1,427.93	*1.35*
1996	4,966.79	*1.50*	12,946.81	*0.71*	1,336.43	*0.93*	1,734.18	*1.36*
1997	5,498.01	*1.50*	14,984.71	*0.70*	1,881.88	*0.83*	1,749.36	*1.55*
1998	4,424.39	*1.29*	12,393.62	*0.49*	2,318.28	*0.76*	1,695.04	*1.73*

Other Income

	All Banks		PSBs		DBs		FBs	
	AA	CoV	AA	CoV	AA	CoV	AA	CoV
1992	437.00	*1.50*	851.02	*0.89*	59.01	*0.87*	354.68	*1.76*
1993	457.59	*1.35*	932.90	*0.76*	84.19	*0.97*	264.01	*1.61*
1994	582.80	*1.52*	1,235.70	*0.91*	127.03	*1.06*	308.40	*1.73*
1995	605.50	*1.39*	1,352.34	*0.72*	159.73	*1.27*	353.63	*1.75*
1996	711.03	*1.41*	1,649.16	*0.74*	225.92	*1.12*	407.29	*1.75*
1997	752.44	*1.43*	1,814.27	*0.75*	289.08	*0.89*	393.25	*1.88*
1998	723.04	*1.16*	1,565.04	*0.40*	460.83	*0.85*	470.17	*1.95*

Number of Bank Observation

Group	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**Total**
All	76	75	73	78	86	89	89	566
PSBs	28	28	27	27	27	27	27	191
DPBs	25	24	24	26	33	34	34	200
FBs	23	23	22	25	26	28	28	175

ABs=All Banks; PSBs= Public Sector Banks; DPBs= Domestic Private Banks; FBs=Foreign Banks

APPENDIX 5.2 – Inputs and Outputs Data for Pakistan (All figures in Million of Pakistani Rupees)

PSBs – Public Sector Banks; DBs – Domestic Banks; FBs – Foreign Banks
AA - Annual Average (in million Pakistani Rupees); CoV – Coefficient of Variation

Bills Purchased and Discounted

	All Banks		PSBs		DBs		FBs	
	AA	CoV	AA	CoV	AA	CoV	AA	CoV
1992	1,135.66	*2.16*	4,402.28	*0.72*	676.28	*1.58*	254.27	*1.06*
1993	1,423.32	*2.21*	5,774.60	*0.73*	963.97	*1.58*	270.42	*1.10*
1994	1,467.54	*2.16*	6,269.12	*0.79*	1,102.57	*1.61*	320.74	*1.16*
1995	3,100.63	*3.70*	32,176.74	*1.38*	1,190.78	*1.66*	404.05	*0.92*
1996	1,628.12	*2.11*	6,417.80	*0.74*	1,386.23	*1.81*	353.79	*0.91*
1997	1,792.15	*1.80*	6,398.16	*0.79*	1,568.90	*1.42*	590.54	*0.84*
1998	1,777.70	*1.77*	6,265.51	*0.76*	1,562.03	*1.25*	548.28	*0.97*

Loans and Advances

	All Banks		PSBs		DBs		FBs	
	AA	CoV	AA	CoV	AA	CoV	AA	CoV
1992	7,260.81	*2.25*	31,148.12	*0.79*	3,898.21	*1.86*	1,884.63	*1.15*
1993	8,796.54	*2.21*	35,971.75	*0.73*	4,790.05	*1.71*	2,302.90	*1.24*
1994	9,084.28	*2.15*	37,287.05	*0.74*	5,226.25	*1.82*	2,851.70	*1.15*
1995	10,602.61	*2.10*	43,522.85	*0.73*	6,181.75	*1.82*	3,827.95	*1.17*
1996	11,731.25	*2.03*	48,395.61	*0.76*	7,416.89	*1.66*	4,652.66	*1.14*
1997	14,450.07	*1.95*	60,367.01	*0.84*	9,771.87	*1.54*	6,057.30	*1.09*
1998	15,936.11	*1.95*	63,030.90	*0.76*	10,461.99	*1.49*	6,206.92	*0.99*

Investments

	All Banks		PSBs		DBs		FBs	
	AA	CoV	AA	CoV	AA	CoV	AA	CoV
1992	5,607.37	*2.02*	21,489.27	*0.79*	3,616.28	*1.60*	1,789.05	*1.16*
1993	5,908.91	*1.83*	20,935.61	*0.80*	4,270.10	*1.53*	2,403.17	*1.08*
1994	7,096.85	*2.05*	29,824.39	*0.85*	4,647.69	*1.77*	2,655.21	*1.19*
1995	6,484.73	*2.34*	32,875.04	*0.89*	4,009.25	*2.23*	2,090.79	*1.07*
1996	7,390.84	*2.15*	37,447.18	*1.01*	4,649.12	*2.06*	3,625.35	*1.09*
1997	9,283.58	*1.96*	41,789.20	*1.03*	7,317.92	*1.67*	4,181.23	*1.27*
1998	9,108.18	*1.94*	39,004.66	*0.96*	7,514.35	*1.58*	3,638.74	*1.48*

Interest Expenses

	All Banks		PSBs		DBs		FBs	
	AA	CoV	AA	CoV	AA	CoV	AA	CoV
1992	943.77	*2.30*	3,994.15	*0.76*	499.60	*2.17*	218.57	*1.02*
1993	1,240.21	*2.11*	4,918.90	*0.77*	796.76	*1.81*	359.17	*1.11*
1994	1,397.97	*2.00*	5,452.39	*0.77*	879.29	*1.78*	537.37	*1.08*
1995	1,662.08	*2.00*	6,914.06	*0.80*	1,011.56	*1.71*	714.21	*1.00*
1996	1,997.00	*2.00*	8,763.42	*0.86*	1,323.25	*1.65*	866.46	*1.05*
1997	2,549.97	*1.84*	10,458.30	*0.88*	1,657.84	*1.46*	1,330.23	*1.05*
1998	2,618.09	*1.83*	12,140.47	*1.15*	1,975.21	*1.32*	1,456.52	*1.02*

Total Income

	All Banks		PSBs		DBs		FBs	
	AA	CoV	AA	CoV	AA	CoV	AA	CoV
1992	1,798.57	*2.07*	6,777.46	*0.73*	928.54	*2.00*	614.48	*1.03*
1993	2,335.87	*1.97*	8,447.32	*0.73*	1,512.07	*1.63*	796.15	*1.07*
1994	2,509.21	*1.92*	9,214.45	*0.74*	1,623.11	*1.66*	988.46	*1.08*
1995	2,828.90	*1.96*	11,288.75	*0.78*	1,851.42	*1.70*	1,168.69	*1.04*
1996	3,057.99	*1.81*	11,114.90	*0.77*	2,252.01	*1.58*	1,398.21	*1.08*
1997	4,516.75	*1.80*	15,020.66	*0.68*	2,958.15	*1.58*	2,068.47	*1.08*
1998	4,386.47	*1.74*	16,117.72	*0.84*	3,278.48	*1.42*	2,139.53	*1.06*

Operating Expenses

	All Banks		PSBs		DBs		FBs	
	AA	CoV	AA	CoV	AA	CoV	AA	CoV
1992	570.33	*2.23*	2,202.06	*0.70*	340.18	*1.99*	111.35	*1.20*
1993	722.63	*2.22*	2,770.99	*0.69*	503.09	*1.88*	127.21	*1.09*
1994	767.86	*2.23*	3,060.07	*0.69*	503.27	*1.97*	157.40	*1.12*
1995	863.25	*2.22*	3,486.54	*0.70*	583.47	*2.10*	204.92	*1.23*
1996	947.35	*2.17*	3,799.51	*0.71*	682.87	*2.01*	250.51	*1.32*
1997	1,725.13	*2.46*	9,060.04	*0.84*	999.34	*2.02*	402.44	*1.29*
1998	1,598.76	*2.20*	6,992.59	*0.76*	1,033.95	*1.82*	437.31	*1.38*

Number of Bank Observation

Group	1992	1993	1994	1995	1996	1997	1998	Total
All	28	29	32	35	36	35	35	230
PSBs	4	4	4	4	4	4	4	28
DPBs	11	11	14	17	17	17	17	104
FBs	17	18	18	18	19	18	18	126

ABs=All Banks; PSBs= Public Sector Banks; DPBs= Domestic Private Banks; FBs=Foreign Banks

APPENDIX 6.1 – The Logistic Function

In a model of efficiency, a set of factors, gathered in a vector x could explain firm efficiency.

$$Prob(Efficiency=1) = EFF = f(x,\beta)$$

$$Prob(Efficiency=0) = 1 - EFF = 1 - f(x,\beta) \qquad \text{(A6.1)}$$

The set of parameters β reflects the impact of changes in x on the probability. Because *Efficiency* is a variable ranging from 0 to 1, with *Efficiency* = 1 indicates fully efficiency and *Efficiency* = 0 indicates fully inefficiency, the linear probability model such as $f(x,\beta) = \beta'x + \varepsilon$ has a number of shortcomings. A minor complication arises because ε , the vector of white-noise error term, is heteroscedastic in a way that depends on β. The model we need is required to produce predictions consistent with the underlying theory of a probability model. For a given regressor vector we would expect:

$$\lim_{\beta'x \to +\infty} EFF = 1$$

and

$$\lim_{\beta'x \to -\infty} EFF = 0$$

A model for a probability is sketched in Figure 1. In principle, any continuous probability distribution defined over the real line in Figure 1 will suffice. One of such distribution is the logistic distribution. The logistic distribution function is written as:

$$EFF = \frac{e^{\beta'x+\varepsilon}}{1+e^{\beta'x+\varepsilon}} \qquad \text{(A6.2)}$$

It is easy to verify that as $\beta'x + \varepsilon$ ranges from $-\infty$ to $+\infty$, EFF ranges between 0 and 1 and that EFF is nonlinearly related to $\beta'x + \varepsilon$. We have :

$$1 - EFF = \frac{1}{1 + e^{\beta' x + \varepsilon}} \tag{A6.3}$$

Therefore we can write

$$\frac{EFF_{it}}{1 - EFF_{it}} = e^{\beta' x + \varepsilon} \tag{A6.4}$$

If natural logarithms are taken for two sides of equation (4) we have:

$$\ln \frac{EFF_{it}}{1 - EFF_{it}} = \beta' x + \varepsilon \tag{A6.5}$$

The term $y_{it} = (\ln \frac{EFF_{it}}{1 - EFF_{it}})$ is called the log-odds, or the log of the odds ratio and could be used as a proxy for efficiency. This log-odds is not only linear in x but also linear in parameters β.

APPENDIX 6.2 – The GMM Framework

The Generalised Method of Moments (GMM) procedure is developed to estimate a panel regression with potentially endogenous explanatory variables. The procedure described below follows Holtz-Eakin et al. (1988), Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998). The GMM approach starts with a dynamic panel regression with a lagged dependent variable ln the right-hand side.

$$y_{it} = \zeta y_{i(t-1)} + \lambda x_{kit} + \mu_i + \upsilon_{it} \qquad \text{(A6.6)}$$

where $k = 1, \ldots K\text{-}1; i = 1, \ldots N; t = 2 \ldots T.$

Taking the first-difference of both sides of equation (1), we have:

$$\Delta y_{it} = \zeta \Delta y_{i(t-1)} + \lambda \Delta x_{kit} + \Delta \upsilon_{it} \qquad \text{(A6.7)}$$

where $k = 1, \ldots K\text{-}1; i = 1 .. N; t = 3 \ldots T$

In (A6.7) the individual bank-specific effects μ_i are eliminated by the differencing operation. In (A6.6), the error terms υ_{it} and the lagged dependent variable y_{it-1} are correlated, thus making the OLS estimation biased. Therefore υ_{it} are assumed to have finite moments and $E(\upsilon_{it}\ \upsilon_{is}) = 0$ for $t \neq s$, i.e. residuals are serially uncorrelated. Under this assumption, values of y lagged two periods or more are qualified as instruments in the first-differenced equation (A6.7), implying the following linear moment restrictions:

$$E(y_{i(t-j)} \Delta \upsilon_{it}) = 0 \qquad t = 3 \ldots T; j = 2 \ldots (t\text{-}1) \qquad \text{(A6.8)}$$

However GMM estimation based on (A6.8) alone can be highly inefficient. It is necessary to make use of the explanatory variables as additional instruments. Given that the problem of likely endogeneity applies to x, assume that they are strictly exogenous would lead to inconsistent estimation. To take into account the problem of endogeneity we treat variables in x as endogenous, i.e. $E(x_{it}\upsilon_{is}) = 0$ for $s>t$. This implies the following additional linear moment restrictions:

$$E(x_{i(t-j)}\Delta\upsilon_{it}) = 0 \qquad t = 3 \ldots T;\ j = 2 \ldots (t-1) \qquad \text{(A6.9)}$$

That is values of x lagged two periods or more are valid instruments in the first-differenced equation. If x is assumed to be exogenous, i.e. i.e. $E(x_{it}\upsilon_{is}) = 0$ for $s \leq t$, which implies the following additional linear moment restrictions:

$$E(x_{i(t-j)}\Delta\upsilon_{it}) = 0 \qquad t = 3 \ldots T;\ j = 1 \ldots (t-1) \qquad \text{(A6.10)}$$

(A6.8), (A6.9) and (A6.10) imply a set of a linear moment restrictions to which the first-differenced GMM applies to equation (A6.7). The moment restrictions (A6.8) and (A6.9) can be written in vector form as $E[Z_i'\varepsilon_i] = 0$ where $\varepsilon_i = ((\upsilon_{i3}-\upsilon_{i2}) \ldots ((\upsilon_{iT}-\upsilon_{I(T-1)}))'$ are the residuals in the first-differenced regression and Z_i, the instrument matrix, is a matrix of the form $Z_i = diag\ (y_{i1} \ldots y_{is},\ x_{i1} \ldots x_{is}),\ (s = 1 \ldots T\text{-}2)$. The number of columns of Z_i , Q, is equal to the number of available instruments. $X_{it} = (y_{i(t-1)}\, x_{kit})'$ is $K\ x\ 1$. The form of the GMM estimator of the $K\ x\ 1$ coefficient vector $\theta=(\zeta\lambda'\varphi')'$ is given by $\hat{\theta} = (\overline{G}'ZA^{-1}Z'\overline{G})^{-1}\overline{G}'ZA^{-1}Z'\overline{y}$ where a bar above a variable denotes that it is in first differences, $\overline{G}$ is a stacked $(T\text{-}2)\ N\ x\ k$ matrix of observations on $\overline{y}'_{i(t-1)}$ and $\overline{x}'_{it}$; $\overline{y}$ is a stacked $(T\text{-}2)\ N\ x\ 1$ vector of $\overline{y}'_{it}$; $Z=(Z'_i \ldots Z'_N)'$ is a $(T\text{-}2)\ N\ x\ Q$ matrix; and A is any $Q\ x\ Q$ symmetric, positive definite matrix.

The first-differenced GMM estimator however can suffer from serious efficiency loss, small sample biases and imprecision for there are potentially informative moment restrictions that are ignored. Following Arellano and Bover (1995) and

Blundell and Bond (1998), to improve the properties of the first-differenced GMM estimator, we consider the following additional level moment restrictions.

$$E(\Delta y_{i(t-1)} \upsilon_{it}) = 0 \qquad t = 3 \ldots T \qquad \text{(A6.11)}$$

$$E(\Delta x_{i(t-j)} \upsilon_{it}) = 0 \qquad t = 3 \ldots T;\ j \geq 1 \qquad \text{(A6.12)}$$

$$E(\Delta x_{i(t-j)} \upsilon_{it}) = 0 \qquad t = 3 \ldots T;\ j \geq 0 \qquad \text{(A6.13)}$$

These linear moment restrictions imply that lagged differences of y and x can be used as instruments in the level equation (A6.6). The system GMM estimator is then obtained by imposing the set of moment restrictions from (A6.8) to (A6.13). By exploiting more moment restrictions, the system GMM estimator is more efficient than the first- differenced GMM estimator that uses only (A6.8) and (A6.10).

The consistency of the system GMM estimator described above depends on the validity of the moment restrictions. Below is a brief discussion of the specification tests that we conduct in this study for the consistency of the system GMM estimator. Relevant formulae and proofs of the specification tests discussed above can be found in more details in Arellano and Bond (1991) and Blundell and Bond (1998).

The overall validity of the moment restrictions is checked by the Sargan test for over-identifying restrictions. The null hypothesis of the Sargan test is that the instruments are not correlated with the residuals in the first-difference regression, that is $E[Z_i' \varepsilon_i] = 0$. The test is based on the following statistic $s = \hat{\varepsilon}' Z (\sum_{i=1}^{N} Z'_i \hat{\varepsilon}_i \hat{\varepsilon}'_i Z_i)^{-1} Z' \hat{\varepsilon} \sim \chi^2_{Q-k}$ where $\hat{\varepsilon} = y - \hat{\theta} G$ and $\hat{\theta}$ is the GMM estimator of the coefficient vector θ for a given Z. The null hypothesis is rejected if the minimised GMM criterion function registers a large value compared with a χ^2 distribution with the degree of freedom equal to the difference between the number of instruments and the number of parameters *(Q – k).*

As the system GMM estimator exploits more moment restrictions, a further test that evaluates the validity of extra moment restrictions (A6.11) and (A6.13) is needed. Since the first-differenced moment restrictions are nested within the set of moment restrictions for the system, the Sargan difference test is used to test for the validity of additional moment restrictions. Let Z_1 be a $n \times Q_1$ matrix containing the columns of Z which remain value instruments when the errors in levels are first-order moving average, and let $\hat{\theta}_1$ be an estimator of θ based on Z_1 associated with the error terms $\hat{\varepsilon}_1$ then $s_1 = \hat{\varepsilon}'_1 Z_1 (\sum_{i=1}^{N} Z'_{1i} \hat{\varepsilon}_{1i} \hat{\varepsilon}'_{1i} Z_{1i})^{-1} Z_1' \hat{\varepsilon}_1 \sim \chi^2_{Q_1-k}$ if the errors in levels are MA(0) or MA(1). In addition $ds = (s - s_1) \sim \chi^2_{Q-Q_1}$ if the errors in levels are not serially correlated.

Another necessary condition for the validity of the GMM instruments is that the level residuals are serially uncorrelated. The Arellano-Bond m_1 and m_2 statistics check whether there is serial correlation in the level residuals. If the level residuals are serially uncorrelated then the first-differenced residuals in (A6.7) will follow a MA(1) process which implies that autocorrelation of the first-order are non-zero but the autocorrelation of the second-order are zero. Based on the first-differenced residuals, the Arellano-Bond m_1 and m_2 statistics, both distributed as *N(0,1)* in large sample, test the null hypotheses of zero first-order and second-order autocorrelation, respectively. The consistency of the GMM estimator does not require $E(\varepsilon_{it}, \varepsilon_{i(t-1)})$ being zero, or no first-order serial correlation in the first-differenced residuals. It hinges heavily on the assumption that $E(\varepsilon_{it}, \varepsilon_{i(t-2)}) = 0$ or no second-order serial correlation in the first-differenced residuals. The test statistic for second-order serial correlation m_2 is based on residuals from the first-differenced equation (A6.7) and takes the form:

$$m_2 = \frac{\hat{\varepsilon}'_{-2}\,\hat{\varepsilon}_*}{\hat{\varepsilon}^{1/2}} \sim N(0,1)$$

where $\hat{\varepsilon}_{-2}$ is the vector of residuals lagged two period; ε_* is a vector of trimmed ε to match ε_{-2} and similarly for G_* and

$$\hat{\varepsilon} = \sum_{i=1}^{N} \varepsilon'_{i(-2)}\hat{\varepsilon}_{i*}\varepsilon'_{i*}\,\hat{\varepsilon}_{i(-2)} - 2\hat{\varepsilon}'_{-2}\,G_*(G'ZAZ'G)^{-1}G'ZA(\sum_{i=1}^{N} Z'_i\hat{\varepsilon}_i\hat{\varepsilon}'_{i*}\,\hat{\varepsilon}_{i(-2)})$$
$$+\,\hat{\varepsilon}'_{-2}\,G_*a\,\hat{\mathrm{var}}(\hat{\theta})G'_*\,\hat{\varepsilon}_{-2}$$

The test statistic for first-order serial correlation m_1 can be calculated on the same line as m_2. An insignificant m_1 and/or significant m_2 indicate the likely presence of invalid moment restrictions due to serial correlation in the level residuals.

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