An Analysis of Efficiency of Commercial Banks in India, 1991 - 2009

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DECLARATION

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I hereby declare that, the work presented in the thesis entitled "An Analysis of Efficiency of Commercial Banks in India, 1991 - 2009" has been carried out by me under the supervision of Professor Bandi Kamaiah and Professor Naresh Kumar Sharma, Department of Economics, University of Hyderabad, and to the best of my knowledge no part of this thesis was earlier submitted for the award of any research degree or diploma of any University.

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This is to certify that, the research embodied in the present thesis entitled "An Analysis of Efficiency of Commercial Banks in India, 1991-2009" has been carried out by **Ms B Madhuri Smitha** under our supervision for the full period prescribed under Ph.D. ordinances of the University, and no part of this thesis was earlier submitted for the award of any research degree or diploma of any University.

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CHAPTER I

INTRODUCTORY BACKGROUND AND OBJECTIVES OF THE STUDY

1.0 Introduction

Efficient financial Institutions play a major role in pooling up community savings and converting them into investments through proper channelization of funds to different sectors of economy. Of all the financial institutions, banks play a pivotal role. Banks influence the level and growth of the economy through the identification and funding of productive investment. Banks also promote efficient allocation of capital and faster growth. They can also monitor the efficiency and productivity of projects much more efficiently. Further, banks gather information and process it which helps to distinguish between a good and a bad borrower. Therefore in recent years the progress of banks is attributed more to their information gathering capacity than to their ability to mobilize savings and channeling them into investments.

There are two major functions of banks namely, (a) Financial intermediation and (b) money creations. Variations in bank credit are an important channel of monetary policy transmission even for central banks that rely on interest rates to convey their policy stance. Modulations in policy interest rates by the central banks influence credit market conditions which reinforce the effect of the traditional interest rate channel of monetary transmission. Banks are also special as their operations have systemic implications. Banks accept and deploy large amounts of un-collateralized public funds in fiduciary capacity. They also leverage such funds through credit creation. In developing economies due to lack of substitutes to extend finance bank credit becomes extremely important not only to the industry but also to agriculture and related activities. In addition to this there

are large numbers of small and medium enterprises in both industrial and service sectors which require credit. Thus banks have to play a major role in the development process of emerging market economies.

1.1 Banking System in India since Independence:

Banking in India has a long history and evolved over the years passing through various phases. At the time of independence the entire banking system was in the hands of private sector and the credit requirements of agriculture and other needy sectors were ignored. To align the banking system to the needs of planning and economic policy, fourteen (14) banks were nationalized in 1969 which was a major turning point. With the nationalization of banks (14 in 1969 and again 6 in 1980), the major segment of the banking sector came under the control of the government. Massive expansion of branch network that followed the nationalization of banks resulted in large mobilization of deposits by banks which helped in stepping up the overall savings rate of the economy. With nationalization the country was able to build up a financial infrastructure geographically wide and financially diverse.

Branch expansion gained momentum after the nationalization of major commercial banks and the introduction of the Lead Bank scheme. Over a period of 33 years after bank nationalization, there was about 800 per cent increase in the number of branches but the most spectacular progress was in rural branches--- increase was from about 1860 to nearly 30600 bank offices. Bank nationalization gave a great fillip to deposit mobilization, due partly to the expansion of a network of bank branches and partly to the incentives given to savers. Banks also meet the credit requirements of industry, trade and agriculture on a much larger scale than before. Just as bank deposits have expanded,

bank credit too has expanded tremendously particularly since July 1969 from about Rs.1,16,300 crores in 1990-91 to Rs.27,70,012 crores during 2008-09.

Soon after nationalization, commercial banks were asked to be especially concerned with the financing of priority sector -- agriculture, small and medium enterprises.. In course of time, other priority sectors were also added, such as retail trade, professional and self employed persons, education, housing loans for weaker sections and consumption loans. However, during this period, a major portion of banks resources were preempted at below market rates by way of directed credit and directed investments. Profitability of banking sector was therefore affected. Banks were also saddled with large non-performing assets. Their capital base also became weak. The deposits and lending rate structures became very complex. Various controls combined with absence of adequate competition resulted in decline in the productivity and efficiency of banks.

1.1.1 Narasimham Committee (1991) on the Banking System in India:

At the time of announcement of the new economic policy, several public sector banks and financial institutions had become weak and some public sector banks had been incurring losses year after year. Their customer service was poor, their work technology outmoded and they were unable to meet the challenges of a competitive environment. It was under these circumstances that the government of India set up a high level committee with Mr. M.Narasimham, a former Governor of Reserve Bank of India as Chairman to examine all aspects relating to the structure, organization, functions and procedures of the financial system. This committee on the financial system submitted its report in November 1991. The Narasimham Committee recommendations were aimed at ensuring a degree of operational flexibility, internal autonomy for the public sector banks in their decision making process, and achieving greater measure of professionalism in banking operations.

1.1.1.1 Banking Sector Reforms:

With a view to overcome several weaknesses that had crept into the system over the years and with a view to create a strong competitive and vibrant banking system, several measures were initiated beginning early 1990s. The reform period can be divided into two phases namely, the first phase from 1991-98, and the second phase from 1998 onwards.

1.1.1.1.1 First Phase of Reforms

A) Financial Health and Soundness.

With a view to improve the health of the banking sector, internationally accepted prudential norms relating to income recognition, asset classification and provisioning and capital adequacy were introduced in April 1992 in a phased manner. To strengthen the capital base of the banks, capital to risk weighted assets ratio was introduced. Indian banks were required to achieve a capital adequacy ratio of 8 percent as early as possible and in any case by March 31, 1994. To ensure financial soundness of banks the government of India embarked on a recapitalization programme of nationalized banks beginning from the financial year 1993-94. The total capital contribution by the govt. to nationalized banks upto March 1998 aggregated to Rs.20,046 crores. Besides, the govt. provided a sum of Rs.1,532 crores during the year ending March 1997 to write off the losses of two banks against their capital to cleanse their balance sheets so that they could make early public issues. Since capital infusion by the govt. was inadequate, to enable banks to fulfill further provisioning norms and to take care of additional capital needs as capital adequacy guidelines were fully implemented, the govt. decided to allow public sector banks to approach the capital market directly to mobilize equity funds from the

public by amending the relevant acts. To control the mounting NPAs, debt recovery tribunals were established for expeditious adjudication and recovery of debts.

B) Removal of External Constraints on Banks, Rationalisation of Interest Structure and Creation of Competitive Environment.

A phased reduction in CRR and SLR was undertaken; SLR was progressively brought down from the peak rate of 38.5% in 1992 to 25% in 1997. CRR was also brought down in phases from 15% to 9.5% in 1997. Banks were given the freedom to fix their deposit and lending rates. Interest rate structures was first rationalized and then deregulated. Banks were allowed to determine their own deposit rates depending on commercial judgments subject to the approval of their boards. One of the major objectives of reforms was to bring in greater efficiency by permitting entry of new private sector banks and foreign banks.

C) Strengthening of Institutions.

To ensure effective implementation of prudential regulations, due to the blurring of the traditional distinctions among the financial intermediaries and increased risks faced by banks in a liberalized environment, there was a need for a strong system of supervision. Subsequently a board for financial supervision (BFS) was set up within the Reserve Bank to look after exclusively the supervisory functions. This board was set up to have an effective oversight on banks, financial institutions, and non banking financial companies. Subsequently, its scope was enlarged to include UCBs, RRBs, and primary dealers.

D) Improving the Rural Credit Delivery.

The activities eligible for priority sector lending were enlarged, interest rates deregulated and alternative avenues of investment were permitted, thereby making the priority sector

lending more flexible than before. The rural infrastructure development fund was set up to provide loans to the state governments for financing rural infrastructure projects.

1.1.1.1.2 Second Phase of Reforms: 1998 Onwards.

Strengthening of Prudential Norms, and NPA Management and Competition Intensified

Steps were taken to strength prudential norms to meet international best practices. In October 1998, the stipulated minimum capital to risk-weighted assets ratio (CRAR) of scheduled commercial banks was raised by one percentage point to nine (9) percent from the year ended March 31, 2000. Income recognition, asset classification and provisioning norms were also tightened. The union budget 2000-01 announced the establishment of a credit information bureau (India) ltd (CIBL) with a view to strengthening the legal mechanism and facilitating credit information bureau to collect, process and share credit information on borrowers. Competition began to intensify in the early 2000s which was reflected in the increased mergers and acquisitions activity. In this phase two large development finance institutions (DFIs) merged/converted into banks. The number of banks gradually declined beginning from 100 at the end of March 2000 to 82 by the end of March 2007 reflecting the increased competitive pressures.

Diversification and Emergence of Universal Banks / Financial Conglomerates

Increased competition within the banking sector and also from non-banking financial institutions and the capital market, made banks to seek new sources of income by offering a variety of services either within the organization or by setting up subsidiaries. Although banks had started diversifying in the mid 1980s after the necessary enabling provisions were incorporated in the banking regulation act, 1949, diversification gained momentum

in the late 1990s. Apart from offering merchant banking activities and services connected with the activity of primary issue, banks started rendering project appraisal, capital structure, fund raising and loan syndication services under one roof. Banks also started rendering advisory services to corporates on mergers and acquisitions, and custodial and depository services for both domestic and foreign customers. Banks were also allowed to undertake insurance business.

Credit Delivery - SMEs

Several measures like identification of new clusters and adopting cluster based approach for financing the small and medium enterprises (SMEs) sector, sponsoring specific projects as well as widely publicizing the successful working models of NGOs, sanctioning higher working capital limit to SSIs in the north eastern region for maintaining higher levels of inventory, and exploring new instruments for promoting rural industry, were undertaken to improve the credit delivery to the SME sector.

Improving Credit Delivery-Rural Sector

The measures suggested include, debt restructuring and provision of fresh loans to farmers   affected by natural calamities, one time settlement for small and marginal farmers, fresh   finance for farmers whose earlier debts were settled through compromise or write-offs and relief measures for farmers indebted to non institutional lenders.

Financial Inclusion

There were concerns that banks had not been able to include vast segments of the population, especially the under-privileged sections of the society into the fold of basic banking services. The formal credit system was not able to adequately penetrate into the informal financial markets. The RBI, therefore advised the banks in November, 2005 to

make available a basic banking "no-frills" account either with "nil" or very low minimum balance as well as charges that would make such accounts accessible to vast sections of population. In 2007, 12.6 million 'no-frills' accounts were opened.

Customer Service and Financial Literacy

The RBI initiated various measures to improve the customer service from time to time. A major policy initiated in this regard was the setting up of banking ombudsman at various offices of the RBI. Recognizing the institutional gap in measuring the performance of the banks against the codes and standards based on established best practices, the RBI announced the setting up of the banking codes and standard board of India (BCSBI) in 2005-06. The RBI apart from safeguarding the interests of the bank depositors also wanted to ensure that the borrowing community too got fair deal from the bankers. Accordingly RBI formulated a fair practices code for lenders, to protect the rightful interests of the borrowers and guard against undue harassment by the lenders. The need was felt to provide a mechanism for improving the financial literacy and level of financial education among the consumers of banking services. Credit counseling, by providing sound advice to arrest the deterioration of incomes and to restructure their debt, could offer a meaningful solution for the borrowers and could enable them to gradually overcome their debt burden and improve their money management skills. Timely counseling could have a positive impact on the asset quality of banks.

Technology

The computerization of banks operations began in a big way in the early 1990s. The pace of internal computerization of branches of banks and their inter connectivity, providing for core banking systems was expedited. By end March 07 about 86% branches were fully computerized. The number of onsite and offsite ATMs increased. To reduce risk in

the electronic payment systems, national electronic fund transfer (NEFT) was introduced. Technology helped the banks to innovate in terms of developing new products and services such as phone banking and internet banking.

1.2. Issues in Banking Development in India.

The Indian banking is presently passing through a critical phase. In view of macro economic and financial sector developments, both domestic and global, the banking sector is facing new challenges. The major issues of banking sector are discussed as under.

1.2.1 Banking and Economic growth:

The Indian economy has moved on to a high growth trajectory with the average growth rate being around 8 per cent which was facilitated by a significant increase in the investment rate. The saving rate also improved to support the investment needs of high growth. In order to maintain the growth momentum there is a need to accelerate the saving rate. This would depend on efficient intermediation between savers and investors. Conversion of the unproductive physical savings into financial savings and mobilization of the untapped savings of rural and semi urban areas requires innovative and cost effective products assumes great importance. Keeping in mind the outreach of banks and also special features i.e. safety and liquidity, banks indeed are in a better position to perform this role compared to the other constituents of the financial system.

1.2.2 Role of Foreign Banks:

In recognition of the emergence of foreign banks as key vehicles in the international integration of the financial system, a liberalized policy towards foreign banks entry has become a high priority in policy maker's agenda in various countries in recent years. To

improve competition and to facilitate better and cheaper financial intermediation, liberalization of financial services by allowing foreign financial institutions to participate in the domestic market becomes essential. Some of the benefits of entry of foreign banks include increasing efficiency through infusion of technology and skill management, introduction of superior risk management practices and stronger capital base.

Entry of foreign banks also brings to the fore several concerns. The increased foreign banks presence can expose a country to external shocks. Opening the domestic financial system to foreign financial services providers without any restrictions also raises the possibility of domestic financial institutions being taken over by foreign banks. In the Indian context various issues associated with increased presence of foreign banks such as impact on the domestic banks, supervisory and regulatory challenges in view of their sophisticated operations and their involvement in complex and sophisticated products, financial inclusions, credit to agriculture and SMEs, coordination between home and host countries regulators pose challenges.

1.2.3 Capital Account Convertibility

Liberalization of capital account transactions is expected to result in a larger two ways flows of capital in and out of the country. In a regime of fuller capital account convertibility, banks have to undertake transactions in multiple currencies when they receive deposits and raise borrowings from both residents and non-residents. Likewise non-resident banks and financial institutions and non-financial entities having links with the banking system would also conduct transactions in multiple currencies. In this scenario banks will be exposed to various risks such as currency risk, counter party credit risk, transfer risk and legal risk etc.. This will require efficient risk management capabilities in the banking system. In the context of liberalized environment, banks own

exposures to exchange rate risk, coupled with their exposures to corporates which are exposed to similar risks, across national jurisdictions add to the multiplicity of risks which brings to the fore the issue of close monitoring and prudential management.

1.2.4 Financial Conglomerates and the Regulatory Structure:

In recent years the distinction between the banks and non- banking financial intermediaries has become blurred. A number of financial conglomerates have emerged that undertakes various financial activities under the same corporate structure. These have challenged institution based regulation as it fails to take into account the gaps and overlaps in regulations. In India also some (several) financial conglomerates have emerged. Devising a mechanism for effective monitoring of these entities in collaboration with other regulators is a major challenge.

1.2.5 Complex Products

In the recent years financial products such as asset backed securities, derivatives, credit default swaps(CDSs) and collateralized debt obligations (CDOs) became highly popular with banks and financial institutions as they allowed them to hedge their risks and manage their regulatory and economic capital more efficiently. Although various structured products have enable the transfer of risks and enhanced the liquidity instruments, the recent financial crisis and consequently the global economic meltdown have brought to the fore the risks posed by these instruments. With the increased use of innovative credit instruments the risk taker or investor became progressively remote from the ultimate borrowers where the actual risks resided. The use of these complex financial instruments poses several regulatory and supervisory challenges.

1.2.6 Financial Inclusions

In India a significant segment of the population predominantly in rural areas, is excluded from the formal financial system. There are large number of people, potential entrepreneurs, small enterprises and others, who are excluded from the financial sector, which leads to their marginalization and denial of opportunity for them to grow and prosper. There is a need to mobilize the small savings of large number of households. There is significant degree of financial exclusion in urban areas also. The cost of financial exclusion is enormous for the society and individual. The inability to realize full potential due to financial constraints is a major impediment for economic growth. Therefore, financial inclusion of various sectors into the formal financial system by providing them access to financial services is by itself a challenge.

1.3 Problem Statement

A well functioning financial sector facilitates efficient intermediation of financial resources. The more efficient a financial system is in resource generation and allocation, the greater is its contribution to economic growth. An efficient system of financial intermediation also contributes to the risk mitigation process in the economy. For instance, enhanced efficiency in banking can result in greater and more appropriate innovations, improved profitability as well as greater safety and soundness when the improvement in productivity is channeled towards strengthening capital buffers that absorb risk. Moreover, efficiency or productivity measures could act as leading indicators for evolving strengths or weaknesses of the banking system and could enable preemptive steps by the regulator when necessary. Therefore investigation and measurement of efficiency and productivity in the banking sector assumes greater significance.

Since the initiation of deregulation process of the financial sector in 1992, significant policy changes have been introduced to strengthen the banking sector. These changes are

expected to have important implications on the efficiency of the banking system. Therefore, from the point of view of both managerial and policy interests, it is extremely important to know the efficiency levels of banks and their temporal behavior so as to understand how the banking industry has been reacting to the reform measures and the subsequent emerging challenges. It is also of interest to know which banks have performed better than others in the post reform period.

In the light of these observations mentioned above, there is a need to undertake a comprehensive analysis of the issue of efficiency of Indian commercial banks since 1991. Though there are a few studies already available in the Indian context, they have not covered the recent years. Further, the existing studies have relied on one or the other approaches such as the ration analysis, parametric methods or non parametric methods. In the present study we intend to employ all these approaches to get a comprehensive picture concerning the nature of efficiency among the Indian commercial banks.

1.4 Objectives and Hypotheses of the Study

In the light of the preceding discussion and keeping in view the recent developments in Indian banking after reforms, the specific objectives of the study are set as follows:

1. To present a brief history of commercial banks in India since independence.
2. To examine the banking sector reforms initiated from 1991 onwards.
3. To have a critical insight into the efficiency of Indian commercial banks using accounting measures. (ratio analysis).
4. To estimate the technical efficiency of Indian commercial banks from 1991 to 2009 to look into the possible factors contributing to variations in technical efficiency, and also to examine the temporal behaviour of the efficiency

5. To estimate the relative technical efficiency of banks using the nonparametric data envelopment analysis (DEA).

1.4.1 Hypotheses

In this study the following hypotheses are formulated.

i. The SBI group is relatively more efficient compared to the other public sector banks.

ii. The private sector banks are technically more efficient compared to the public sector banks, SBI group included.

iii. The foreign banks are more efficient compared to the private as well as public sector banks.

iv. Technical efficiency of banks is not time invariant especially in the light of the financial sector reforms.

1.5. Scope and Limitations of the Study

The present study covers the post reform period i.e**.** 1991-2009. The data on various inputs and outputs that have been used to calculate efficiency of commercial banks in India, have been compiled from the "Statistical Tables Related to Banks in India" published by the RBI. Both parametric (stochastic frontier approach, SFA) and a non parametric (data envelopment analysis, DEA) approaches have been used to estimate efficiency. In SFA four measures of outputs namely, net interest margin (total interest earned less total interest expended), other income (income from commission, brokerage etc.), credit and investment have been used. The study has also used two broader

measures of outputs reflecting the profit earning and the growth and safety of banking sector. The profit earning measure is obtained by adding net interest margin and other income. Another variable has been constructed by adding credit and investment reflecting banking growth. Deposits, borrowings, fixed assets and labor have been used as inputs. The study estimates technical efficiency. In SFA the technical efficiency scores have been presented for different combinations of outputs and inputs. The banks have also been divided into different groups namely, public sector, private sector and foreign banks, based on the three ownership criterion. .

To estimate technical efficiency using DEA, two alternative combinations of inputs and outputs have been used. The inputs considered are number of employees, establishment expenditure, non-establishment expenditure, interest expenditure, non- interest expenditure and fixed assets. The outputs considered are deposits, advances, investments, net interest margin, total income and other income.

The technical efficiency under constant returns to scale (CRS), variable returns to scale (VRS), and scale efficiency, has been estimated for different groups of banks and the entire banking sector.

The main limitation of the study is that only technical efficiency measures are calculated. Allocative, cost or profit efficiencies have not been estimated in view of non-availability of consistent price data.

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CHAPTER II

EVALUTION OF BANKING IN INDIA

2.0 History of Banking in India:

The history of banking activity evolved with the moneylenders accepting deposits and issuing receipts in their place. Evidence suggests that money lending activity in India could be traced back to vedic period i.e. 2000 to 1400 B.C. Professional banking in india took shape around 500 B.C. Kautilya's *Arthashastra,* dating back to 400 B.C. contained references to creditors, lenders and lending rates. Banking was fairly varied and catered to the credit needs of the trade, commerce agriculture, as well as individuals in the economy.

A wide network of banking spread through out the cities and towns of commercial importance. They had their own inland bills of exchange or hundis, which were the major forms of transactions between Indian bankers and their trans-regional connections. Banking practices in India were in sharp contrast with the European Counterparts. Dishonoring of hundis seldom happened.   Most banking worked on mutual trust, confidence and without securities and facilities that were considered essential by British bankers.

Banking regulation also had a rich tradition and evolved along with banking in India. The classic *Arthashastra* mentioned about the norms for banks going into liquidation, it also opined that if any bank ran into bankruptcy, debts owed to the state had priority over other creditors.

The pre-independence era was marked with the existence of private banks organised as joint stock companies. Most banks were small and had private share holding of the

closely held variety. They were largely localized and many of them failed. (Though the banks come under the supervision of Reserve Bank in 1935, the process of regulation and supervision was limited by the provisions of the Reserve bank of India Act 1934 and the Companies Act 1913. The network of indigenous banks and money lenders that was prominent at that time was exploitative and these indigenous bankers largely remain isolated from the institutional part of the system. Cooperative Credit which was the only hope succeeded only in few regions.

2.0.1 Early Phase of Banking in India – up to 1947: Beginning of Banking in India:

The beginning of commercial banking of the joint stock variety that prevailed else where in the world could be traced back to the early 18th century. The Western variety of joint stock banking was brought to India by the English Agency houses of Calcutta and Bombay. (Now Kolkota and Mumbai) The first Bank of joint stock variety was Bank of Bombay, established in 1720 in Bombay. This was followed by Bank of Hindustan in Calcutta, which was established in 1770 by an agency house. This agency house, and hence the bank, was closed down in 1832. The General Bank of Bengal and Bihar proved to be a short lived experiment. Trade was concentrated in Calcutta after the growth of East India Company's trading and administration, with this grew the requirement for modern banking services, uniform currency to finance foreign trade and remittances by British army personnel and civil servants. The first presidency bank was the Bank of Bengal established in Calcutta on June 2, 1806 with a capital of Rs.50 lakh. The bank had the task of discounting the treasury bills to provide accommodation to the Government. The bank was given powers to issue notes in 1823. The Bank of Bombay was the second presidency bank set up in 1840 with a capital of Rs.52 lakh, and the Bank of Madras the third presidency bank established in July 1843 with a capital of Rs.30 lakh. They were known as Presidency banks as they were set up in the three presidencies that

were the units of administrative jurisdiction in the country for the East India Company. The presidency banks issued currency notes until the enactment of the Paper Currency Act, 1861, when this right to issue currency notes by the Presidency Banks was abolished and that function was entrusted to the Government.

The Presidency Bank Act, which came into existence in 1876, brought the three Presidency Banks under a common statute and imposed some restrictions on their business. It prohibited them from dealing with risky business of foreign bills and borrowing abroad for lending more that 6 months, among others. The Act prescribed the periodic inspection of the books of these banks. The proprietary connection of the Government was, however, terminated, though the banks continued to hold charge of the public debt offices in the three presidency towns, and the custody of a part of the Government balances.

The net also stipulated the creation of Reserve Treasuries at Calcutta, Bombay and Madras into which sums above the specified minimum balances proposed to the presidency banks, were to be lodged only at their head offices. The Govt. could lend to the presidency banks, were to be lodged only at their head offices. The Govt. could lend to the presidency banks from such Reserve Treasuries. The major banks were organised as private share holding companies with the majority share holdings being Europeans. The first Indian owned bank was the Allahabad Bank set up in Allahabad in 1865, the second, Punjab National Bank was set up in 1895 in Lahore, and the third, Bank of India was set up in 1906 in Mumbai. All these banks were founded under private ownership. The *Swadeshi* Movement of 1906 provided a great impetus to joint stock banks of Indian ownership and many more Indian Commercial Banks such as Central Bank of India, Bank of Baroda, Canara Bank, Indian Bank, and Bank of Mysore were established between 1906 and 1913. By the end of December 1913, the total number of reporting commercial

banks in the country reached 56 comprising 3 Presidency banks, 18 class 'A' banks (with capital of greater than Rs.5 lakh), 23 class 'B' banks, (with capital of Rs. 1 lakh to 5 lakh) and 12 exchange banks. Exchange banks were foreign owned banks that engaged mainly in foreign exchange business in terms of foreign bills of exchange and foreign remittances for travel and trade. Class A and B were joint stock banks. The banking sector during this period, however, was dominated by the presidency banks as was reflected in paid-up capital and deposits.

The Swadeshi movement also provided impetus to the Cooperative Credit movement and led to the establishment of a number of agricultural credit societies and few-urban cooperatives. The inability of joint stock banks caters to the needs of clientele with limited means of effectively drove borrowers to moneylenders and similar agencies for loans at exorbitant rates of interest. This situation was the prime mover for non-agricultural credit cooperatives coming into being in India. The main objectives of such cooperatives were to meet the banking and credit requirements of people with smaller means to protect them from exploitation.

2.0.2   World War I and its Impact on Banking in India:

The presidency banks were amalgamated into a single bank, the Imperial Bank of India, in 1921. The Imperial Bank of India was further reconstituted with the merger of a number of banks belonging to old princely states such as Jaipur, Mysore, Patiala and Jodhpur. The Imperial Bank of India also functioned as a Central Bank prior to the establishment of the Reserve Bank in 1935. Thus, during this phase, the Imperial Bank of India performed three sets of functions, viz., Commercial Banking, Central Banking, and the banker to the Government. By 1930, the number of commercial banks increased to 107 with the Imperial Bank of India still dominating the Indian Banking Sector. Besides,

at end of March 1929, 158 cooperative banks also existed. The number of cooperative banks rose sharply during the period of 1922-23 to 1928-29. Although greater than commercial banks in number, the size of deposits of cooperative banks was much smaller.

In 1930, the banking system, in all, comprised 1258 banking institutions registered under the Indian Companies Act, 1913. Of the 1258 entities registered as banks in 1930, while some were banks in genuine terms, others were indigenous banks, Nidhis and loan companies.

2.0.3   Setting up of the Reserve Bank of India and its Role:

It was felt that the establishment of a central bank would bring in greater governance and integrate the loosely connected banking structure in the country. It was also believed that the establishment of a central bank as a separate entity that does not conduct ordinary banking business (like the Imperial Bank of India) was likely to have the stature to be able to deftly handle the central banking functions without the other joint stock banks feeling any rivalry towards it. Accordingly the Reserve Bank of India Act, 1934 was enacted paving the way for the setting up of the Reserve Bank of India. The issue of bank failures and the need for catering to the requirements of agriculture were the two prime reasons for the establishment of the Reserve Bank. The Banking sector came under the purview of the Reserve Bank in 1935. The Reserve Bank of India Act, 1934 gave the Reserve Bank powers to regulate issue of bank notes, custody of commercial banks cash reserves and discretion of granting them accommodation. The Reserve Banks main function could be classified into the following broad categories (a) to act as a banker to the Govt., (b) to issue notes, (c) to act as a banker to other banks and (d) to maintain the exchange ratio. The RBI Act had a limited control on banks although its obligations in each sphere were spelt out in clear terms. There was some amount of built-in flexibility

as the Reserve Bank was vested with extra powers and maneuverability under extraordinary circumstances that could be exercised only with the prior approval of the Governor General in council or the Central Board of the Bank as might be prescribed in each case.

In 1935, banks were required to maintain cash reserves of 5% of their demand liabilities and 2% of their time liabilities on a daily basis. The task of managing the currency that was assigned to the Controller of Currency came to the Reserve Bank in March 1935 under section 3 of the RBI Act 1934. The provisions of the RBI act also required the reserve bank to act as a banker bank. In accordance with the general central banking practice, the operations of the Reserve Bank with the money market were to be largely conducted through the medium of member banks, viz., the scheduled banks and the provincial cooperative banks. The 'scheduled' banks were banks which were included in the second schedule to the RBI Act and these banks in British India that subsequently became eligible for inclusion in the schedule by virtue of their paid up capital and reserves being more than Rs.5 lakh in the aggregate. The power to include or exclude banks in or from the schedule was rested with the Governor General in council.

Some promotional role was envisaged for the Reserve Bank from the very beginning, as agricultural credit was a special responsibility of the Reserve Bank in terms of the RBI Act. The Reserve Bank assumed a proactive role in the sphere of agricultural credit for the economy and took concrete credit for the economy and took concrete action by commissioning two studies in 1936 and 1937 in this area. During the period from 1935 to 1950 the Reserve Bank continued to focus on agricultural credit by fostering the cooperative credit movement through the provision of financial accommodation to cooperatives. As a result of the concerted efforts and policies of the Reserve Bank, a well-differentiated structure of credit institutions for purveying credit to agriculture and

allied activities emerged. Within the short-term structure, primary agricultural credit societies at the village level formed the base level, while district central cooperative banks were placed at the intermediate level, and the state cooperative banks at the apex level. The long term structure of rural cooperatives comprised state cooperative agriculture and rural development banks at the state level, and primary cooperative agriculture and rural development banks at the decentralised district or block level. These institutions focused on providing typically medium to long-term loans for making investments in agriculture and rural industries.

The Reserve Bank in the earlier years did not have adequate powers of control or regulation. Commercial banks were governed by the company Law applicable to ordinary non-banking companies, and the permission of the Reserve Bank was not required even for setting up of a new bank. The classification of banks was expanded to include the banks with smaller capital and reserve base. Class A banks were divided into A1 and A2. Further two new categories of banks, viz., C and D were added to include the smaller banks. Banks with capital and reserves of greater than Rs.5 lakh and included in the second schedule of the RBI Act 1934 were classified as class A1, while the remaining non scheduled banks with capital and reserves of greater than Rs.5 lakh were classified as class A2. The rest of the non scheduled banks were classified according to their size; those with capital and reserves of greater than Rs.1 lakh and lower than Rs.5 lakh were classified as class B; banks with capital and reserves of greater than Rs.50,000 and upto Rs.1 lakh were classified as class C; and those with capital and reserves of less than Rs.50,000 were classified as class D. In 1940, the number of reporting banks was 654.

The under developed nature of the economy and the lack of an appropriate regulatory frame work posed a problem of effective regulation of a large number of small banks. Mushrooming growth of small banks in a scenario, where adequate regulation was not in

place, led to various governance issues. The Reserve Bank's statute alone then did not provide for any detailed regulation of the commercial banking operations for ensuring sound banking practices.

2.1 Banking in the Early Years of Independent India: 1947 to 1967:

At the time of attaining freedom, Indian banking was entirely in the private sector. In addition to the Imperial Bank, there were five big banks, each holding public deposits aggregating Rs.100 Crore and more viz., Central Bank of India, Bank of Baroda Ltd., and United Commercial Bank Ltd. All other commercial banks were also in the private sector and had a regional character; most of them held deposits of less than Rs.50 Crore. Interestingly, the Reserve Bank was also not completely State owned until it was nationalised in terms of the Reserve Bank of India.

Many spheres of economic activity under-went a change after Independence. A phenomenal transformation took place in the banking sector which was one of the most crucial areas. Banking sector was plagued with a number of difficulties on the eve of Independence. Domestic scheduled commercial banks dominated the banking system. Non scheduled banks though large in number can situated a small share of the banking sector. Of the 84 banks operating in the country in organised sector before partition, two banks were left in Pakistan. Many of the remaining banks in two states of Punjab and West Bengal were deeply affected.

The year 1948 was marked by a number of bank failures. About 45 larger banks (out of more than 637 banks) were closed down. Some of the main reasons for failure were that they had over-reached themselves by opening more branches than they could sustain on the strength of their resources and they also made large advances against property or inadequate security. And some of the banks were also functioning with very low capital

base. Repeated failures chattered the faith of the savers and people diverted their financial savings to the considered it as a safer avenue.

The first task before the Reserve Bank after Independence, thus, was to develop a sound structure along contemporary lines. It was recognised that banks and banking soundness were crucial in promoting economic prosperity and stability. Banks, through their spread and mobilisation of deposits, promote the banking habits and savings in the economy. This could help in garnering resources for investment and development. The commencement of planned economic development required the banking industry to spread for and wide to augment deposit mobilisation and provide banking services.

The Banking Companies Act 1949 (Banking Regulation Act) was the first regulatory step by the Govt. of independent India to streamline the functioning and activities of commercial banks in India. It focused on basic prudential features for protecting the interests of depositors and covered various aspects such as organisation, management, audit and liquidation of the banking companies. It granted the Reserve Bank control over opening of new banks and branch offices, powers to inspect books of accounts of the banking companies and preventing voluntary winding up of licensed banking companies. This act described banking as distinct from other commercial operations.

Bank failures continued even after Independence and enactment of Banking Companies Act, although such failures were reduced considerably. At that point of time liquidation was long and time consuming and suspension of business was a long drawn process for licensed banking companies. Winding up was an easy exit route for banking companies that were not granted license. This made it easy for the fly-by-night operators to voluntarily wind-up their operations. As a result many non-scheduled banks were untraceable. Out of the 165 nonscheduled banks reported to exist in June 1954, the

whereabouts of 107 banks were not known. The licence of all those and the remaining nonscheduled banks, barring six, was cancelled. The Banking Companies Act 1961 clarified the provisions related to compulsory reconstruction or amalgamation of banks. The Act enabled compulsory amalgamation of a banking company with the State Bank of India or its subsidiaries.

During the period 1954 and 1966, several banks were either amalgamated or they otherwise ceased to function or their liabilities and assets transferred to other banks. The policy of strengthening of the banking sector through a policy of compulsory amalgamation and mergers helped in consolidating the banking sector. The success of this could be ganged from the visible reduction in the number of non scheduled banks from 474 in 1951 to 210 in 1961 and further to 20 in 1927. The Banking Companies (Second Amendment) Act, 1960 which came into force on September 19, 1960 sought to facilitate expeditious payments to the depositors of banks in liquidation and also vested the government and the Reserve Bank with additional powers to rehabilitate banks in difficulties. In order to ensure the safety of deposits of small depositors in banks in India, the Deposit Insurance Corporation Act, 1961 was enacted. Accordingly, Deposit Insurance Corporation of India was established in January 1962. India was then one of the few countries to introduce such deposit insurance. This scheme was expected to increase depositor's confidence in the banking system and was expected to facilitate mobilisation of deposits and help promote spread and growth of the banking sector. The corporation provided insurance cover against loss of all or part of deposits with an insured bank upto a certain level.

2.2 Lending to Agriculture and Spread of Banking to Rural Areas:

With Independence not only did the operating environment change but policies also were geared towards planned objectives. The First Five-Year Plan observed that central banking in a planned economy could hardly be confined to the regulation of the overall supply of credit or to a some what negative regulation of the flow of bank credit. It would have to take on a direct and active role (i) in creating or helping to create the machinery needed for financing developmental activities all over the country; and (ii) ensuring that the finance available flows in the directions intended. The governments desire to use banking as an important agent of change was at the heart of most policies that were formulated after independence. Those were the first attempts at enhancing the outreach of institutional credit. Banks, which were unique among financial institutions, performed the function of channeling the resources to most productive uses. Banking in the planned era was to contribute to development. Therefore, the banking sector was expected to spread the institutional credit across the country. The need for these changes stemmed from the fact that the banking sector had to play a crucial role in promoting development because the banks at that time wore small, weak and concentrated in the urban areas and most of the banks in organised sector engaged primarily in extending loans to traders dealing with agricultural produce.

Banking had not penetrated into the rural semi urban centers. A great degree of interlinkage of markets of agricultural output and credit existed with the agricultural moneylender and traders giving advances to the cultivator and purchasing his produce at less than the market price. Such an inter linkage between the credit and the output markets had sustained high interest rates and low product price cycles that brought about a high-interested rate-high debt-low income kind of equilibrium. This was sustained, as

institutional bank credit was not available to agriculture, small industries, professionals and self-employed entrepreneurs, artisans and small traders. The moneylenders / landlords acted as monopolists and charged exorbitantly high rates of interest to cultivators. The interlinkage of markets of output, credit and labour could be effectively broken only by the spread of the institutional credit. Cooperatives had penetrated into the rural sector but were weak. At the time of Independence, most of the bank credit went to commerce and industry, and very little to agriculture. This was despite the fact that agriculture constituted about 55 percent of GDP in 1950.

The grant of small agricultural loans required the banks to maintain a large number of small accounts that that were both time consuming and less profitable. Besides, lending operations were largely security based and the small borrowers had very little security apart from their land, which was often not conencumbered. The needs of the agricultural sector were not met adequately, as the banks had no expertise or desire to expand their rural operations. Moreover, banks were run by business houses with other considerations such as profit and financing parent industries. The agricultural operation did not interest many of them. According to the All India Rural Credit Survey Committee, the total borrowing of the farmers was estimated at Rs.750 Cr. in 1951-52. Of this, commercial banks provided only 0.9 percent, agriculturist moneylenders provided 24.9 percent and professional moneylenders another 44.8 percent. Thus, the financial system at the time of Independence was typically under-developed. In 1951, there were 551 commercial banks in the country. The bank office to population-ratio was at a staggering one branch per 1,36,000 persons. Saving habits had also not developed adequately, with the saving rate being at 10 percent of national income. The underdeveloped banking system was characteristic of a more general lack of depth in the financial system.

The main objective after Independence was to extend banking facilities to rural areas. Accordingly, banks were advised to expand their network to rural and semi-urban areas. It was felt that the machinery, postal savings banks and cooperative banks should be further strengthened in the villages. The role of the Reserve Bank was in this regard to expand and coordinate the institutional credit structure for agricultural and rural credit. The policy initiative by the Reserve Bank or Govt. was three fold. First, to understand the dimension of the problem, a committee was set up. Second, the Imperial Bank of India was nationalised. Third, to address the issue of training of the bank officials in the area of agricultural banking, an institution was set up.

In order to focus on agricultural and rural credit needs, the RBI Commissioned the All India Rural Credit Survey Committee (AIRCS) in 1951. The main objective of this survey was that banking should help to alleviate problems faced by the average Indian. The Committee observed that the rural credit system lacked focus. The Committee also observed that agricultural credit fell short of the right quantity, was not of the right type, did not serve the right purpose and often failed to go to the right people. The performance of the cooperative sector was not effective and did not meet the credit needs of the rural people to the extent necessary. To promote the institutionalisation of credit to agriculture the committee recommended amalgamation of the Imperial Bank of India and major state associated banks to form the State Bank of India (SBI). The creation of SBI would help to foster the growth and expansion of banking sector, to serve the needs of the borrowers with small means who were hither to neglected by the privately owned banks. The Government in accordance with the recommendations of the survey nationalised the Imperial Bank of India with the objective of extension of banking facilities on a large seals, more particularly in the rural and semi-urban areas and for diverse other public purposes. The Imperial Bank of India was converted into SBI in 1955 with the enactment

of SBI Act 1955. The nationalisation of the State Bank was expected to bring about momentous changes in the focus from credit worthiness to 'purpose' worthiness. The ownership of the SBI remained with RBI to safeguard the sound banking principles, and to maintain the high standards of business while remaining oriented to the objectives of satisfying the credit requirements of the needy people.

The State Bank of India, which was required to open 400 branches within 5 years in unbanked centers, exceeded the target by opening 416 branches. The SBI was envisaged to act as the principal agent of the Reserve Bank to handle banking transactions of the union and the state governments throughout the country. With the selling up SBI a large number of branches were opened in unbanked centers. SBI competed with safe avenues like post offices and physical savings, with the opening of branches far and wide in the country SBI was able to mobilise more deposits. Aggregate deposits of scheduled commercial banks, which registered a negative growth in 1951-53 and a small positive growth of 1.9 percent in 1953-54, grew by 10-12 percent during the period 1954-55 and 1956-57. The increased deposit mobilisation was also facilitated by the increased income levels. The first Five year plan had a high multiplier effect on the economy which rose the income levels of the people thereby leading to the spread of banking habits. The financial savings grew sharply during 1954-55 to 1955-56 due to increased deposit mobilisation. A part of the increased financial savings during 1953-54 and 1955-56 emanated from conversion of physical savings into financial savings.

Eight banks that then formed subsidiaries of SBI were nationalised in 1960. This brought one third of the Banking segment under the direct control of the Government. The idea was to spread institutional credit for and wide in order to free the average Indian from the often exorbitant interest rate-debt cycle. In order to restructure the short term cooperative credit structure and to reorganize the institutions specialising in long term lending for

agricultural development and to provide adequate institutional credit to meet the medium term requirements of agriculture, the Agricultural Refinance Corporation of India was established in 1963. Its objective was to refinance central land mortgage banks, state cooperative banks and scheduled commercial banks.

With these new developments between 1952 and 1960 and further between 1960 and 1967, the population per office declined from 1,36,000 in 1951 to 92,000 in 1960 and further to 65,000 in 1967. The share of agriculture in credit dispensed by scheduled commercial banks also did not improve. Credit to agriculture constituted only 2.2. percent, i.e, an increase of merely 0.1 percent between 1951 and 1967 in sharp contrast to almost doubling of the share of industry from 34 percent in 1951 to 64.3 percent in 1967.

2.3 Emergence of Administered Structure of Interest rates and Micro Controls:

Designing monetary policy became more challenging during this period due to the two wars and the drought. The rising deficit and the accompanying inflation led to an administered structure of interest rates and several other micro controls. In early years, the Reserve Bank relied on direct control over the lending rates of Banks, rather than indirect instruments such as the bank rate for influencing the cost of Bank credit. This was generally done by stipulating minimum rates of interest. The exigencies also required further sub classification of interest rates with minimum lending selective credit control. Also, concessional or ceiling rates of interest were made applicable to advances for certain purposes or to certain sectors to reduce the interest burden, thereby facilitating their development. Interest rates on deposits were also regulated in September 1964. The objectives behind fixing the rates on deposits were to avoid unhealthy competition amongst the banks for deposits and keep the level of deposit rates in alignment with the

lending rates of banks to ensure the profitability of banks. Changes in interest rates were governed by voluntary inter-bank agreements amongst the important Indian and foreign banks which used to fix ceilings on interest rates. Thus, interest rate regulations were aimed at satisfying the conflicting objectives such as enhancing savings rate, while keeping the cost of credit for productive activities at a reasonably low-level. Those seemingly opposing objectives were addressed by setting the interest rates according to depositor, borrower, purpose, background of the borrower, his economic status, type of activity for which the credit was granted and the amount of such credit.

Under administrative set up, the spread of the banks were well worked out, as a result banks lost initiative to optimise their resources, offer competitive rates and retain business. Because of the administered structure of the interest rates, banks also could not price their products depending on the credit-worthiness of the borrowers which also led to misallocation of resources. The concentration of resources in the hands of a few entities affected the genuinely productive sectors. It was therefore, decided to take measures to promote effective use of credit and prevent the larger borrowers from pre-empting source credit and enlarging the spectrum of borrowers covered by bank credit in the overall context of national priorities as enunciated over the years.

To sum up, the banking scenario that prevailed in the early Independence phase had three distinct features. One, bank failures had raised the concerns regarding the soundness and the stability of the banking system. Two, there was large concentration of resources from deposits mobilisation in a few hands of business families or groups. Banks raised funds and on-lent them largely to their controlling entities. Three, agriculture was neglected in so far as bank credit was concerned. The key development in this period was the enactment of the Banking Regulation Act which gave the RBI the power to control the banking system. Compared to the pre independence period the number of banks that

failed declined. The Reserve Bank was successful in promoting the safety and soundness of the banking sector as several weak banks were weeded out through amalgamation or liquidation. As a result the number of nonscheduled banks declined sharply from 475 in 1951 to 20 in 1967. Due to impetus from the multiplier effect of large public investments that led to higher incomes and structural charges in economy the banking sector grew steadily.

2.4 Banking Scenario in the Pre Nationalisation Period:

The nexus between the banks and the industry and neglect of agriculture was a major cause of concern for the authorities. Agricultural sector did not receive credit from most of the banks. The banks did not penetrate into rural areas and institutional credit was not available to the Indian farmers. The farmers were under the grip of money lenders who charged exorbitant rates of interest. Not only the farmers but also the small traders and small scale industrialists did not have access to credit because of the nexus between banks and big industrial houses. There was apprehension that a few business houses might acquire control over a significant proportion of banking assets through the banks associated with them. Besides, such control might also Jeoparadise the interests of the depositors if, as a consequence, banks became overexposed to individual firms or business groups.

In order to address these concerns, the concept of social control over banking was introduced in December 1967 through the Banking Laws (Amendment) Act 1968, which came into force on February 1, 1969. The Act stipulated that every bank was to have a chairman who was not an industrialist but was a professional banker and had special knowledge and practical experience of banking or financial, economic or business administration and his term should not exceed 5 years at a time. The Act also specified

that not less than 51 % of members, board of directors should have an expertise in accountancy, agricultural and rural economy, banking, economics, law, finance and small scale industry. The Reserve Bank was vested with the powers of appointment, removal or termination of the services of not only the Chairman, but also of any director, the Chief executive officer, or any other officer or employee of a bank, Whenever the circumstances so required.

It was felt that through social control a better alignment of the banking system with the needs of economic policy would be possible. The main objective of this social control was to prevent the misuse of bank credit and to direct a larger volume of credit to that priority sector, in line with the objectives of planned development. The National Credit Council (NCC) was set up in February 1968 to assist the Reserve Bank and the Government to allocate credit according to plan priorities. It was entrusted with the task of (i) estimating the demand for the bank credit from the different sectors of the economy; and (ii) fixing priorities for grant of loans or for investment after taking into account the availability of resources, and needs of the priority sector, especially agriculture, small scale industries and exports. The council worked towards bringing about an optimum utilization of resources by coordinating the lending and investment policy of commercial and cooperative banks and other specialized institutions. In the broader picture, the commercial banking sector and cooperatives were to supplant the usurious network of the moneylenders and its indigenous variants that charged exorbitant interest rates. The scheme of social control was aimed at bringing some changes in the management and through it distribution of credit by the commercial banks and delinking the nexus between big business houses and big banks. Despite the system of social control on banks, a large segment of the population remained outside the purview of the organised sector credit.

2.5 Nationalisation of Banks and Spread of Banking:

Though the banking system experienced some improvements in terms of deposit growth, the spread of banking system was still confined to urban areas. The progress of banking with regard to social objectives was inadequate. A notable feature of Indian commercial banking was the control of the major banks by lenders of commerce and industry. Banks were run to satisfy their requirements rather than along commercial principles. The consequence was the gradual erosion in the capital base of banks. The ratio of paid up capital and reserves to deposits declined by more than 75 per cent from 9.7 per cent in 1951 to 2.2 per cent in 1967. The rapid increase in deposits in relation to their owned capital enabled the industrialist shareholders to enjoy immense leverage. It was felt that if bank funds had to be channeled for rapid economic growth with social justice, there was no alternative to nationalisation of atleast the major segment of the banking system. Accordingly, the government nationalised 14 banks deposits of over Rs.50 Cr by promulgating the Banking Companies (Acquisition and Transfer of Undertakings) Ordinance, 1969. Those Banks were the Central Bank of India, Bank of Maharashtra, Dena Bank, Punjab National Bank, Syndicate Bank, Canara Bank, Indian Overseas Bank, Indian Bank, Bank of Baroda, Union Bank, Allahabad Bank, United Bank of India, UCO Bank, and Bank of India. The objective was to serve better the needs of development of the economy in conformity with national policy objectives.

It was believed that nationalisation would mark a new phase in the implementation of the nations crooned objectives and policies. It was also felt that bank deposits could be used for furthering economic development of the country as a whole rather than for certain industries and business houses. Thus, the immediate tasks set for the nationalised banks were mobilisation of deposits on a large scale and on-lending those funds for all

productive activities, irrespective of the size and social status of the borrower, particularly to weaker sections of the society. On the eve of nationalisation, the banks had a definite urban orientation as about 44 percent of total deposits and 60 percent of total credit were accounted for by the five centers.

Due to nationalisation there was a structural transformation in the banking system. Specific emphasis was laid on providing credit and banking facilities to the unbanked areas. This was done by designing specific branch license policy and by initiating specific schemes like the Lead Bank Scheme (LBS). LBS introduced by RBI was intended to mobilize deposits on a massive scale throughout the country and also for stepping up of lending to weaker sections of the economy. The 'Lead Bank' designated for the district was responsible for taking lead role in surveying the credit needs of the population, development of banking and of credit facilities in the district allotted to it.

Initially all the districts of the country were allotted to 22 public sector banks and 3 private sector banks taking into consideration the resource base of the bank and regional orientation. Districts were allotted in clusters to facilitate control and in each state two or more than two banks were allotted the responsibility of districts. Each bank was also allotted districts in more than one state. The allotment of districts to various banks under the LBS had a major role in the spread of banking to unbanked centers. In about 5 years after nationalisation of banks, the branch network expanded by 129 percent. The population per bank office declined from 65,000 per bank office in June 1969 to 31,660 in December 1975. Of the 10,543 new branches opened 5,364 (50.1 percent) were in rural areas. As a result, the share of rural branches in total bank branches increased from 17.6 percent in 1969 to 36.3 percent in 1975. Banks spread out first to rural areas and then building on this experience forayed further into unbanked areas. In 1977, banks

were given the incentive of a license to open one branch in metropolitan and one in urban areas, as an incentive for opening four branches in rural areas.

Branch expansion continued in the 1980s. Regional distributors of bank branches also improved in 1980s in comparison with the 1970s. The branch licensing policy was intended to tackle the urban bias of banks but it was felt that this policy alone could not address the issue of rural deposits were not used to just increase urban credit, banks were directed that each rural and semi urban bank should maintain a credit deposit ratio of at least 60 percent. The credit deposit ratios for the banks in rural and semi urban branches were carefully mentioned.

After nationalisation reorientation of bank lending took place. The priority sectors of the economy which did not receive much attention in the earlier period got access to credit. Banks involved themselves in other socially desirable sectors. Integration of credit planning with economic planning and policy was the main focus of RBI during this period. A broad credit plan tuned to the overall plan and monetary requirements was drawn up taking into account the national priorities, the anticipated pace of deposits accretion, general economic, situation and likely developments in the different economic sectors. The plan had to provide for allocation for certain activities such as govt. requirements and certain essential govt. commercial operations like food procurement and buffer stock operations. Another important step was that of arriving at aggregate estimates for certain key sectors. Separate estimates were made for the busy and slack seasons, particularly in respect of sectors susceptible to seasonal changes. Banks were required to chalk out a credit plan of their own keeping in view the broad credit policy and banks were asked to explore the scope for redeployment of existing credit and linking it to genuine productive purposes.

Immediately after the nationalisation, confidence in the banking sector increased, which was reflected in the sharp increase in the share of bank deposits in household savings and financial savings of households in their total saving. Conscious efforts were made to keep the deposit rates attractive. The period of nationalisation also coincided with the period of the Green Revolution and its benefits started flowing to the rural sector in the terms of higher income. Rapid expansion of the branch network in rural areas, special emphasis on deposit mobilisation and rise in income levels propelled the growth of bank deposits. The spread of banking and deposit mobilisation were the two most significant achievements of the nationalisation. The growth of deposit, intrurn, was led by an increase in the savings rate.

2.6 Institution of Directed Credit and the Setting up of Regional Rural Banks:

The need to channel flow of credit to certain sectors of the economy known as priority sectors was felt as early as 1961. Banks were expected to play a more active and positive role in aiding sectors such as agriculture and small scale industries. Once the main constraint of credit was resolved, these sectors were expected to do reasonably well. However, the bulk of bank advances continued to be directed to large and established business houses, while agriculture, SSI and exports did not receive adequate attention. As a result, the need was felt for imposing lending stipulations.

The formal directives to channel the flow of credit were issued in the slack season of 1968 when severe imbalances developed in the economy in the agricultural output which resulted in a shortfall in agricultural output and slowing down of industrial production. Consequently, from 1970s banking policy was used as an important instrument of growth and for securing a progressive reduction in inequalities in income, concentration of

economic power and regional disparities in banking facilities. This was done because it was strongly felt that some sections of the population could not afford the market rates of interests and therefore, should be provided credit on a preferential basis at concessional rates of interest. As a result the promotional aspects of banking policy came into greater prominence.

The definition of the priority sector was formalized in the 1972, although initially there were no specific targets in priority sector lending. However, in November 1974, public sector banks were advised that their priority sector lending should reach a level of not less than one third of the outstanding credit by March 1979. National targets for advances to priority sectors as a whole, with sub targets for weaker sections of the society were laid down. In November 1978, private sector banks were also advised to maintain one third of their total advances to the priority sectors by the end of March 1980. Subsequently the target was enhanced to 40 percent of aggregate advances. In the case of scheduled commercial banks, for instance, 81 percent of total borrowing accounts were for amounts up to Rs.10,000 but they accounted for less than 4 percent of bank credit. In order to correct for this situation, two pronged measures were taken. First, special emphasis was laid on the economic upliftment of the weaker sections of society in rural areas by stipulating specific targets. Second, to mitigate the default risk that was in rate to the smaller borrowers, the Reserve Bank promoted the establishment of the Credit Guarantee Corporation of Indian Ltd. in 1971 for providing guarantees against the risk of default in payment. This policy encouraged the commercial banks and other institutions to grant loans to various categories of small borrowers.

The branch expansion policy was designed to remove inter regional disparities in respect of bank credit given the fact that the incidence of poverty and lack of access to credit was more in the rural areas. To uplift the weaker sections and to cater to their credit needs the

differential rate of interest was introduced in 1972. The scheme targeted low-income people in rural areas and gave them credit at concessional rate. The target group of this scheme was landaus labourers, physically handicapped persons, orphanages, women's homes, scheduled castes and scheduled tribes who did not have any tangible security to offer and to the lending institutions. The minimum quantum of lending under this scheme for each bank was one percent of its total advances of the previous year. A major problem in implementing this scheme was identifying the eligible borrowers who should be the weakest of the weaker sections.

Various measures initiated had a positive impact on lending to agriculture as the share of agricultural credit in total bank credit increased from 2.2 percent in 1967 to 8.0 percent in 1970-71 and further to 9.1 percent in 1974-75. However the improvement fell short of expectations. This was mainly because commercial banks were not tuned to the needs and requirements of small and marginal farmers, while the cooperatives lacked resources to meet the expected demand. The need, therefore, was felt a separate banking structure, capable of combining the local feel and familiarity of rural problems characteristic of cooperatives and the professionalism and large resource base of commercial banks. While the idea of starting rural banks was first suggested by the Banking commission (1972), action along these lines was initiated after the 'Twenty point programme' of the govt. of India launched in the mid 1970's. The Regional Rural Banks ordinance was promulgated on September 26, 1975, which was subsequently replaced by the Regional Rural Banks Act on February 9, 1976. RRB's were set up with a view to developing the rural economy by providing credit for the purpose of development of agriculture, trade, commerce, industry and other facilities, particularly to the small and marginal farmers agricultural labourers, artisans and small entrepreneurs. They were expected to combine the rural touch and local feel with the modern business organization. The Differential

Rate of Interest (DRI) scheme was modified to allow sponsor banks to route the DRI advances through RRB's on a refinance basis, in addition to the routing of such advances on an agency basis.

It was recognized that cost of credit rather than access was key constraint facing the rural poor. Therefore the commercial banks and RRB's were directed to charge a flat rate of 9 percent on all priority sector loans. This policy was aimed to free the rural poor from the clutches of moneylenders. The results of nationalisation of banks and introduction of directed credit programs and other initiatives were extremely encouraging. The share of rural branches increased sharply from 17.6 percent in 1969 to 58.2 percent in 1990. The share of the non-institutional sources in rural credit declined with the rise in the spread of institutional banking to rural areas. The share of rural credit in total credit outstanding and rural deposits in total deposits also increased significantly. The credit deposit ratio in rural areas increased from 37.6 percent in 2969 to 60.6 percent in 1981 and remained at that level in 1990.

Scheduled commercial banks advances to agriculture increased while those to industry declined. In order to achieve the objective of growth deposit mobilisation was a crucial aspect. While the expansion of bank branch network helped to some extent, the deposit interest rate had to be attractive. While the lending rate for the priority borrowers was at a concessional rate, the rates to the non-priority borrowers increased due to cross-subsidization. A ceiling rate on export credit was also prescribed in March 1968 to encourage the flow of credit to the sector. Effective March 1969, floors / ceiling was also used to provide sufficient funds to certain economic activities / borrowers.

Due to oil shock in 1970's in order to control the inflation resulting out of it the RBI fixed minimum lending rate of 10 percent on all loans, except for the priority sector. In April

1974, interest rates on deposits were increased for various categories pushing up the cost of funds for the banking sector. In view of the inflationary situation, the minimum rate chargeable against selective credit controls was also raised in July 1974. During this period commercial banks charged high rates of interest which increased the cost of borrowing. The Revenue Bank in 1976 prescribed the maximum rate for bank loans in addition to the minimum lending rates. Smaller banks with demand and time liabilities of Rs.25 cr. to Rs.50 cr., were given some flexibility. In June 1977, the structure of interest rates on deposits was rationalised and the spread between short and long term rates widened. Significant modifications were made in the structure of interest rates in 1981. This was because the structure of lending rates then prevalent offered inadequate gradation in the rates charged to various categories of beneficiaries in the priority sectors, although a plethora of rates prevailed. A series of anomalies developed and these were addressed by further regulation. For instance, several categories of advances to the priority sectors only ceiling rates of interest were indicated. This allowed different banks to charge different rates for the same kind of advances in a particular area causing substantial horizontal inequality.

With the increased proliferation of directed credit arrangements, multiple interest rate prescriptions based on a variety of criteria (such as, economic activity, commodity, location and specific group of borrower, among others) and the resultant cross subsidization created a very complex administered interest rate structure with virtually no role for market forces to play in pricing and allocation of credit. The differential interest rates made the banks functioning more complex. The refinance facility was useful in helping the banks to cover their costs for the preferred activity. However such measures further distorted the markets. Such measures enlarged the monetary base, altered the credit multiplier and complicated monetary management. The plethora of compulsions

on the banking sector translated into a complex set of micro regulations and led to financial repression. This approach to economic management led to crowding out of private enterprise as the increase share of credit flows was mapped up by government and public enterprises. These policies affected the commercial banks balance sheets and in turn their profitability.

2.7 Nationalisation of Banks – The Second Phase:

In order to address the issue of credit delivery in greater measure in 1980 six more banks were nationalised. With the nationalisation of these 6 banks by the government, the total number of public sector banks, including the State Bank of India and its associate banks rose to 28 in April 1980, constituting 91 percent deposits of the banking sector.

2.7.1   Increase in Statutory Pre-emptions and their Impact on the Banking Sector:

With the substantial rise in plan expenditure the banking sector was increasingly used to finance fiscal deficit. During this period the CRR was raised from 5 to 15 percent. The CRR was gradually raised from 5.0 percent in June 1973 to 15.0 percent by July 1989. Besides, an additional CRR of 10.0 percent was also introduced effective November 1983. SLR became an instrument of financing the deficit of central and state governments in due course. Between 1970 and 1991 the SLR was revised by 12.5 percentage points. Thus, by 1991, 63.5 percent resources of the banking sector were pre-exempted in the form of SLR and CRR. Banks earned less than market rate of interest on eligible CRR balances (over the then statutory minimum of 3 percent), while the yield on government securities was far below the saving deposit interest rates, let above the lending interest rates.

The proliferation of directed credit arrangements, administered structure of interest rates and increase in statutory preemptions all had an adverse impact on banks profitability. The deterioration in profitability was observed across all bank groups, although it was more pronounced in respect of SBI group.

2.8 Causes for Low Profitability of Public Sector Banks:

The Narasimham Committee (1991) clearly explained that the deteriorating profitability of public sector banks in India, at that time, was the result of two sets of factors, namely, those responsible for declining interest income for banks on the one side, and those responsible for increasing cost of operation on the other.

The declining interest income was the result of high proportion of the total deposits being impounded in CRR and SLR and earning relatively low rate of interest. Further, a high proportion of bank deposits had to be allocated to priority sectors under social banking and the rate of interest earned was quite low. At least one per cent of the total deposits had to be lent to the weaker sections of the community at a low-concessional rate of interest of 4 percent only. Barely 30 percent of the total deposits of the banks was really available for lending at the market rate of interest. Above all, the public sector banks had been forced by the Government in agriculture and industry to lend to dubious parties – and large proportion of these loans became doubtful debts known as non performing assets (NPAs).

While their income was not rising as it should, the banks were faced with the problem of rising costs of operation-uneconomic branch expansion, heavy recruitment of employees, growing indiscipline and in-efficiency of the staff due to trade union activity, low-productivity, heavy salary bill, etc. Because of these reasons, bank expenditure had been

mounting, profits were squeezed and some of the public sector banks have been in the red for many years.

RBI took some early steps towards liberalisation in the 1980's, with a view to providing some relief to borrowers with a good credit record and at the same time to provide flexibility to banks in the matter of interest rates charged to their borrowers, the ceiling on all lending interest rate was removed, subject to a minimum rate. Banks were given discretion to charge differential rates judiciously to categories other than those being provided credit at concessional lending rates. A number of measures were also taken to bring short term interest rates in better alignment with other interest rates in the system. In the govt. securities market, coupon rates on government bonds were gradually increased to reflect demand and supply conditions.

The rapid expansion of branch network and hightened controls strained the profitability of commercial banks. In response to these developments, a number of measures were undertaken in the mid 1980's for consolidation and diversification and, to some extent, deregulation of the financial sector. The consolidation measures were aimed at strengthening banks structures, training, house keeping, customer services, internal procedures and systems, credit management loan recovery, staff productivity and profitability. Certain initiatives were also taken to impact operational flexibility to banks. The Indian banking sector in the early 1980's faced competition from the stock and bond markets non-banking financial companies and mutual fund schemes. Many companies floated bonds with remunerative yields, which became an attractive option for the investors. The small saving instruments (like the National Savings Certificates VI issue) also became popular as they offered tax benefits. This turned savers away from the bank deposits that offered very low or negative interest rates. The banking sector was largely constrained as the Banking Regulation Act ( ) did not permit it to undertake non banking

activities. As a result, the share of deposits in household sectors savings declined while that of deposits with non banking companies and in small savings instruments floated by the Government increased.

Banks in India were not allowed to undertake activities that traditionally did not pertain to banking peruse. The Banking Regulation Act prohibited banks from investing in non banking assets. Thus, the individual and corporate investors had variety of investment opportunities other than savings in bank deposits.

Due to financial disintermediation the role of the banks declined. In this scenario the banking regulation act was amended which allowed the banks to take up activities like merchant banking, securities market related activities, equipment leasing, hire purchase, mutual funds, housing finance and venture capital. The diversification of banks activities was a positive development. The industrial sector was also more comfortable with their banks handling these activities. Reserve Bank tried to address the distinct risks arising out of deregulation by encouraging banks to engage in securities business through subsidiaries that helped to put in place firewalls between traditional banking and nontraditional activities.

RBI was especially concerned with the health of the banks. It designed a scheme to augment the capital base of the nationalised banks. During the Seventh Five year plan (April 1985-March1990) it was decided to contribute a sum of Rs.2,000 Cr. for allocation among 20 nationalised banks. The objective behind this scheme of augmentation of capital base was to strengthen the owned funds to deposit ratio with the aim of reaching a level of 2.5 percent. The amount allocated was simultaneously invested in non-negotiable special securities bearing interest rate of 7.75 percent per annum.

2.9 Phase of Financial Sector Reforms-1991-92 Onwards:

In the history of evolution of banking in India the phase of financial sector reforms initiated as a part of structural reforms encompassing trade, industry, investment and external sector was a significant one. In order to realise the full potential of reforms in the real economy a vibrant and a competitive financial sector was crucial. Consequently high-powered committee on the financial system (CFS) was constituted by the Govt. of India in August 1991 under the Chairmanship of Sri M.Narasimham to examine all aspects relating to the structure, organization, functions and procedures of the financial system.

The Committee, which submitted its report in November 1991, made wide ranging recommendations, which formed the basis of financial sector reforms relating to banks, development financial institutions (DFIs) and the capital market in the years to come. The committee appreciated the commendable progress made by the banking sector in extending its geographical spread and its functions / operations that promoted financial intermediation and growth in the economy. However the committee was concerned with the poor health of the banking sector and cautioned that unless the deterioration in the financial health of the system was treated quickly, it could further erode the real value of and return on the savings entrusted to it and even have an adverse impact on depositors and investors confidence.

Accordingly financial sector reforms were initiated as part of overall structural reforms to impart efficiency and dynamism to the financial sector. The country's approach to reform in the banking and financial sector was guided by 'pancha sutra' or five principles. (i) Cautious and sequencing of reform measures, (ii) introduction of norms that were mainly reinforcing (iii) introduction of complementary reforms across sectors (monetary, fiscal,

external and financial sectors); (iv) development of financial institutions, and (v) development and integration of financial markets. The evolution of the banking sector in this phase could be further divided into two sub phases, i.e., from 1991-92 to 1997-98 and 1997-98 onwards.

2.9.1 First Phase of Reforms: 1991-92 to 1997-98:

The first phase of reforms (1991-92 to 1997-98) may be analyzed as follows:

2.9.1.1 Financial Health and Soundness:

Some of the important problems that the banking sector faced in the early 1990's were fragile health, low profitability and weak capital base. In order to address these issues several mutually reinforcing measures were initiated, with a view to improving the health of the banking sector, internationally accepted prudential norms relating to income recognition, asset classification and provisioning, and capital adequacy were introduced in April 1992 in a phased manner.

It was realized that based on the revised classification of advances the aggregate domestic non-performing assets constituted 23.2% of total outstanding advances as on March 31, 1993. This implied that about one fourth of banks advances were locked up in unproductive assets. This not only adversely affected banks profitability but also prevented recycling of funds, thereby constraining the growth of their balance sheets.

To strengthen the capital base of the banks, capital to risk weighted assets ratio was introduced. Indian banks were required to achieve a capital adequacy norm of 8 percent as early as possible and in any case by March 31, 1994. To ensure financial soundness of banks the government of India embarked on a recapitalization programme of nationalised banks beginning from the financial year 1993-94. The total capital contribution by the

Government to nationalised banks upto March 1998 aggregated Rs.20,046 Cr. Besides, the Government provided a sum of Rs.1,532 Cr. during the year ended March 1997 to write off the loses of two banks against their capital to cleanse their balance sheets so that they could make early public issues.

Since capital infusion by the government was inadequate to enable banks to fulfill further provisioning norms and take care of additional capital needs as capital adequacy guidelines were fully implemented, the government decided to allow public sector banks to approach the capital market directly to mobilize equity funds from the public by amending the relevant acts. However, it was prescribed that the government ownership would remain at least at 51 percent of equity of nationalised bank. By end March 1998, nine PSBs raised capital aggregating by Rs.6,015 Cr. From the market, including proceeds from the GDR issue of SBI aggregating Rs.1,270 Cr. Raised during 1996-97. Besides, some banks also raised subordinated debt for inclusion in their Tier II capital. Due to raising of capital there was diversification of ownership of the banks which made a significant qualitative difference to their functioning. In order to contain fresh NPAs from a rising on account of adverse selection, banks were put on guard against the defaulters to other lending institutions.

To address the issue of recoveries the commercial banks were asked to make use of Lok Adalats which were conferred a judicial status and emerged as a convenient and low cost method of settlement of disputes between banks and small borrowers, with the enactment of 'the Recovery of Debts Due to Financial Institutions Act (1993)' several tribunals were established at a number of places in the country. The various measures initiated had a favourable impact on the quality of banks balance sheets. In a short span, banks were able to bring down their non performing assets significantly. Gross NPAs of public sector banks as percentage of gross advances, which were 3.2 percent at end March 1993,

declined to 16.0 percent by end March 1998. Despite increased provisioning, overall profitability of the banking sector, in general and public sector banks, in particular, improved as detailed in the subsequent section. The soundness of the banking sector also improved significantly, of the 75 banks, 58 banks could achieve the stipulated CRAR of eight percent by end March 2006. At the end March 1998, out of the 27 PSRB, 26 banks attained the stipulated 8 percent capital adequacy requirement.

2.9.1.2 Removal of External Constraints on Banks:

High preemptions in the form of CRR and SLR had reached peak level of 63.5 percent in the early 1990s, which adversely affected the profitability of the banks. The administered structure of interest rates did not allow the banks to charge interest rates based on the credit worthiness of the borrowers. This had negative effect on the allocative efficiency of resources. A phased reduction in the SLR and CRR was undertaken beginning January 1993 and April 1993, respectively. The SLR was progressively brought down from the peak rate of 38.5 percent in February 1992 to the then statutory minimum of 25.0 percent by October 1977. Interest rates on Government securities were also made more or less market determined. The CRR of scheduled commercial banks (SCBs), which was 15 percent of net demand and time liabilities (NDTL) between July 1, 1989 and October 8, 1992, was brought down in phases to 9.5 percent by November 22, 1997. Between November 1995 and January 1997, the CRR was reduced by as much as 5 percentage points. The incremental CRR of 10 percent was also withdrawn.

The reduction in statutory preemption's augmented the lendable resources of the banks with the normal liquidity conditions prevailing in the money market there was significant enhancement in the proportion of bank funds that were made available for financing growth and employment in the private sector. However, despite augmentation of lendable

resources of banks, credit growth slowed down from 1996-97 both on account of demand and supply side factors. In view of application of prudential norms, banks became wary of enlarging their loan portfolio. The relatively high level of NPAs, in particular had a severe impact on weak banks. Banks capacity to extend credit was also impaired due to little headroom available in the capital adequacy ratio (8.7 percent at end March 1996). At individual bank level, some banks, as indicated earlier, were not able to meet the capital adequacy requirements at end-March 1998.

The demand for funds by the corporate sector also slowed down. Rise in real interest rates caused by downward stickiness of nominal interest rates coupled with falling inflation rate also contributed to slackness in credit expansion. Hence, despite lowering of statutory preemption in the form of CRR and SLR, banks continued to invest in Govt. securities, far in excess of the requirements. Banks were also provided with freedom to fix their own deposit and lending rates. The structure of interest rates, which had become extremely complex, was first rationalized and then deregulated, barring a few rates both on the deposits and lending sides. The structure of interest rates on domestic term deposits, except for saving bank accounts, was made more flexible beginning October 1, 1995. Banks were allowed to determine their own deposit rates, depending on commercial judgment subject to the approval of their boards.

Lending rates were nationalised from 6 to 3 categories in 1993-94. The minimum lending rate for credit limits over Rs 2 lakh was abolished. The only lending rates that continued to be regulated were those pertaining to exports, small loans of up to Rs.2 lakh, and the differential rate of interest (DRI) scheme. Banks were required to announce a prime lending rate (PLR) for advance for over Rs.2 lakh uniformly applicable at all the branches taking into account the cost of funds and transaction cost with the approval of their boards.

Since the administered interest rate structure proved to be inefficient and costly and also did not ensure the flow of credit to the needy, interest rates were deregulated. While deregulating the interest rates care was taken to prevent the banks from charging high rates of interest i.e. the problem of adverse selection. A major safeguard in this regard was the prescription of provisioning and capital adequacy norms which compelled banks not to accept risk beyond a point. Banks, over the years, developed a set of criteria for determining the rate charged on individual borrowers. The deregulation of interest rates led to innovations of various types, including fixed, floating and partly fixed and partly floating interest rates, among others.

Lending interest rates of scheduled commercial banks reached a peak of 20 percent in October 1991, however with abundant liquidity resulting from large capital flows the interest slowed a decline to 14 percent by 1997-98. Deposit interest rate also softened significantly from 13 percent per annum (with maturity over 3 years and up to 5 years) in 1991-92 to 11.5- 12.0 percent. Reduction in NPAs together with reduction in CRR/SLR and deregulation of interest rates had a significant positive impact on the profitability of the banking sector. The financial results of 27 public sector banks during 1994-95 indicated a net profit of Rs.1,116 Cr. In contrast to a net loss of Rs.4,349 Cr. in 1993-94. The performance of nationalised banks was particularly significant as they registered a net profit of Rs.270 Cr. During 1994-95 as compared with a net loss of Rs.4,705 Cr. in 1993-94. As a result the profitability of the banking sector, measured by return on assets, improved to 0.8 percent by 1997-98.

2.9.1.3 Creating a Competitive Environment:

The Indian banking sector over the years had become less competitive as no new bank was allowed to be set up in the private sector after nationalisation of 14 banks in 1969.

The lack of threat of entry of new players led to inefficiency in the banking sector. Restrictions like regulation of interest rates, the system of financing working capital requirements, opening or closing of branches on the basis of their commercial judgments adversely affected the competitive environment as well as the efficiency of the banking sector. Keeping this in view several measures like, permitting entry of private sector banks, liberalised licensing of more branches foreign banks, and increased operational flexibility to banks to improve the performance of the banking sector.

First, the Reserve Bank in January 1993 announced the norms for entry of new private banks thereby allowing the private sector to play a role in the banking system. Secondly, it was resolved to give greater freedom to the banks in respect of opening of new branches and rationalize their branch network. Banks were also given freedom in respect of installing ATMs. Thirdly, India adopted a more liberal policy of permitting branches of foreign banks in India. Fourthly, the administered interest rate structure reduced the scope of price competition among banks and marginalised their incentive to efficiently allocate resources. Deregulation of interest rates was, thus, a major element in the process of infusing competition as detailed earlier. Fifthly, consistent with the policy of liberalisation, it was decided to allow full operational freedom to banks in assessing the working capital requirements of borrowers. Sixthly, all restrictions relating to project loans by commercial banks were withdrawn.

Despite the fact that the competitive conditions were created the competition within the banking sector did not penetrate enough. The share of foreign banks at 8.2 percent at end-march 1998 was the same as at end-march 1993. Normally when competition intensifies it inevitably leads to increased merges and acquisition activities but these activities did not increase much as there were only four merges during this phase.

2.9.1.4 Strengthening of Institutions:

To ensure effective implementation of prudential regulations, due to the blurring of the traditional distinctions among the financial intermediaries and increased risks faced by banks in a liberalised environment there was a need for a strong system of supervision. Subsequently a board for financial supervision (BFS) was set up within the Reserve Bank to look after exclusively the supervisory functions. This board was set up to have an effective oversight on banks, financial institutions and non banking financial companies. Subsequently, its scope was enlarged to include UCBs, RRBs and primary dealers. A computerised site monitoring and Surveillance (OSMOS) system for banks was instituted in November 1995. A fresh review of the banks inspection system was undertaken and a new approach to on-site inspection of banks was adopted from the cycle of inspections commencing from July 1997. Thus, supervision, now apart from covering the supervisory process of the Reserve Bank also focused on external audit and internal audit.

The RBI as the regulator was especially concerned with providing effective customer service. For expeditions and inexpensive resolution of customer complaints against deficiency in banking services, the Reserve Bank announced in June 1995, the Banking Ombudsman's Scheme 1995, under the provision of the Banking Regulation Act, 1949. The scheme covered all scheduled commercial banks having business in India, except RRBs and scheduled primary co-operative banks. According to this scheme if any person grievance was not addressed within 2 months he could approach the banking ombudsman within a period of 1 year. The Banking Ombudsman Scheme (BOS) which was revised in 2006 covered all commercial banks, RRBs and scheduled primary cooperative banks. Banking ombudsman have been authorized to look into complaints concerning deficiency in banking service and sanction of loans and advances, in so far as they relate to non observance of the Bank directives on interest rates etc. BOS 2006 included new areas

like credit card issues, failure in providing the promised facilities, non-adherence to fair practices code and levying of excessive charges without prior notice etc.

2.9.1.5 Improving the Rural Credit Delivery System:

Despite the increased geographical spread, and functional reach of the commercial banks RRBs and co-operative banks, the rural credit scenario had several weaknesses. Rural financial system as a whole had certain problem areas like decline in productivity and efficiency erosion of repayment ethics and reduction in profitability. Given these weaknesses a viable rural credit delivery system was absent on the eve of economic reforms in 1991. In this context, it was felt that there was a need for better alignment of interest rates and mix of target and non-target lending. Therefore early measures were required to bring about an enduring improvement in the credit delivery system.

The committee on financial system recommended for the reexamination of the continued relevance of directed credit programme, said that it should be phased out. It also recommended that the priority sector be redefined to comprise small and marginal farmers, tiny sector of industry, small business and transport operators, village and cottage industries, rural artisans and other weaker sections and the credit target for this redefined priority sector should be fixed at 10 percent of aggregate credit. For ensuring the flow of credit to sectors excluded from the redefined priority sector, the Committee on Financial System recommended introduction of a refinance facility from the Reserve Bank.

The Reserve Bank after a detailed study felt that from a pragmatic viewpoint, it was essential to ensure that any changes in the policy on priority sector credit did not result in a disruption in the flow of credit for productive purposes. The activities eligible for priority sector lending, therefore were enlarged, interest rates deregulated and alternative

avenues of investment were permitted, thereby making the priority sector lending far more flexible than before.

Though the non-viability of RRBs was an increasing concern it was also important to strengthen them, taking into account the fact that they cater to the needs of small borrowers and weaker sections. Therefore a number of policy initiatives were taken to improve the health of RRBs. The Reserve Bank allowed RRBs to maintain the cash reserve ratio at 3 percent of their net demand and time liabilities. Later, on December 22, 1993, the Reserve Bank in consultation with the Government and the National Bank for Agriculture and Rural Development (NABARD), announced a package of measures for RRBs with a view to giving them greater freedom to rationalize their existing branch network and bringing in operational efficiency. Action was also initiated on the managerial, operational and organizational restructuring of RRBs and cleansing of their balance sheets.

Apart from strengthening commercial banks and RRBs, several measures were initiated for ameliorating the problems in the flow of agricultural credit. First, the coverage of rural credit was extended to include facilities such as storage as well as credit through NBFCs. Second, procedural and transactional bottlenecks were sought to be removed, reducing margins, redefining over dues to coincide with crop cycles, new-debt restructuring policies, one-time settlement and relief measures for farmers indebted to non institutional lenders. Third, the Kisan Card Scheme was improved and widened in its coverage, while some banks popularized General Credit Cards (GCCs) which was in the nature of clean consumption. Fourth, public and private sector banks were encouraged to enhance credit delivery while strengthening disincentives for shortfall in priority sector lending. Fifth, the banks were urged to price the credit to farmers based on actual

assessment of individual risk rather than on a flat rate, depending on category of borrower or end use while ensuring that interest rates charged were justifiable as well as reasonable.

2.9.1.6 Summing up of First phase Reforms:

Notwithstanding various measures, credit flow to agriculture decelerated to 17.3 percent during the 6 year period from 1992-93 to 1997-98 as compared with 18.1 percent during 1980's. To sum up, the main issues faced at the beginning of this sub-phase (1991-92 to 1997-98) were the poor financial performance, low asset quality, weak capital position of banks and the absence of adequate competition. Several measures, therefore, were initiated by the government, the Reserve Bank and the banks themselves to improve their profitability, financial health and capital position. A significant improvement was observed in the financial performance, asset quality and capital position by the end of this sub-phase. The improvement in the financial performance was indeed remarkable as the banks were subjected to the objective accounting norms.

2.9.2 Second Phase of Reforms: 1998-99 onwards:

The salient features of the reform of the Second phase of financial sector reforms are as follows:

2.9.2.1 Strengthening Prudential Norms and NPA Management:

The prudential norms introduced fell short of international best practices, therefore a need was felt to strengthen them. The framework for further strengthening the banking sector was provided by the Committee on Banking Sector Reforms – CBSR (Chairman: Shri M.Narasimham), which submitted its report in April 1998. However, while strengthening the prudential norms, it was also necessary to ensure that some risk aversion by banks, which had surfaced after application of prudential norms, did not aggravate. In October

1998, the stipulated minimum capital to risk-weighted assets ratio (CRAR) of scheduled commercial banks was raised by one percentage point to 9 percent from the year ended March 31, 2000. Risk weights were also prescribed for government and other approved securities, investments in securities outside the SLR and State Government guaranteed securities issued by defaulting entities. Banks were subjected to asset liability management (ALM) framework. The ALM framework was, therefore, complemented with guidelines on risk management.

Income recognition, asset classification and provisioning norms were also tightened. According to the revised norms, an asset was to be treated as doubtful, if it remained in sub standard category for 18 months instead of 24 months, by March 31, 2001. Asset classification norms were tightened further in may 2002, when banks were advised that from the year ended March 2005, an asset would be classified as doubtful if it remained in the sub-standard category for 12 months as against the earlier norm of 18 months. Income recognition norms were tightened further from March 2004, where-by an asset was classified as NPA if it remained unpaid for a period of 90 days instead of six months earlier. The Basel Committee on Banking Supervision (BCBS) of BIS had issued the 'Amendment to the capital Accord to Incorporate Market Risks' containing comprehensive guidelines to provide explicit capital charge for market risks. In June 2004, banks were required to maintain capital charge for market risks on the lines of Basel norms in a phased manner over a two year period.

The strict application of Prudential Norms led to risk aversion, which affect the small and medium corporates. Therefore steps needed to be taken to make the norms more effective and quick in producing the desired results. The pace at which debt recovery tribunals (DRTS) performed, was painfully slow due to legal and other structural factors. After examining the various proposals, it was decided to set up an asset reconstruction company.

Also, instead of a single centralised (ARC) , it was decided that there should be multiple ARCs.

To contain the fresh NPAs the union Budget 2000-01 announced the establishment of a Credit Information Bureau (India) Ltd. (CIBIL). With a view to strengthening the legal mechanism and facilitating credit information bureaus to collect, process and share credit information on borrowers of bank/FIs. Various measures initiated to recover past dues of banks had a favourable impact as banks recovered as much as Rs.25,520 Cr. between 2003-04 and 2006-07 locked in NPAs using various mechanisms. Although the asset quality had been improving after introduction of prudential norms, it showed a distinct improvement in this phase as both gross and net NPLs declined sharply to around global levels.

As the asset quality began to improve credit growth, which has decelerated significantly between 1996-97 and 2003-04 partly on account of risk aversion, began to pick up from 2004-05. Credit growth, which was initially concentrated in retail segment, soon turned broad-based encompassing agriculture, industry and small scale sector. Credit growth accelerated to over 30 percent in 2004-05 and remained more or less at that level in the following 2 years. Banks deposit growth rate, however, was not able to keep pace with the rapid credit growth. An important feature of the rapid credit growth was the sharp increase in bank credit to the household sector. As a result, the share of retail credit in total bank credit increased from 10 percent at end march 1996 to 25 percent at end-march 2007.

2.9.2.2 Competition Intensified:

Although the competitive conditions were created in the early 1990s, their impact remained muted, as alluded before. However competition began to intensify in the early

2000s, which, was reflected in the increased mergers and acquisitions activity. In this phase, two large development finance institutions (DFIs) merged/converted in to banks. In January 2001, the Reserve Bank permitted the reverse merger of ICICI with its commercial bank subsidiary. ICICI Ltd. became the first DFI to convert itself into bank. On October 1, 2004, Industrial Development Bank of India, another large DFI, was converted into a banking company. In April 2005, it merged its banking subsidiary (IDBI Bank Ltd.) with itself. In all, during this phase, four new private sector banks and one new-public sector bank came into existence (including conversion of two major DFIs viz., ICICI and IDBI into banks). Besides, 16 foreign banks were also set up. However despite emergence of new domestic and foreign banks, the number of banks gradually declined beginning from 100 at end-march 2000 to 82 by end-march 2007, reflecting the increased competitive pressures.

With a view to addressing the downward stickiness of PLRs and the wide disparity in charging interest to different category of borrowers, a scheme of benchmark PLRs (BPLRs) was introduced by the Reserve Bank in 2003-04 for ensuring transparency in bank's lending rates as also for reducing the complexity involved in pricing of loans. However, owing to increased competition, many banks introduced sub BPLR lending and the spreads between the minimum and maximum lending rates increased significantly.

With the liberalisation of FDI regime, with a view to further liberalising foreign investment in the banking sector the Govt. announced (vide GOI, press note of March 5, 2004) an increase in the FDI limit in private sector banks from 49 percent to 74 percent under the automatic route, including investment by FIIs, which could not exceed 49 percent within the aggregate foreign investment ceiling of 74 percent of the paid up capital and at all times, at least 26 percent of the paid up capital, was required to be held by residents.

2.9.2.3 Diversification and Emergence of Universal Banks / Financial Conglomerates:

Prior to initiation of reforms, banks were mostly engaged in traditional non-fund based business, viz., opening letters of credit, acceptances, issuing guarantees, remittance business and foreign exchange business such as offering forward contracts to exporters or importers. With increased competition within the banking sector and also from non banks and the capital market banks had to seek new sources of income by offering a variety of services either within the organization or by setting up subsidiaries. Although banks had started diversifying in the mid 1980s after the necessary enabling provisions were incorporated in the Banking Regulation Act, 1949, diversification gained momentum in the late 1990s. Apart from offering merchant banking activities and services connected with the activity of primary issue, banks started rendering project appraisal, capital structure, fund raising and loan syndication services under one roof. Banks also started rendering advisory services to corporates, including on mergers and acquisitions, and custodial and depository services for both domestic and foreign customers. Banks were also allowed to undertake insurance business. Diversification of business led to gradual increase in non interest income, the share of which in total income increased significantly between 1999-2000 and 2004-05.

Banks also became active in setting up subsidiaries to undertake various non-traditional activities such as insurance. The number of subsidiaries set up by banks increased from 37 at end –March 1998 to 131 by end-March 2008. Keeping in view the systemic risks posed by the emergence of financial conglomerates, a monitoring mechanism was also put in place in consultation with other regulators, viz., Securities and Exchange Board of India (SEBI) and Insurance Regulatory and Development Authority (IRDA). A nodal cell was established at the Reserve Bank for smooth implementation of the monitoring mechanism.

2.9.2.4 Ownership and Governance:

Two major concerns arose with regard to ownership of banks and they were concentration of ownership and the quality of management that controlled the banks. In this context regulation norms were needed. A diversification of ownership was considered desirable, as also ensuring 'fit and proper' status of such owners and directors.

The Reserve Bank after a detailed consultative process released a comprehensive policy framework of ownership and governance in private sector banks in February 2005. The broad principles underlying the framework were to ensure that: (i) ultimate ownership and control were well diversified (ii) Directors and CEO were 'fit and proper' and observed sound corporate governance principles (iv) private sector banks maintained minimum net worth of Rs.3.00 Cr. for optimal operations and for systemic stability, and (v) policy and process were transparent and fair.

2.9.2.5 Credit Delivery – SMEs:

Unlike large industries, which have access to various domestic and international sources of finance, small and medium enterprises (SMEs) are dependent largely on bank finance. Consequent upon the deregulation of interest rates, there was an expectation that credit to the SME sector decelerated in the 1980s.(8.1 percent as compared with 20.7 percent in the 1980s) and the first four years of the current decade. Realising the critical role of small industries in the economy, the Reserve Bank initiated several measures with a view to increasing the flow of credit to small scale industry (SSI) units. These included refining the definition of small scale and tiny enterprises, broadening the scope for indirect finance to these industries; making investments in several avenues such as securitised assets, lines of credit, bills discounting and leasing and hire purchase eligible for priority sector advances. Besides, in pursuance of the recommendations made by

several working groups and high powered committees appointed by the Central Government and the Reserve Bank, a set of comprehensive guidelines to be followed for advances to all categories of borrowers in the SSI sector was evolved.

With a view to give the benefits of soft interest rate policy to SSI sector banks were advised to set the interest rates on advances keeping in view general downward movement in interest rates. As per the announcement made in the union Budget 2003-04, the Indian Banks Association advised the banks to adopt the interest rate of two percent above and below its BPLR for secured advances. To make available timely credit to the sector, a time frame was fixed for disposal of loan applications. In the Mid term Review of Monetary and Credit Policy for 2003-04, banks were allowed to increase the loan limit from Rs.15 lakh to Rs.25 lakh (with the approval of their boards) for dispensation of collateral requirement, on the basis of good track record and the financial position of the SSI units. Moreover, all new loans granted by banks to NBFCs for the purpose of on lending to the SSI were also allowed to be reckoned as priority sector lending.

Several measures like identification of new clusters and adopting cluster based approach for financing the small and medium enterprises (SME) sector; sponsoring specific projects as well as widely publicising the successful working models of NGOs., sanctioning higher working capital limits to SSIs in the North Eastern Region for maintaining higher levels of inventory, and exploring new-instruments for promoting rural industry, were undertaken to improve the credit delivery to the SME sector. Various measures had a positive impact on the credit flow to the SME sector, which accelerated from 2004-05. The average growth rate of lending to the SME sector during last three years (2004-05 to 2006-07) accelerated to 37.3 percent from 8.1 percent in the 1990s.

2.9.2.6 Improving Credit Delivery – Rural Sector:

Due to constraints on timely availability, high cost, neglect of small and marginal farmers and continued presence of informal markets, the credit did not reach the real beneficiaries in the rural areas. It was held that while the commercial banks were more focused in improving efficiency and profitability, they tended to give comparatively less priority to rural credit. Inspite of a series of actions, there was some element of dissatisfaction that overall situation with regard to rural credit did not improve to the desired level. Infact, credit growth to agriculture during 1990s slowed down to almost one half as compared with the 1980. The Government and the Reserve Bank therefore took several measures to increase the flow of credit to agriculture.

These measures included (i) debt restructuring and provision of fresh loans to farmers affected by natural calamities, (ii) one time settlement for small and marginal farmers (iii) fresh finance for farmers whose earlier debts were settled through compromise or write-offs and (iv) relief measures for farmers indebted to non institutional lenders. The actual disbursement of credit to agriculture by banks exceeded the targets during all the three years up to 2006-07. In order to further promote the outreach of the banking sector, banks have been permitted to use the services of non Governmental organizations / self help groups (NGOs)/(SHGs), micro finance institutions (MFIs) and other civil society organizations (CSOs) as intermediaries in improving financial and banking services through the use of business facilitator and business correspondent models. These intermediaries cab take banking to the doorstep of the people. This step will facilitate banks to offer competition to the informal sector, which had been thriving due its accessibility, flexibility and ease in conducting transactions.

In view of decline in credit to agriculture, the need was felt to reposition the RRBs as an effective instrument for the rural credit delivery system, improve their operational viability and take advantage of the economics of scale. The Govt. of India initiated the first phase of amalgamation of RRBs sponsor bank-wise at the state level in September 2005. Consequent upon the amalgamation of 154 RRBs into 45 new-RRBs, sponsored by 20 banks in 17 states, effected by the Govt. of India beginning September 12, 2005, and creation of one new-RRB in the union territory of Pondicherry (Now Puducherry) the total number of RRBs declined from 196 to 88 as on May 2008. Various measures initiated by the Government and the Reserve Bank had a desired impact as the credit growth to agriculture picked up significantly from 2003-04 onwards. As a result, the average credit growth rate to agriculture during 2003-04 to 2006-07 accelerated to 27.4 percent from 10.6 percent during 1990s and 18.1 percent during the 1980s. The share of credit to agriculture in total bank credit increased from 10.9 percent at end March 2004 to 12.2 percent at end March 2007. Credit intensity (agriculture credit/agriculture GDP) of the agriculture sector also increased from 17.0 percent at end March 2004 to 31.0 percent at end March 2007. Net NPLs of RRBs declined from 5.2 percent at end March 2005 to 3.4 percent at end March 2007. Credit growth of RRBs accelerated to 22.9, as an average, during the three year period (2004-05 to 2006-07) from 17.8 percent on an average during the preceding three years (2001-02 to 2003-04) and 17.7 percent during the previous 10 years (1994-95 to 2003-04).

2.9.2.7 Financial Inclusion:

Bank nationalisation in India marked a paradigm shift in the focus of banking from class to mass banking. The banking industry witnessed tremendous growth in volume and complexity over the years. Despite making significant improvements in all the areas relating to financial viability, profitability and competitiveness since the early 1990s,

there were concerns that banks had not been able to include vast segment of the population, especially the underprivileged sections of the society, into the fold of basic banking services. The formal credit system was not able to adequately penetrate into the informal financial markets.

The Reserve Bank was also concerned with regard to the banking practices that tended to exclude vast sections of population. It was, therefore, felt necessary to bring them within the fold of the formal banking sector so that at least the basic banking services were made available equitably to all sections of the society, not only to promote financial inclusion of the excluded class of people but also to expand their business. It was in this context in the Annual Policy Statement for the year 2005-06, the Reserve Bank stated that there were legitimate concerns with regard to the banking practices that tended to exclude rather than attract vast sections of population, in particular pensioners, self-employed and those employed in the unorganized sector. Against this background, the policy stated that the Reserve Bank would implement policies to encourage the banks, which provided extensive services while disincentivising those, which were not responsive to the banking needs of the community, including the underprivileged. Banks, were therefore, urged in the policy statement to review their existing practices to align them with the objective of financial inclusion.

It was recognized that in many banks, the requirement of minimum balance and charges levied, although accompanied by a number of free facilities, deterred a sizeable section of population from opening or maintaining bank accounts. The Reserve Bank, therefore advised the banks in November 2005 to make available a basic banking 'no-frills' account either with 'nil' or very low minimum balances as well as charges that would make such accounts accessible to vast sections of population. This was aimed at achieving the objective of greater financial inclusion. The nature and number of

transactions in such accounts could be restricted, but made known to the customer in advance in a transparent manner. Banks were also advised to give wide publicity to the facility of such a 'no-frills' accounts, including on their websites, indicating the facilities and charges in a transparent manner. Within two years of the introduction of the scheme, there was a significant progress. By end December 2007, about 12.6 million 'no-frills' accounts were opened by scheduled commercial banks in India.

2.9.2.8 Customer Service and Financial Literacy:

The Reserve Bank initiated various measures to improve the customer service from time to time. A major policy initiated in this regard was the setting up of Banking Ombudsman at various offices of the Reserve Bank. Recognizing the institutional gap in measuring the performance of the banks against codes and standards based on established best practices, the Reserve Bank in its Annual Policy Statement for 2005-06 announced the setting up of the Banking Codes and Standards Board of India (BCSBI). It was set up as an autonomous and independent body adopting the stance of a self regulatory organisation. The BCSBI provided for voluntary registration of banks with the board as its members and committing to provide customer services as per the agreed standards and codes. The Board, in turn, monitored and assessed the compliance with codes and standards, which the banks agreed to. The Board released in July 2006, a code of Banks commitment to customers to provide a framework for a minimum standard of banking services. As at end-October 2007, out of 74 scheduled commercial banks registered with the BCSBI indicating their intention to become members, 70 banks, accounting for 98 percent of the total domestic assets of the Indian banking system, enrolled as its members.

A new department called Customer Service Department was created in the Reserve Bank, on July 1, 2006 by regrouping various customer service related activities handled by

different departments of the Reserve Bank under a single department. The functions of the department encompassed a variety of activities relating to customer service and grievance redressal in the Reserve Bank and the banking sector, including the aspects relating to the Banking Ombudsman Scheme and the Banking Codes and Standards Board of India. The RBI also wanted to ensure that the borrowing community too got fair deal from the bankers. The Reserve Bank, had, accordingly, formulated a Fair Practices code for lenders, which was communicated to the banks in 2003 to protect the rightful interests of the borrowers and guard against undue harassment by the lenders. The code was revised in March 2007 to include the requirement that the banks should provide to the borrowers comprehensive details regarding the loans as also the reasons for rejection of the loan applications of the prospective borrowers, regardless of the amount or type of the loan involved.

2.9.2.9 Technology:

It was recognized that technology was a crucial element that improves productivity and renders efficient customer service. Computerisation of banks began in the early 1990. Two areas in which the use of technology was clearly visible was computerisation of branches and installation of ATMs. In 2002 banks were asked to pay special attention to the computerisation and networking of branches on a time bound basis. By end-March 2007, about 86 percent branches were fully computerized, of which a little more than half the branches were under 'core banking solutions'.

The use of ATMs also increased significantly in recent years. The number of on-site ATMs almost doubled between end-march 2005 and end-march 2007. The number of off-site ATMs also increased. The ratio of ATMs to branches also improved significantly in recent years. A number of initiatives were undertaken for bringing about efficiency in

the payment and settlement systems. To reduce risk in the electronic payment systems, the implementation of real time gross settlement (RTGS) and national electronic fund transfer (NEFT) enabled receipt of funds on a real time / near to real time basis on a credit push basis. The share of electronic transactions, both in terms of volume and value has increased significantly in recent years. In India the spread of the RTGS system was very rapid in comparison with other countries.

Technology helped the banks in innovate in terms of developing new products and services such as phone banking and Internet banking. It also helped in handling large transactional volumes and adapting according to the changing customer expectations, apart from providing almost real time information processing capabilities for both the banks and the customers. Technology ensured a rapid transformation of the banking sector by ushering in competitions, productivity and efficiency of operations, and better asset / liability management, among others. Effective funds movements through the RTGS platform also greatly helped the cash management by banks.

2.9.2.10 Summing of Second phase of Reforms:

After nearly 10 years of the second phase of reforms, the complexion of the Indian banking sector changed quite significantly. The main issues faced in this sub phase were to (i) strengthen the prudential norms in line with the international best practices and at the same time ensure that the risk aversion did not aggravate; (ii) increase the flow of credit to agriculture and SMEs; (iii) bring a large segment of excluded population within the fold of the banking sector; (iv) strengthen the corporate governance practices; (v) strengthen the urban cooperative banks and resolve the issue of dual control; and (vi) improve the customer service.

On almost all the fronts, there was a significant improvement. Although efforts to strengthen the banking sector had begun in the early 1990s, norms introduced were not in line with the international best practices. Also, with the application of prudential norms, banks had developed risk aversion. Therefore, while strengthening prudential norms, institutional arrangements were put in place to enable banks to expeditiously recover their past dues. Various measures initiated had a positive impact as banks were able to recover large amounts locked up in NPLs. Banks, therefore, gradually shed their risk aversion and credit began to grow sharply beginning from 2004-05. Banks' NPLs level gradually declined to global level; their gross NPAs declined from 15.4 percent at end-march 1997 to 2.5 percent at end-March 2007. This was the most important achievement of this phase. The profitability of scheduled commercial banks as reflected in their average return on asset improved further, albeit marginally, from 0.8 percent in 1997-98 to 0.9 percent in 2006-07. This was significant because competition intensified during this phase as reflected in the acceleration of mergers and acquisitions activity and squeezing of net interest margins. The improved profitability, despite increased competition, was, among others, on account of (a) sharp decline in NPLs, and (b) increased credit volumes. To improve their profitability in diversified activities has led to emergence of bank led groups / financial conglomerates. The capital adequacy ratio of banks also improved from 8.7 percent at end March 1997 to 12.9 percent at end March 2007. At individual bank level, the capital to risk weighted assets ratio (CRAR) also known as Capital Adequacy Ratio (CAR) of most banks was over 10 percent, i.e., higher than the stipulated target which itself was higher than the international norm. Thus, the impact of reforms initiated in the early 1990s became clearly visible in this phase as the Indian banking sector had become competitive, profitable and strong.

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CHAPTER III

REVIEW OF LITERATURE

3.0 Introduction:

In the forgoing chapter, an attempt has been made to trace the evolution of banking in India. As part of tracing the evolution, the roles of banking and financial sector reforms were also noted. Under the second phase of reforms, banks have been subjected to prudential norms and opened to competition among themselves. To face the stiff competition in a deregulated environment, banks should operate efficiently in respect of improving the profitability and / or reducing cost. Hence, to monitor banking activities, measurement of banking efficiency has been a crucial issue during the past one decade. The focus of the present thesis has been on highlighting this issue in the Indian context.

Accordingly, this chapter aims at reviewing the previous work in this direction so as to provide the necessary background to the present study. Since the relevant literature, especially in the context of developed economies has been truly abundant, and given that a large part of the work has been carried out using parametric (stochastic frontier) and non-parametric (data envelopment analysis) approaches, the chapter is organised as follows: section 3.1 presents an overview of select studies during the past one decade outside India, using the stochastic frontier approach. This is followed by a similar review of studies which are based on equally popular non-parametric data envelopment analysis (DEA), in section 3.2. This is followed by an overview of the available studies in the Indian context, in section 3.3.

3.1 An overview of studies outside India – SFA:

Stochastic frontier analysis is a parametric approach to measuring the relative efficiency of banks. This technique has been popular in the literature. In this section we review select studies that were conducted in the recent past (past one decade) to highlight the various aspects of efficiency measurement.

We start with the study by Bikker (1999) who examined the efficiency in the European banking industry for the period 1989 to 1997. The stochastic cost frontier approach was used to estimate the x-efficiency of the European banks and a multi-product translog cost function to compare cost levels. The model had been applied to data pertaining to the nine European countries. The sample consists of all banking categories which included 3085 banks. The variables used were loans, demand deposits, savings and non interest income.

The study found that Spanish banks appeared to be the least efficient ones followed by banks in France and Italy, whereas Banks in Luxembourg were most efficient, followed by banks in Belgium and Switzerland. Banks in Germany, Netherlands and the United Kingdom took a medium position. Cost levels in Spanish banks were estimated to be 33% above the European average and X-inefficiency even 46%. Costs in Luxembourg were 34% below the European average and X-inefficiency 37%. The overall outcome indicated that differences in average cost levels and X-inefficiency between European Union countries were huge, the average inefficiency was most probably higher than the 20%, found often in the literature. The study suggested that in the countries where banks were less efficient, large scale consolidation and rationalization of the banking industry was necessary in order to improve its soundness.

Bonin, *et al* (2005) investigated the effects of ownership especially by a strategic foreign owner, on bank efficiency for eleven transition countries in an unbalanced panel consisting of 225 banks. Using SFA the study computed profit and cost efficiency taking account of both time and country effects directly for the period 1996-2000. The output variable were total deposits, total loans, total liquid assets and investments and the input prices were price of capital and price of funds. The paper observed that privatization alone was not sufficient to increase banks efficiency as government owned banks were not appreciably less efficient than domestic private banks. The study found that foreign owned banks in particular those with a strategic foreign owner collected more deposits and more loans than domestic private banks. The government owned banks made fewer loans, collected fewer deposits and had higher non interest expenditure than majority foreign owned banks. The participation of an international institutional investor had a considerable additional positive impact on profit efficiency.

The relative cost efficiency of a sample 289 banks in 15 east European countries using SFA for the years 1994-2001, was examined by Fries and Taci(2004). The paper found that the consolidation of smaller banks in the region would contribute to greater cost efficiency in banking. Greater macroeconomic stability and competition in banking from foreign entry as well as development of the supportive institutions promote cost efficiency. Banking systems with higher ratios of capital to total assets and banks with lower loan losses also tended to have lower costs.

The study found that privatized banks with majority foreign ownership were the most cost efficient, followed by newly established private banks, both domestic and foreign owned. Policies that many governments and central banks in Eastern Europe adopted to promote transformation of socialist banking systems into market oriented ones had, therefore, contributed to increased cost efficiency.

In the context of Pakistan, Kiani (2005) investigated empirically technical efficiency of commercial banks and also made efficiency comparisons between domestic and foreign banks. The paper employed the parametric techniques to study the nature and extent of cost inefficiency. Efficiency scores had been derived by implementing a parametric translog stochastic cost frontier on a balanced data of 18 banks from 1976-1996 operating in Pakistan. The study used the maximum likelihood estimating procedure to estimate parameters of the model. The maximum likelihood parameters estimates for the translog cost frontier for the year 1976-96 indicated a shift in respective cost structures of bank's overtime.

The results showed that technological change occurred overtime for the Pakistani banks as well as the foreign banks. The results indicated that the domestic banks operating in Pakistan were relatively less efficient than their foreign counterparts. Ranking for the full sample indicated that the Deutsche Bank is relatively the most efficient bank, while the Punjab provincial bank for cooperatives was about 18% inefficient per annum as compared with its full potential, and thus regarded as the least efficient bank. The Deutsche bank was found to be most efficient having 97% efficiency levels and was ranked at number one, while the American national trust and savings Association was least efficient and was ranked at no.9. National Bank of Pakistan was relatively most efficient among the nine Pakistani banks while Punjab Provincial Bank for cooperatives was found to be least efficient. The study suggested that all Pakistani commercial banks need to improve their respective cost efficiency to bring them at an overall higher level. It also suggested that a more transparent market based system was needed which would improve intermediation efficiency reduce rent seeking activities, which helps in increasing the overall cost efficiency of banks without any political interference.

In the context of China's banking sector over the period 1985-2002, .Fu and Heffernan (2007) employed SFA to investigate cost X-efficiency. The objective was to assess whether different ownership types and banking reforms affect X-efficiency. The sample consists of four state owned and ten joint stock commercial banks. A two stage regression model was estimated to identify the significant variables influencing X-efficiency. The dependent variables used were total costs and the independent variables were total deposits, total loans, total investments, non-interest income.

The study found that that the grand mean x-efficiency in China's banking sector ranged between 40% and 50%. The joint stock banks were found to be relatively more x-efficient than the state banks, and the gap between them widening during the two reform stages. The paper observed that the x-efficiency in China's banking sector could be improved if more state banks were converted to joint stock ownership, the dependence on purchased funds was reduced, greater cost control was encouraged, and hard budget constraints replace soft-ones.

For the Central and Eastern European Countries (CEEC) Rossi *et al* (2005) measured the managerial behaviour and cost/profit efficiency in the banking sectors. The study period covers the years 1995-2002 and the sample included 278 banks of nine selected CEECs, Czeck Republic, Hungary, Poland etc. The study used SFA based on a Fourier flexible form to estimate efficiency. The study employed the modified production approach; price of labor, price of capital and price of deposits as inputs and loans, deposits and other earning assets as outputs.

The paper found that there was a low level of cost and profit efficiency for banks in CEECs. Conversely the results also revealed a significant tendency of efficiency (both cost and profit) to increase overtime, although this trend was not equally spread over all

countries. There were large and significant differences across countries and large gaps between cost and profit efficiency- banks in the former accession countries seem to be more efficient in controlling costs than in generating profits. Low cost efficiencies of banks were even often offset by high profit efficiencies and vice-versa. The study found that there was a negative correlation between cost efficiency and bad loans. It also observed that the exogeneity of bad loans was triggering inefficiency. High levels of problem loans, generated by external factors- such as environmental conditions, level of criminality etc – caused a decrease in the level of cost efficiency. The result indicated that the low level of efficiency recorded in the CEECs could therefore be partially ascribed to uncontrolled external factors. Bank inefficiency and failures in the markets were primarily associated with external shocks. The study suggests that regulatory and supervisory rules should therefore focus on reducing banks exposure to unforeseen events. This could for instance be done by increasing the diversification of loan portfolios – limits on loan concentration, promoting mergers with foreign institutions or an encouragement of banks towards a low risk profile by lowering the ratio between loan and total assets.

For ten Asian countries, Shen *et al* (2009) estimated the cost efficiency in banking industry during the period 1998-2005. An unbalanced panel data set contained 285 banks was taken. Intermediation approach was adopted. The outputs specified were total loans, other earning assets and non interest income; the input variables were price of funding or deposits, price of labor and price of fixed assets. Another important set of variables were the cross country environmental variables (i) those that describe the main macro economic conditions. (ii) Variable that describes the structure and regulation of the banking industry and (iii) accessibility of the banking service. The study compared the

cost efficiency scores estimated from the panel data SFA models with or without incorporating the cross country heterogeneous factors.

The study found that when heterogeneity was considered, the cost efficiency score was higher than when it was not included. Moreover India was found to be the most efficient among the ten Asian countries while China ranks only fourth as 20% less efficient which indicated that the Chinese banking industry was not so competitive against their neighbors and it had to deepen the financial reforms and improve the managerial ability. The study also found that higher density of population contributes to an increase in the costs of banks. Higher the inflation, higher the costs that banks might incur. Influence of unemployment was negative.

Papadopoulos (2008) used the flexible Fourier functional form and the stochastic cost frontier methodologies to estimates X-inefficiencies, scale economies and technical change for a sample of Finnish, Swedish, Danish and Norwegian banks between 1997-2003. The results indicated the inefficiencies range between 20 per cent and 29.3 per cent in all four national samples. Swedish banks were the least efficient (mean 0.2932) and Danish banks the most efficient (mean 0.2014) with Finnish and Norwegian banks in the middle (mean 0.2345 and 0.2428 resply). The finding suggest that inefficiency increases with bank size where largest sized banks were generally the least efficient and the smallest sized institutions were the most efficient.

The paper also concludes that with the passage of time efficiency increased across all four national banking markets. The results suggest that banks in all four markets are characterized by economies of scale. The strongest economies of scale were displayed by Danish and Norwegian banks. Typically, medium sized banks reported the strongest economies of scale and the largest and smallest banks weaker economies of scales. The

impact of technical change in reducing bank cost appeared to be systematically increasing with bank size.

Baig *et al* (2008) examined the technical efficiency of the Pakistan banking sector for the period of 1990to2005, using stochastic frontier production function. The study used intermediation approach using deposits, labor as inputs and advances as outputs. The findings were as follows. Estimates of technical efficiency indicated that state owned or public sector banks were less efficient than private owned banks and foreign banks. Foreign banks were most efficient in the banking sector when their performance was analyzed from the year 1992-2005. The results very clearly showed the effectiveness of the reform process carried out in financial sector especially in the banking industry. Although state owned banks had huge assets as compared to other banks in the industry yet they were less efficient. One reason might be the cost ineffectiveness and over burdening staff with comparatively less facilities. Another reason for the low technical efficiency score of state owned banks could also be attributed to their involvement in less productive hence very essential state financial and social activities like pensioners accounts etc.

For Zambia, Musonda (2008) evaluated cost efficiency of banks using the SFA, by incorporating banks specific and environmental (including regulatory) factors in the analysis. The period of study was 1998-2004. The author adopted intermediation approach. The inputs chosen were labor, funds and capital; the outputs were sum of net loans, overdraft and inter bank placements, and investments in government securities.

The results showed that Zambian banks were on average inefficient. The study observed that there had been some improvement in the relative cost efficiency of banks, with small banks displaying spectacular growth in performance. The efficiency gap between

domestic banks and foreign banks remained wide. The study found that large banks appeared to adapt to technological change compared to the small banks. Regulatory intensity has not adversely impacted banks performance. On the other hand macro economic uncertainty particularly in the early years of this sample period exacerbated the banks cost inefficiency. These factors suggested that there should be stronger policy responses to overcome the structural impediments which continue to effect banks cost performance. On the other hand macroeconomic uncertainty particularly in the early years of this sample period exacerbated the inefficiency. These factors suggested that there should be stronger responses to overcome the structural impediments which continue to effect bank cost performance.

For 10 sub Saharan African middle income countries, Chen (2009) estimated cost efficiency using Stochastic Frontier Analysis. The cost function was estimated using deposits, other borrowed funds, labor and fixed capital as inputs and various types of loans and other earning assets such as securities, investments and total deposits as output.

The study concluded that banks were operating at 20-30 per cent below the cost efficiency frontier, and that foreign banks on an average were more efficient than private banks and government owned banks. He also found that a stable macro environment, deeper financial development, higher degrees of market competition, stronger institutions and better governance would help improve the bank efficiency levels.

In a similar study, Ncube (2009) analyzed the cost and profit efficiencies of eight (8) South African commercial banks. The study period was 2000-2005. Stochastic frontier approach was used and intermediation approach adopted. The inputs used were labor, capital and funds, and the outputs were advances and deposits.

Cost efficiency was found to have significantly improved over time, while the change in private efficiency levels was not significant. The small banks recorded higher average profit efficiency levels than the big banks, but these differences were found to be statistically insignificant. A weak positive correlation was found to exist between the cost and profit efficiencies with the most cost efficient banks also being most profit efficient. With regard to bank size, cost efficiency declined with increasing bank size.

In another study for a group of 29 Sub-Sahara African countries, Kiyota (2009) analyses the efficiency and profitability of commercial banks during 2000-2007. The paper analyses the efficiency and profitability of commercial banks by each group such as domestic bank, Sub-Sahara African foreign bank, or non SSA foreign bank. The study employed SFA to measure banks cost and profit efficiency. Using regression analysis the paper discussed the correlation of technical efficiency with the financial indicators. The dependant variables were cost efficiency and profit efficiency. Independent variables used were financial indicators such as asset quality, capital ratios, operational and liquidity ratios etc.

The study found that the profit efficiency of non-SSA foreign banks had a negative and statistically significant relationship with three variables namely, return on average equity (ROAE), equity to net loans and net loans to total assets during the pre crisis period (2004-2007). The position and statistically significant relationship with interest rate spreads was observed in the same period where as the signs of the both relationships were opposite for the 2000-2003 with statistical significance. These results implied that the African banking sector might be exposed to contagion risks. There might be contagion risks from distressed foreign parent banks to local subsidiaries within Sub-Saharan Africa because parent banks could withdraw capital from African subsidiaries, call in loans to

their African subsidiaries, no longer invest local profits in local subsidiaries, or did a combination of these.

Pasiouras *et al* (2009) examined the impact of banking regulations on banks cost and profit efficiency across various countries. The paper used SFA to provide international evidence on the impact of the regulatory and supervision framework on bank efficiency. Their sample consisted of a panel data set of 2853 observations from 615 publicly listed commercial banks operating in 74 countries, covering the period 2000-2004. The paper focused on banking regulations related to the three pillars of Basel-II (capital requirements, official supervisory power and market discipline) and restrictions on bank activities on cost and profit efficiency. The study compared banks cost and profit efficiency levels and simultaneously investigated their response to cross country differences in banking regulations, while controlling for country level environmental characteristics such as market structure, financial and overall economic development and macro economic conditions. The study used value added approach, the outputs were loans, other earning assets and total deposits; the input prices were cost of borrowed funds, cost of physical capital and cost of labor.

The full sample overall mean cost efficiency score was 0.8789 while that of profit efficiency was 0.7679. Over the estimated period, banks had become, on average, more profit efficient but less cost efficient, since the efficiency scores for cost decreased each successive year from 0.8899 in 2000 to 0.8685 in 2004, while those for profit increased from 0.7592 to 0.7842 over the same period. The results indicated that (i) stricter capital regime requirements, related to the first pillar of Basel I, had a positive impact on cost efficiency but a negative impact on profit efficiency. (ii) official disciplinary power and market discipline had a statistically significant and negative impact on both cost and

profit inefficiency. (iii) with regard to restrictions on bank activities, a negative effect on cost efficiency and a positive effect on profit efficiency was observed.

For the Greek commercial banks from 1993 to 20D08, Delis *et al* (2009) evaluated the cost and profit efficiency, and also compared the cost efficiency measures obtained from parametric and non-parametric approaches. They argued that a comprehensive approach to bank efficiency measurement required a cross checking between the different available techniques. To perform this task the study proceeded in two stages. First, it analyzed both cost and alternative profit efficiency of the Greek banking system over the period 1993-2005 using the SFA. Translog cost and profit functions were estimated following the intermediation approach. Secondly, the study analyzed the effect of size and of the ownership status on the cost and profit measures of efficiency. They compared the results of the SFA with those obtained by a variant of non-parametric approach viz: VRS-DEA. The paper adopted the intermediation approach and specified the following inputs and outputs—Labor and borrowed funds were the input variables and other earning assets were the outputs.

They found lower levels of cost efficiency than profit efficiency; both measures reflected an improving trend over the sample period. The difference between the levels of cost and profit efficiency was quite significant. Large sized banks were found more cost efficient than their smaller counterparts, while an opposite result was established under profit efficiency. Furthermore, the state owned banks emerged as more cost efficient, while at the same time they were less profit efficient. The results of the DEA exercised revealed higher average inefficiency than those of the SFA. In fact the average programming inefficiency scores almost doubled compared to those of the SFA. Furthermore, inefficiency scores derived from the stochastic and programming frontiers appear to have gradually declined over the sample period, indicating a significant positive correlation

between the yearly average scores of the two approaches. Both methods indicated that cost efficiency was positively related to bank size, while the findings regarding the effect of ownership status were contradictory between the two approaches. The results obtained from the various methods were substantially different. This might be attributed to the inner advantages and disadvantages of each approach and hence, it is important to use more than one methodology to evaluate bank inefficiency.

In yet another study for the sub Saharan African Countries, Kablan (2010) estimated the level of banking efficiency and the factors determining it for the periods 2000-2004. The paper also sought to explain the level of financial development in Sub-Saharan Africa (SSA). The sample consisted of 137 banks in 29 African countries. The study used SFA to measure cost efficiency in SSA. The followed the intermediation approach and value added principle. The outputs were deposits, loans and securities and the inputs were labor, physical capital and financial capital.

The results showed that generally banks in SSA countries were cost efficient. The cost efficiency score of SSA banks was 0.76 suggesting that the banks were 76% efficient. The study found that capitalization and NPLs had a negative impact on efficiency, per capita GDP had a very small but significant negative impact. The density of the rural population had a negative impact on cost efficiency of SSA by banks. The study also found that financial development was adversely effected by inflation and concentration i.e. dominance of the system by a few banks.

3.2 An Overview Studies outside India – DEA

Data envelopment analysis is a non-parametric technique which has been employed for measuring banking efficiency. In this section, a few important studies are reviewed.

Barr *et al.* (1999) estimated the productive efficiency of banks using a constrained multiplier, input oriented, data envelopment analysis model from 1984 to 1998. The inputs used in the study were salary expenses, premises and fixed assets, other non-interest expense, interest expense and purchased funds. The outputs were earning assets, interest income and non-interest income. The study found that there was a strong and consistent relationship between efficiency scores and the inputs and outputs, as well as independent measures of bank performance. Non-interest income, other non-interest income and purchased funds were inversely related efficiency and earning assets and return on average assets were positively related to efficiency. The study found that only return on average assets, the ratio of non-performing loans to gross loans and the relative level of purchased funds seemed to be impacted by improved economic conditions. Institutions rated by examiners as the strongest had higher efficiency scores than those institutions rated as the weakest in each year of the study.

For a sample of Turkish commercial banks, Jackson and Fethi (2000) estimated the technical efficiency. The technical efficiency was derived for a cross section of forty eight (48) Turkish commercial banks in the year 1998. The efficiency was evaluated using the non- parametric frontier methodology, the DEA. This analysis was repeated under different scale assumptions. To investigate the determinants of efficiency Tobit model was used. After obtaining the efficiency measures, they implemented censored regression analysis (using Tobit model) to explain the variations in calculated efficiencies to a set of explanatory variables. These variables were bank size, profitability, capital adequacy ratio, number of branches and ownership. The study had usable data for 48 commercial banks for the year `1998. This study adopts Griffel-Tatje and Lovell's (1997) value added approach to specify the inputs and outputs. The number of employees and

the sum of non labor operating expenses, direct expenditure on buildings and amortizations expenses were specified as the two inputs, whereas the outputs were loans, demand deposits and time deposits.

In the initial analysis of 48 banks based on two inputs and three outputs amounts to 0.67, indicating that on average, banks could produce outputs with approximately 33% fewer inputs. (The efficiency scores ranged from 14% to 100% when CRS was assumed). The paper concludes that both bank size and profitability have significant positive effect on efficiency, indicating that the larger and more profitable banks had higher technical efficiency. On the other hand the capital adequacy was significantly negatively related to the technical efficiency. The number of branches yields a negative and insignificant coefficient. The paper concludes that the negative coefficient of the State ownership variable confirms that the State ownership worsens efficiency.

Jemric and Vujcic (2002) analyzed bank efficiency in Croatia between 1995-2000 using DEA. Different sets of inputs and outputs were used for the two approaches i.e. operating approach and intermediation approach. For the operating approach the inputs used were interest and related costs, commissions for services and related costs, labor related administrate cost and capital related administrative cost and the outputs were interest and related revenues, non-interest revenues. For the intermediation approach fixed assets and software, number of employees and the total deposits received were used as inputs. Total loans extended and short term securities were used as outputs.

The paper found that the foreign-owned banks were on average the most efficient and the new banks were more efficient than the old loans and in terms of size, the smaller banks were globally efficient, while larger banks were locally efficient. The paper found that the most significant cause of inefficiency among State-owned and old banks versus

foreign-owned and new ones was the number of employees and fixed assets. The results also showed that the technically more efficient banks had less non-performing loans.

For the Spanish banking sector, Maudos and Pastor (2003) estimated the cost and profit efficiency. They estimated the cost and profit efficiencies of commercial and saving banks for the period 1985-1996. The paper adopted non-parametric DEA methodology to estimate the efficiency. The authors adopted the intermediation approach and specified following variable as inputs and outputs. The inputs used were loanable funds, number of employees and physical capital. The outputs used were profitable assets and securities portfolio.

The paper found that the cost efficiency of savings banks and commercial banks was 80.20% and 90.90% respectively which was higher than the levels of profit efficiency. The paper also found that the standard profit efficiency levels of the commercial banks (66.5%) were higher than those of the saving banks (47.2%) to such an extent that the minimum difference occurs in the last year of the sample. In the case of the alternative profit efficiency the commercial banks enjoyed higher levels of efficiency 52.9% as against the savings banks 34.7%. The paper observed that levels of standard profit efficiency being higher than alternative profit efficiency implied the existence of market power in the setting of prices.

In a comparative study concerning India and Pakistan, Ataullah *et al* (2004) attempted a comparative analysis of the evolution of the technical efficiency of the banking industry for the period 1988-1998. Data envelopment analysis was applied to two alternative input output specifications to measure technical efficiency and to decompose technical efficiency into two components, pure technical efficiency and scale efficiency. The first model postulated operating and interest expenses as inputs, and loans and advances and

investments as outputs. The second model postulated operating and interest expenses as inputs and interest and non-interest income as outputs.

It was found that the overall technical efficiency of the banking industry improved following the financial liberalization, especially after 1995-96. In the case of India efficiency increased due to improvement in both pure technical efficiency and scale efficiency. In Pakistan, the increase in overall technical efficiency was due to an improvement in scale efficiency. The results suggested that the efficiency of commercial banks was much higher in the first model which used earning assets as outputs, than in the second model, which used income as output. The paper observed that the 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. The results also suggested that implementation of financial liberalization closed the efficiency gap between large and small banks. The results also suggested that there was still room for improvement in the efficiency of bank in both the countries

Similarly, Hauner (2004) estimated cost efficiency, scale efficiency and productivity change using date envelopment analysis for the period 1995-99. The sample covers all German and Austrian commercial banks whose total assets exceeded five billion dollars at the end of 1999. Intermediation approach was used. The inputs used were banks aggregate funds and labor. The outputs were loans, fixed income and securities.

The study concluded that the average cost efficiency score of German Austrian Banks over the years 1995-99 was 0.63, i.e., the sample banks could have produced the same output quantities with only 63 per cent of the observed cost. The study found a slight deterioration in cost efficiency over the second half of the 1990s. The decomposition of cost efficiency into technical and allocative efficiency suggested that cost inefficiency

was mostly due to the use of wrong inputs at the prevailing input prices, rather than waste of inputs. On average, technical efficiency amounted to 0.94 and allocative efficiency to 0.66.Technical efficiency and allocative efficiency remained on average virtually unchanged over the five years observed. It was found that Austrian banks were less cost efficient than German Banks. No significant differences between the cost efficiency of privately owned banks and cooperative banks were found. Independent (i.e., not state owned) saving banks were found to be significantly cost efficient. State owned banks were found to be more cost efficient than other banks.

Chen et al (2005) examined the cost, technical and allocative efficiency of 43 Chinese Banks over the period 1993-2000 using DEA. The paper attempts to identify the change in Chinese bank efficiency due to deregulation initiated in 1995.The study uses interest expenses, non-interest expenses, price of deposit and the price of capital as inputs and loans, deposits and non/interest income as outputs. The paper found that the financial deregulation of 1995 improved cost efficiency levels including both technical and allocative efficiency. The technical efficiency dominated the allocative efficiency of Chinese banks. Results showed that the large State owned banks and smaller banks are most efficient than medium sized Chinese banks.

Hauner and Peiris (2005) analysed the impact of banking sector reforms undertaken in Uganda to improve competition and efficiency using DEA. The paper found that the level of competition has increased significantly and had been associated with a rise in efficiency. The paper adopted the intermediation approach to estimate efficiency with deposits, loans and contingent liabilities as inputs and deposit holdings, securities and loans as outputs. It has been found that on an average, larger banks and foreign owned banks have become more efficient, while smaller banks have become less efficient in the face of increased competitive pressures.

Jen-Li Hu *et al* (2006) analyzed the efficiency of 12 Chinese banks using the DEA for the period of 1996-2003. The input variable included in the study was savings, number of employees and the net fixed assets and the outputs were investments and lending.

First, the DEA approach was used to estimate the efficiency scores then the Tobit regression was used to analyze how the environmental variable affect the efficiency scores of banks. The study found that: (i) Nationwide joint equity commercial banks had significantly higher over all technical and scale efficiency but lower pure technical efficiency than State owned specialized banks. (ii) The marginal increasing relation existed between deposit loan ratio and allocative efficiency. (iii) Small sized banks had higher cost, allocative over all technical and pure technical efficiencies than large sized banks. (iv) The banks had lower costs, over all technical, pure technical, and scale efficiency after the 2001 WTO participation. (v) The banks had lower cost efficiency after the 1997 Asian financial crisis. (vi) The banks in China had significantly increasing over all technical and scale efficiencies from 1996-20003.

Ariff and Can (2008) investigated the cost of profit efficiency of 28 Chinese commercial banks for the period 1995-2004. They examined influence of ownership type, size, risk profile, profitability and key environmental changes on the bank efficiency using a Tobit regression. The intermediation approach was used. They used three inputs—total loanable funds, number of employees and physical capital and their prices. Two outputs namely total loans and investments and their prices were considered.

The study found that the profit efficiency levels of the banks analyzed were well below those of cost efficiency, and alternative profit efficiency levels lower than those of standard profit efficiency. Joint stock commercial banks on average were more cost and profit efficient than state owned commercial banks. Taking all banks together while

standard profit efficiency had remarkably increased, cost efficiency and alternative profit efficiency had not improved over the period analyzed. The coefficient on state ownership was negative and significant at 1% in terms of alternative profit efficiency. Medium sized banks were most efficient. The paper observed that banks which had a higher ratio of loans to assets tended to incur higher credit risk and thus higher loan loss provisions, and were less efficient. More profitable banks with a focus on fees based activities tended to be more efficient. The results suggested, speedier reforms to open the banking market, diversifying ownership, minimizing the Government's capital subsidy, and enhancing asset quality control to improve bank efficiency of Chinese banks.

Kablan (2007) measured WAEMU (West African Economic Monetary Union) banks efficiency and its determining factors after the banking sector reforms from 1993-1996 using DEA to estimate technical efficiency and SFA for cost efficiency for 35 banks. The study period was from 1999 to 20004. The study used labor, physical capital, and financial capital as inputs and loans, deposits, securities as outputs.

The estimated scores of efficiency of WAEMU banks were around 0.67 for cost efficiency and 0.76 and 0.85 for technical efficiency under CRS and VRS respectively. The paper concluded that efficiency level increased during the study period apart from Ivory Coast, Burkina Faso. The paper found that the local banks with private capital were the most efficient ones followed by foreign banks subsidiaries and State owned banks which displayed the lowest cost and technical efficiency scores. The paper also found that even the import of new technologies did not contributed to the improvement of technical efficiency.

For the Bulgarian banks, Nenovsky *et al* (2007) estimated efficiency of the banking system. The study covered the period of 1999-2006. They used standard indicators for

bank efficiency, namely, return on assets, return on capital, operating profit, net interest income, non-interest expenditures and exchange rate revaluations. DEA approach was used to estimate banks efficiency scores. Operating approach and intermediation approach had been used to estimate efficiency. For the operating approach they used two variables for inputs- interest and related cost and non-interest costs, while for the outputs they took interest and related revenues and non-interest revenues. For the intermediation approach the production factors used were the fixed assets, the no. of employed and the deposits while the final products were covered by loans and securities.

The study concluded that under the operating approach to DEA they observed a tendency of increase in average efficiency of the banking system, which was interrupted in the last year of the analyzed period. Intermediation and operating approaches to DEA showed that there was equalization in the Bulgarian banking system during the analyzed period. The foreign banks had relatively higher efficiency as compared to the domestic and State owned banks, as a result of the transfer of knowledge, better management practice, including administrative cost optimization.

Staub (2010) estimated cost, technical and allocative efficiencies for the Brazilian banking system (2000-2007) using cost data and data envelopment analysis. The sample includes an unbalanced panel data of 127 banks. They followed the intermediation approach and employed capital, labor as inputs and investments, total loans, net of provision loans and deposits as outputs. The results showed that the average allocative and technical efficiencies were about 66.9% and 63.3% respectively. Allocative efficiency was always greater than technical efficiency for the period from June 2000 to December 2002. In the later period, beginning in June 2003 allocative efficiency falls and was below technical efficiency by the end of 2006 and 2007. During the period 2000-2007 allocative inefficiency has increased. This might have been due to fluctuations and

instability in factor prices. It was found that foreign banks were less cost efficient than their domestic counterparts. State owned banks were more efficient than private banks. Banks with foreign participation and foreign banks were the least economic efficient.

Rehman and Raoof (2010) investigated the overall efficiency scores of Pakistani banking sector over the period of 199-2007 using DEA. The inputs used in this study were deposits and net capital. The outputs were loans and advances and investments. The results showed an inconsistent performance of banking sector. In 1998 all banks performed well which was evident from their high efficiency scores. But after this the performance became inconsistent. In 1999 and 2001 banking sector efficiency scores were very low as compared to the world standard. The study concludes that due to high rate measures and acquisitions in banking sector during 2006-2007, the performance of public sector banks was significantly different from private and foreign banks in terms of technical efficiency. The performance of private and foreign banks declined.

3.3 Indian Studies:

The issue of measuring performance of banks has been the prime concern of regulators as well as economists since the early 1970s. Starting with the Luther Committee (1977) several official committees as well as research studies have highlighted this issue. The PEP (1977) Committee proposed a system of assessment of relative performance of banks in respect of four dimensions namely, productivity, social objectives (spatial), social objectives (sectoral), and profitability. The committee in all proposed 19 indicators for monitoring bank performance. The Mnistry of Finance, Government of India, also made use of similar indicators during 1985-86. The Pendharkar Working Group (1982-83) also emphasized the need for evolving a system of evaluation and rating of banks. The Group had identified certain parameters. The Chakravarty Committee (1985) also expressed

concern over the conceptual issues arising out of measuring the operational performance of banks. Later, the Padmanabhan Working Group (1991) recommended adoption of CAMEL rating mechanism. The Narasimhan Committees (1991, 1998) and the Verma Committee (1999) also dealt with this issue.

In this sub-section an attempt is made to review select studies in the Indian context to serve as background to the empirical work of this thesis.

Starting with the study by Rangarajan and Mampilly (1972), several researchers had contributed towards analyzing the productivity growth of banks. Shetty (1979) critically examined the extent to which banking system in India had been able to achieve the objectives set before it initially by the scheme of "social control" over commercial banks introduced in 1968 and subsequently by the nationalization of major Indian banks. The study analyzed the performance of commercial banks during the post-nationalization period i.e. 1969-78 in regard to branches, deposits and credit etc. of the banks.

Focusing on profits of Indian commercial banks, Angadi (1986) two denominators namely, working funds and current operating earnings, and concluded that the significant factors affecting profitability of the banks were outside the policy constraints or exogenous factors namely, the earnings and the expenses of the banks. The rise in expenses responsiveness was followed by the rise in the earnings but the rate of increase of the former was much higher than in the later. Similarly fall in the expenses responsiveness was followed by the fall in the responsiveness of earnings. However, the fall in the former was much less than the fall in the latter. This trend in responsiveness of earnings and expenses explained the deteriorating situation of the banks during 1963-1982.

There are other studies which analyzed the banking performance issue (see. Tyagarajan (1975), Karkal (1983), Agarwal (1991), Subrahmanyam (1993), Subrahmanyam and Swamy (1994)). These studies however failed to link growth performance to regulatory events, and also to examine the efficiency of banking service as such. Further there are more studies in the literature that took a broader view of the performance of the banking sector and attempted to examine efficiency.

Adopting the methodology of principal components, Hansda (1995) attempted to identify the strategic variables that influenced the performance variability of public sector banks during the period 1991-94. The performance of banks was sought to be judged on the basis of productivity, financial management, profitability and sustainability. The study found that there was no relative change in the position of 18 of 28 public sector banks during the study period.

It may however be noted that studies upto this point of time mainly used methods such as ratio analysis, regression analysis, index numbers, multivariate analysis. In the subsequent periods, quite a few studies have adopted the modeling approach to examine the efficiency of banks using the parametric as well as non parametric DEA models.

Using the DEA, Bhattacharyya *et.al* (1997) examined the impact of the limited liberalisation initiated before the deregulation of the 1990s on the performance of various categories of banks. The study covered in all 70 banks during the period 1986-91. The study used advances, investments and deposits as outputs and interest expense and operating expense as inputs and constructed one grand frontier for the entire period and measured the technical efficiency of the banks under study. It was found that public sector banks had the highest efficiency among the three categories, with foreign and private banks having much lower efficiencies. It was also noted that, public

sector banks started showing a decline in efficiency after 1987, private banks showed no change and foreign banks showed a sharp rise in efficiency.

Das (1997) examined overall efficiency technical, allocative and scale - at PSBs for the period 1990-96. A non-parametric programming approach was used to calculate the overall, technical, allocative, pure technical and scale efficiencies of PSBs. The study found that there was a decline in overall efficiency which was attributed to the decline in technical efficiency, both pure and scale, which was not offset by an improvement in allocative efficiency. The study, however, also pointed out that the deterioration in technical efficiency was mainly on account of four nationalised banks. In a similar study, Sarkar and Das (1997) compared performance of public, private and foreign banks for 1994-95 by using measures of profitability, productivity and financial management and reiterated the conclusion that the public sector banks performed poorly relative to the other two categories.

Sarkar et al (1998) compared the performance of banks using two measures of profitability namely, return on assets and operating profit ratio, and four efficiency measures namely, net interest margin, operating profit to staff expense, operating cost ratio and staff expense ratio (all ratios except operating profit to staff expense having average total assets in the denominator) across the three categories of banks - public, private and foreign - in India. The authors had made these comparisons after controlling for a variety of non-ownership factors that might have an impact on performance: asset size. These factors were: proportion of investment in government securities, the proportion of directed credit, the proportion of rural and semi- urban branches, and the proportion of non-interest income to total income.

The study found that between private banks and PSBs, there was only a weak ownership effect. Traded private banks were found to be superior to PSBs with respect to profitability measures but not with respect to efficiency measures. Non-traded private banks did not significantly differ from PSBs in respect of either profitability or efficiency. There was, however, a strong ownership effect between foreign banks and private banks, with the former outperforming the latter with respect to all indicators. The study concluded that private enterprises might not be unambiguously superior to public enterprises in a developing economy. The study ascribed the particular ordering of performance that they found foreign, traded private, non traded private and public - to the link between performance and the market for corporate control. The stronger the link, better the performance.

In a related study Sarkar *et al* (1998) examined the ownership-performance issue by estimating the Analysis of Covariance model for two profitability performance measure namely, Return on Assets (RoA) and Operating Profit Ratio (OPR), and four efficiency performance measure namely, Net Interest Margin (NIM), Operating Profit to Staff Expense (OPSE), Operating Cost Ratio (OCR) and Staff Expense Ratio (SER) by pooling data for two years, 1993–1994 and 1994–1995 on 27 public banks, 23 domestic private banks, and 23 foreign banks.

The study concluded that traded private banks were superior to public banks with regard to both return on assets and income earning potential and private banks as a group (including non-traded banks) were significantly superior with respect to the return on assets. The study noted that neither traded nor non-traded private banks seemed to have any comparative advantage with respect to the operational efficiency parameters. Foreign banks were found more profitable and efficient than traded private banks that were more profitable than non-traded private banks. Non-traded banks, however, were not found to

have any significant differences in performance, either with respect to profitability or efficiency *vis-a -vis* the public sector banks. The study suggested that there existed only a weak ownership effect of private banks over public banks in India.

In another study, Das (1999) compared the performance of public sector banks for three years in the post-reform period: 1992, 1995 and 1998. He found that there was certain convergence in performance and also noted that while there was an increase in emphasis on non-interest income, banks had tended to show risk-averse behaviour by opting for risk-free investments over risky loans.

The study by Srivastava (1999) examined whether: (i) bigger banks are better for India and (ii) to what extent has the domestic impetus of financial sector reforms made banking more efficient. The study period was 1995-96 and included all schedule commercial banks in India save RRB's. This paper analyzed the cost structure in Indian banking using stochastic frontier approach (SFA) and found that most, if not all, Indian banks were operating at scales below the optimal size. Banks with a larger size were found to be more cost efficient.

The first major study employing DEA to analyse the issue of banking efficiency in India was conducted by Saha and Ravisankar (2000). Emphasizing the need to measure efficiency of public sector banks keeping in mind the interests of regulators as well as investors, the study was undertaken during the period 1991-92 to 1994-95. Four inputs and eight outputs were selected for the DEA analysis. The inputs were: no of bank branches, staff (no of employees), establishment expenditure and non-establishment expenditure. The outputs were: deposits, advances, investments, spread, and total income, interest income, non- interest income and working funds. The study came out with the conclusion that barring few exceptions, the public sector banks in general improved their

efficiency scores over the years 1992 to 1995. This finding was consistent with the market perceptions of the banks.

In a similar study, Sathye (2003) estimated the productive efficiency of different groups of Indian banks i.e. PSBs, private and foreign banks. The sample consists of 27 public sector commercial banks, 33 private sector commercial bank and 34 foreign banks. The sample period was 1997-98. The efficiency measures were obtained using variable returns to scale (VRS) input oriented model of the DEA methodology.

Two models had been constructed to show how efficiency scores varied with the change in inputs and outputs. In the first model interest expenses, non-interest expenses were used as inputs and net interest income and non /interest income were used as outputs. In the second model the inputs were deposits and staff and outputs were net loans and non-interest income. The study showed that in the first model the public sector banks had a higher mean efficiency score as compared to the private sector and foreign commercial banks in India. As per second model, they had lower mean efficiency score than the foreign banks but still higher than private sector commercial banks. Most banks on the frontier were foreign owned.

Ram Mohan (2002) evaluated the performance of Public sector banks (PSBs) since deregulation in absolute and relative terms using financial measures of performance relating to the period 1994-95 to 1999-2000. The study used indicators viz., net profits, net interest margin, intermediation cost and non-performing assets. The study found that PSBs have improved their performance in both absolute and relative terms and noted that there was a trend towards convergence in performance between public and private sector banks.

Using a generalized shadow cost function approach, Kumbhakar and Sarkar (2003) analyzed the relationship between deregulation and total factor productivity (TFP) the growth of which was decomposed into a technological change, a scale, and a miscellaneous component. The study adopted a disaggregated panel data analysis, using the population of public and private banks over 1985-96 that covering both pre- and post-deregulation periods. The study found that while private sector banks improved their performance on account of the freedom to expand output, public sector banks did not respond well to the deregulation measures.

In another study, Ram Mohan (2003) evaluated the performance of public sector banks (PSBs) consequent to disinvestnment by examining the long-term returns to the stocks of public and private sector banks in India. Comparing with returns to the Sensex both on an unadjusted as well as risk-adjusted basis, the study estimated the holding period returns for a total of 24 banks - nine PSBs, eight old private sector banks and seven new private sector bank. The study concluded that a mean nominal return of PSBs was superior to that of the Sensex over the corresponding period. On a risk-adjusted basis, they delivered a lower return with respect to the Sensex. Though in neither case was the difference in performance with respect to the Sensex statistically significant.

Ram Mohan (2004) compared the performance of three categories of banks - public, private and foreign using physical quantities of inputs and outputs, and comparing the revenue maximization efficiency of banks during 1992-2000. The study had adopted the DEA approach for the revenue maximization efficiency instead of profit efficiency. The author found that PSBs performed significantly better than private sector banks but no differently from foreign banks. Further the study concluded that

there was a convergence in performance between public and private sector banks in the post-reform era.

Bhaumik and Dimova (2004) examined the impact of ownership and competition on bank performance from 1995 to 2001 in India. The performance of a bank was determined by the size of the bank's assets (ASSET), its priority sector advances as a percent of total advances (PRIORITY), investment in government securities as a percent of total investment (GOVSEC), non-interest income as a percent of total income (NONINT), non-urban branches as a percent of total branches (NONURBAN), ownership, a time trend (TIME), and interactions between the time trend and ownership dummies. The study considered four different types of Indian banks namely, public-sector banks (PUBLIC), old or incumbent private-sector banks (OLDPRIV), de novo or new private-sector banks (NEWPRIV), and foreign banks(FOREIGN). Further the study included quadratic form of assets of bank in the model considering the diseconomies scale if bank is too large.

The study found that private-sector and foreign banks were better performing, and hence more efficient, than public-sector banks initially. However, competition forced public-sector banks to eliminate this performance gap by the financial year 1998–1999. After 1998–1999, neither ownership nor competition per se affected bank performance significantly. Furthermore, capital market discipline had no influence on the performance of banks during the entire time period.

Jaffery *et al* (2007) measured changes in productivity and technical efficiency levels within banking sectors of the Indian sub-continent: specifically India, Pakistan and Bangladesh, over the period 1993–2001. A Malmquist index of total factor productivity (TFP) change over the time period in question was employed, along with a Tobit

regression, in order to determine whether these measures of regulatory and financial reform has had the desired effect upon the Indian sub-continent in terms of productivity and efficiency levels. It is found that technical efficiency both increased and converged across the Indian sub-continent in response to reform. India and Bangladesh experienced immediate and sustained growth in technical efficiency, whereas Pakistan endured a reduction in efficiency during the middle years of the study, before rebounding to levels comparable to the rest of the sub-continent in the latter years of the study. Results indicated that the measures employed to modernize the financial sectors of these respective countries had the desire effects upon levels of technical efficiency.

Ghosh *et al* (2008) wanted to check whether market liberalization leads to decline in the cost of capital for domestic firms. Stulz (1999a,b) had identified two primary reasons for the decline in the potential for reduced systematic risk resulting from better diversification of risk and the potential for lower agency costs resulting from alignment of manager and shareholder interests. The study examined agency cost theory of the recent liberalization of foreign investment limits on Indian banks using event study analysis. They had found the result in favour of Stulz's (1999a, b) hypothesis.

Bhaumik and Piesse (2008) examined banks' behavior in the context of credit markets of India. They used dynamic panel model and estimated portfolio choice model for bank-level data for 9years (1995–96 to 2003–04). The study indicated that, in India, the data for the domestic banks fitted well the portfolio-choice model, especially for private banks, but the model did not explain the behaviour of foreign banks. In general, allocation of assets between risk-free government securities and risky credit is affected by past allocation patterns, stock exchange listing (for private banks), risk averseness of banks, regulations regarding treatment of NPA, and ability of banks to recover doubtful credit. It

was also evident that banks dealt with changing levels of systematic risk by altering the ratio of securitized to non-securitized credit.

In a straight forward application of the SFA on panel data, Shanmugam and Das (2004) measured technical efficiency of banks in four different ownership groups in India during the reform period 1992-99. The data set was an unbalanced panel of 94 banks belonging to four different ownership groups. The outputs were net interest margin, non-interest income, credits and investments. The inputs were deposits, borrowings, labor and fixed assets.

The results indicated the dominance of deposits in producing all outputs. The paper found that the observed outputs less than their respective potential outputs due to technical inefficiency of banks. The technical efficiency of raising interest margin was varied widely across sample banks and was time invariant. The banking industry showed a progress in terms of efficiency of banks raising non-interest income, investments and credits. The efficiency improvement was considerable in the case of investments in all banks, particularly in private banks. The study also found that the State Bank Group and foreign banks were more efficient than their counter parts.

The competitiveness of Indian commercials banks in a deregulated environment was examined by Amarender Reddy (2004) for the deregulated period 1996-2002. The data used for this study has been collected from annual reports of Reserve Bank of India. Efficiency change, scale efficiency and pure technical efficiency change between two periods has been estimated by using data envelopment analysis.

The results showed that there was an increase in technical efficiency and scale efficiency of most of the banks. The year to year variation in technical efficiency explained by variation in scale efficiency and general economic environment rather than variation in

pure technical efficiency. Most of the banks faced decreasing returns to scale especially public sector banks due to white spread bank branches with little inter-connectivity. The foreign banks and new private banks exhibited most productive scale size. Tobit analysis revealed that both pure technical efficiency and scale efficiency influenced negatively by number of branches per bank, whereas positively influenced by total assets. Share of priority sector advances and asset quality was having positive influence on scale efficiency.

Das *et al* (2005) estimated various efficiency scores of Indian banks during 1997-2003 using DEA. This study adopted the 'intermediation' approach to measure the efficiency. Borrowed funds, number of employees, fixed assets and equity were used as inputs. And the outputs included investments, performing loan assets and other non-interest fee based income.

This paper found that Indian banks were not much differentiated with respect to input oriented or output oriented technical efficiency and cost efficiency while differences were found in terms of revenue efficiency and profit efficiency. The results stressed the need for choosing a proper mix in shaping the revenue and profitability of Indian banks. Bank size, ownership and being listed on the stock exchange were some of the factors that had a positive impact on average profit efficiency and to some extent revenue efficiency scores. The paper also concluded that the median efficiency scores of Indian banks in general and of bigger banks in particular had improved during the post reform period.

Extended the purview of efficiency analysis to the private as well as to foreign banks operating in India, Varadi et al (2006) employed the DEA on the data relating to 27 public sector, 30 private and 36 foreign banks during the period 1999-2000 to 2002-03. Considering four indicators namely, productivity, profitability, financial management and

asset quality, the study came out with an important finding that the public sector banks were the most efficient followed by the foreign and private banks.

Sensarma (2006) studied efficiency and productivity of schedule commercial banks in India during the period 1986 -2000 using stochastic frontier analysis. This paper obtained cost inefficiency and its determinants. Then using the parameters and efficiency estimates from the frontiers, various measures of productivity and their components were computed. The approach used in this was valued added approach. Outputs used in this study were value of fixed deposits, saving deposits, current deposits, investments and loans and advances. Labor and capital were the two inputs.

The results indicated that although there were cost line efficiencies in the Indian banking sector, they had been declining over time even while deregulation led to a slowdown in the rate of decline. The paper found that total factor productivity had gone up for all bank groups during the period under study. This suggested that deregulation achieved the aim of reduction in intermediation costs and improving productivity. The study concluded that public sector banks had performed well like the private banks in the post deregulated period both in terms of cost efficiency as well as TFP. Foreign banks had been poor performers in terms of cost efficiency and productivity. Performance of new private banks in terms of cost efficiency and TFP appears to have been best in the industry.

Productive performance trends of Indian commercial banks in terms of cost and technical efficiency for the period 1997-98 to 2004-05 using DEA was examined by Sahoo (2006). The study followed the intermediation approach. The inputs used were borrowed funds, labor and fixed assets and the outputs were investments, performing loan assets and non interest income.

The results showed that the average annual trends in technical efficiency for all ownership groups had improved. The foreign banks had a leading edge over the nationalized banks in both operational and price measures of performance. The study found that there was higher cost efficiency per private banks when compared the nationalized banks.

Using the stochastic frontier analysis, Mahesh and Bhide (2008) examined the efficiency levels of Indian banks for the period 1985-200. The study estimated the bank specific cost, profit and advance efficiencies.

The results showed that while loan advance efficiency had not shown much improvement after deregulation, cost and profit efficiencies showed varying trends for different bank groups. Public sector banks ranked first, in two of the three efficiency measures. The results also showed that competition had a significant impact on the efficiency levels of commercial banks across all three efficiency measures.

The impact of financial regulations on cost and profit efficiency of Indian commercial banks during the post reform period 1992-04 was examined by Das and Ghosh (2009). The sample covered all commercial banks in India. The study used the non-parametric data envelopment analysis to estimate cost and profit efficiency. The study also analyses the factors behind the possible differences in efficiency. The study adopted the intermediation approach. The inputs chosen were: deposits, number of employees, fixed assets and equity. The outputs were investments, loans and advances and other non-interest fees based incomes.

The findings indicated high levels of efficiency in costs and lower levels in profits, testifying the importance of inefficiencies on the revenue side of banking activity. Profit efficiency of banks which are listed in the stock market is notably higher as compared to

their unlisted counterparts. Also profit efficiency was found to differ significantly across bank ownership. The study also found that bank size, deposit mix, and prudential parameters such as capital position and delinquent loans were important factors that drive the differences in efficiency.

Sahoo and Tone (2009) examined the role of competition on profit change and its drivers using radial and non-radial DEA models. The study had pointed out that the increasing efficiency change trends in all ownership groups after 2002 indicated that the Government reform process instituted on the banking industry had a favorable effect on the performance of the Indian banking sector. Further it was noted that despite the fact that nationalized banks were the oldest banks, their output and resource allocation behaviors did not reflect their learning experience.

Kumar and Gulate (2010) analyzed the trends of cost efficiency and its components across PSBs during the post deregulation period 1992-93 to 2007-08 using DEA. The study examined the issue of convergence in cost, technical and allocative efficiency levels of Indian PSBs. Empirical results indicated that deregulation had a positive impact on cost efficiency levels of PSBs. Further, technical efficiency of PSBs followed an upward trend while allocative efficiency followed a path of deceleration. The convergence analysis revealed that the inefficient PSBs were not only catching up but also moving ahead than the efficient ones.

Ray and Das (2010) measured cost and profit efficiency of all major Indian commercial banks using Data Envelopment Analysis, analyzed the possible determinants of measured efficiency, and examined the statistical distribution of the efficiency using the nonparametric methods during the post-reform period of seven years beginning with the financial year 1996–97. Inputs and outputs of banks were selected based on the asset

approach which can be viewed as a variant of the intermediation approach. Four inputs – (borrowed) funds (deposits and other borrowings), number of employees, fixed assets, and equity and three outputs- investments, performing loan assets, and other non-interest (fee-based) incomes were selected.

The results showed that there was considerable variation in average levels of profit efficiency across various ownership categories of banks. In general, state owned banks were found to be more efficient than their private counter parts. Further, efficiency tends to be low among the small banks (assets up to Rs. 50 billion), indicating that at the existing scale of operations, these banks were operating far below the efficient frontier. The study also examined the distribution of efficiency using nonparametric kernel density estimates and revealed that there was a rightward-shift of the efficiency distribution over the years. The major part of the shift came from the state owned banks. Based on the conditional distribution, the study found strong evidence of ownership explaining the efficiency differential of banks. Additionally, bank size and product-mix were also found to be important, although to a lesser extent.

Tabak and Tecles (2010) analyzed the efficiency of the banking sector in India during the period of 2000–2006. The study had employed a Bayesian stochastic frontier to measure banking efficiency and also tested for the inclusion of off-balance sheet data in model specification. Cost and profit efficiencies were estimated s deviation from the frontier. Four outputs: loans (net of provisions), other earning assets, deposits and off-balance sheet items and three input prices price of funds (PF)

Kumar and Gulati (2010) appraised the efficiency, effectiveness, and performance of 27 public sector banks (PSBs) operating in India by using a two-stage performance evaluation model using the cross-sectional data for the financial year 2006/2007. The

technique of data envelopment analysis had been used for computing the efficiency and effectiveness scores for individual PSBs. The overall performance scores have been derived by taking the product of efficiency and effectiveness scores.

The empirical results revealed that high efficiency did not stand for high effectiveness in the Indian PSB industry. A positive and strong correlation between effectiveness and performance measures was noted. Further, on the efficiency front, State Bank of Travancore appeared as an ideal benchmark, while State Bank of Bikaner and Jaipur, and State Bank of Mysore emerge as ideal benchmarks on the effectiveness front.

Rakhe (2010) analyzed the financial performance of foreign banks in comparison with other bank groups in India. The study had also examined the determinants of profitability in the Indian banking sector using panel data regression analysis using a sample of 59 banks, which include 14 FBs, 14 old PrSBs, 5 new PrSBs and 26 PSBs. The study found that access to low cost funds, diversification of income, adequate other income to fully finance the operating expenses are the important factors leading to the higher profitability of foreign banks vis-à-vis other bank groups in India. The study also indicated that efficiency of fund management is the most important factor determining profitability in the banking system followed by generation of other income.

Zhao *et al* (2010) examined the impact of financial sector reforms on the cost structure characteristics and on the ownership–cost efficiency relationship in Indian banking also examined the impact of reforms on the dynamics of competition in the lending market. They had estimated a cost frontier and a partial adjustment model. They used a two-input, three-output specification for the cost frontier model. The book value of performing loans (measured as the difference between total loans and non-performing loans), other earning

assets, and fee-based income as output and two inputs total loanable funds and non-interest operating costs were selected.

Results of the study indicated that commercial banks changed both their input mix and output composition to accommodate the changes in the regulatory environment. Pure cost technology worsened at the initial stages of the reform, but improved after 1996. There was only a upward shift of the cost frontier after 1997, and did not find significant structural break in the efficient cost function associated with the change of policy focus. Indian commercial banks accomplished the majority of the adjustments to their production process before the change in policy measures. The study further opined that the reforms had affected the ownership–cost efficiency relationship. The analysis of the dynamics of competition in the lending market also suggested a stronger competitive market forces in 1998–2004, despite tighter prudential norms.

In an interesting paper, Rajan et al (2011) addressed the issue of endogeneity of multiple outputs in a model of multiple-output and multiple-input production function frontier using semi-parametric estimation methods, in the context of examining technical efficiency and productivity performance of Indian scheduled commercial banks during the period 1979-2009. More specifically, the study introduced multivariate kernel estimators for the joint distribution of the multiple outputs and correlated random effects, to overcome the endogeneity issue. Following the intermediation approach and considering total loans and total investments as measures of output, the study concluded there were productivity and efficiency gains due to economic reforms.

3.4 Concluding Remarks:

From the foregoing review, it is clear that there are quite a few interesting issues associated with measuring efficiency of banks. These include:

i)   Identifying the inputs and outputs for implementing the DEA and SFA

ii)   Choosing the type of efficiency such as technical, allocative, profit, cost, advances, and productive efficiencies.

iii)   Decomposition of cost efficiency into allocative and technical efficiencies

iv)   Choice between the intermediate and operating approaches in the case of DEA

v)   Identification of determinants of efficiency measures which would explain the efficiency differences. This may be done using tobit analysis and regressions analysis.

vi)   Functional form of the frontier – flexible or translog or multi – product cost function.

For the DEA, the input variables that have been identified include labour / number of employees, fixed assets, total deposits, other non-interest expenses, interest expenses, loans and contingent liabilities. Similarly, the output variables include total loans and advances, short-term securities, interest and related revenues, non-interest revenues, total liquid assets and investments, over draft and inter-bank placements etc.

The factors that have been identified to determine efficiency include bank size, profitability, capital adequacy ratio, number of branches, ownership, deposit-mix. Similar to DEA, the SFA is based on a parametric frontier (flexible, translog or a multi-product cost function) the estimation of which facilitates computation of efficiency measures.

This method also requires an explicit identification of input and output variables. This analysis may be supplemented with tobit analysis to arrive at factors that would influence differences in efficiency measures across banks.

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CHAPTER IV

TRENDS IN PRODUCTIVITY AND EFFICIENCY OF COMMERCIAL BANKS IN INDIA

4.0 Introduction

A well-functioning financial system, by facilitating efficient allocation of resources from savers to investors, promotes economic growth. Within the financial system, the most important is the banking systems which induce a more efficient allocation of capital and foster growth. But efficiency of the financial system in *ex ante* condition to reap the benefit of financial sector, as pointed out by Mohan (2005), that the more efficient a financial system is in resource generation and in its allocation, the greater is its contribution to economic growth. Moreover the capacity of risk mitigation process of an economy very much depends on the efficient system of financial intermediation. The efficiency and productivity of banking sector has an important implication for the development of itself and also to contribute to economic growth. Casu *et al* (2002) opines that efficiency in banking can result in greater and more appropriate innovations, improved profitability as well as greater safety and soundness when the improvement in productivity is channeled towards strengthening capital buffers that absorb risk. Thus what is needed for the development of an economy is not simply banking system but an efficient one.

Many studies have investigated the impact of banking efficiency on the survival and failure of banks. Barr and Siems (1996) have found that banks receiving high efficiency scores are much more likely to survive than banks which have relatively lower scores. Podpiera and Podpiera, (2005) have confirmed a negative and significant relation between cost efficiency and the risk of a bank failure. Several other studies have also validated the

relevance of regular cost efficiency screening for early warning signals of managerial problems in commercial banks. The assessment of efficiency and productivity of banking, thus, assumes importance.

Moreover, for evolving strengths or weaknesses of the banking system, efficiency or productivity measures could act as leading indicators and enables the regulator to take pre-emptive steps when necessary. Therefore, investigation and measurement of efficiency and productivity in the banking sector have always been areas of interest for economic research.

Though several factors have been found to play an important role to achieve efficiency and productivity of banking system, a policy environment facilitating tapping of economies of scale, diversification of activities and introduction of state of the art technologies has generally been the common driving force behind higher efficiency and productivity levels across countries and banking system. Specific factors may vary across countries. These factors, therefore, have been engaging the attention of policymakers all over the world.

In the above backdrop, this chapter assesses efficiency and productivity of the banking sector in India using ratio analysis. The focus of the present chapter is to assess whether efficiency and productivity of the banking sector have improved in the post-reform period; and if so, to what extent. Efficiency has been tested along three different dimensions, viz., ownership (public versus private), size (small versus large) and activity (specialisation versus diversification).

4.1 Measurement of Productivity and Efficiency – An Accounting Framework

Productivity and efficiency of banking sector may be measured using accounting measures and economic measures. While accounting measures enable a disaggregated and incisive analysis of bank's performance in terms of individual parameters determining the overall efficiency level, economic measures provide a composite and precise estimate of efficiency and productivity by comparing each bank against the best performer in the industry. In this section productivity and efficiency of the banking sector in India have been measured using accounting measures.

Ratio analysis has been a popular approach to evaluate efficiency and productivity in the banking sector, whereby the performance of a banking unit is adjudged in terms of certain key parameters and their ratios such as cost to income ratio, business per employee, business per branch etc. Every ratio gives an insight into a particular aspect of efficiency and productivity of banks. It may however be pertinent to noted that all the ratios are inter-linked. For example, deposit mobilisation and credit creation is the core of banking business. Hence, the intermediation cost which relates income from credit and cost of deposit would illuminate bank's efficiency in its core function of raising deposits from savers and on lending to user groups. Cost to income ratio is a proxy of how efficiently bank undertakes its overall operations and can be termed as an overall efficiency measure of the bank. Similarly, net interest margin ratio relates how efficiently banks manage their pecuniary risk arising from asset-liability mismatch.

Ratio of non-interest income to interest income or total income has been used to broadly measure efficiency of banks for non-fund or fee based activities, where personnel skills and business acumen of bank employees handling the particular desk would matter. However, it is difficult to segregate cost incurred by a bank on its personnel staff handling

fee-based activities, given the fact that the same set of personnel may be engaged in handling both fund and non-fund based activities. Banks often employ a transfer pricing mechanism to calculate the contribution of each banking activity towards total profits.

Size of business or quantum of credit or investment portfolio and price or lending rates or interest/dividend/capital gains per unit of investment are the two factors on which income depends. Thus, after ascertaining bank's competence in sub-activities, its efficiency could be seen in terms of overall quantum of business per unit of its inputs, that is, business per employee or business per branch. Finally, this could be followed by profitability ratios such as return per unit of assets or returns on equity.

Intermediation cost, interest spread, operating expenditure, cost to income ratio, return on assets, return on equity, business per employee, income per employee and business per branch are some of the commonly used accounting measures for assessing the efficiency and productivity of a banking unit have been used. Each of the ratios is indicative of the productivity/efficiency and reflects on certain aspect/s of a bank's functioning.

4.1.1 Operating Costs to Total Assets Ratio

This ratio indicates the amount of operating costs expended per unit of assets. It reflects the efforts taken by a bank to cut cost by rationalising its labour force and branches and back office operations. Larger the ratio, the lower is the efficiency. Based on the fact that ultimately, the banks use these operating costs to generate assets (i.e., loans) from their available funds (i.e., deposits), this ratio is also used to represent the intermediation cost of banking system by some researchers. As Bhide, Prasad and Ghosh (2002) opined, a reduction in operating costs is expected to ultimately result in reduction in lending rates and also net interest margins, thereby facilitating greater credit off take, and hence,

economic growth. In terms of the Basel II norms, banks should have cost to asset ratio of about one per cent (Ghosh, C.R et al, 2004).

There has been a gradual and almost sustained decline in the cost-asset ratio for the Indian banking industry as a whole from the peak level of 2.93 per cent in 1995-96 to 1.73 per cent in 2008-09. However, the trend varied across the bank groups. The cost-asset ratio of new private sector banks, which declined sharply between 1997-98 and 2001-02, increased gradually from 2002-03 onwards and reached at peak in 2007-08 and again declined marginally in next year. However, the ratio for all other bank groups, which generally increased in the 1990s, declined in the 2000s. For the entire period, i.e., between 1991-92 and 2008-09, while the ratio for public sector banks and old private sector banks declined, it increased in respect of foreign banks and new private banks, but in case of foreign banks in the last year it has come down marginally (Table 4.1).

The sharp decline in the operating cost to total assets ratio of public sector banks in 2001-02 was on account of rationalization of the workforce. State Bank of India and nationalised banks introduced voluntary retirement schemes during 2000-01, which had a major bearing on the cost-asset ratio for public sector banks in 2001-02[1]. The sharp decline in operating expenses during 2006-07 to 2008-09 may be explained in terms of a lower increase in wage bill as compared with the previous years as banks in recent years have tended to outsource many routine activities. Increase in the ratio in the case of new private sector banks that began in the late 1990s reflects expansion of branch network and spending on technological up-gradation and creation of infrastructure. New private sector and foreign banks have invested large amounts on technology up-gradation, which has had the salutary effect of leveraging technology to provide better consumer support and to manage assets in the long-run (D'Souza, 2002), though operating costs did increase in the

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[1] Report on Currency and Finance 2003-08 Volume - V

short term. This is substantiated by the steadily increasing non-labour cost to earning assets ratio in the case of foreign banks, much above the industry levels.

	Table 4.1: Operating Cost to Total Assets of Commercial Banks in India (Per cent)							
Year	Domestic Banks						Foreign Banks	All Commercial Banks
	Public Sector Banks			Private Banks				
	State Bank Group	Nationalised Banks	All public Sector banks	Old Private Banks	New Private Banks	All Private Banks		
1	2	3	4	5	6	7	9	10
1991-92	2.48	2.67	2.60	2.97	*	2.97	2.26	2.59
1992-93	2.64	2.64	2.64	2.71	*	2.71	2.70	2.65
1993-94	2.66	2.64	2.65	2.49	*	2.49	2.65	2.64
1994-95	2.95	2.76	2.83	2.35	*	2.35	2.72	2.79
1995-96	3.09	2.93	2.99	2.63	1.82	2.47	2.77	2.93
1996-97	2.94	2.85	2.88	2.49	1.94	2.36	3.04	2.85
1997-98	2.68	2.65	2.66	2.30	1.76	2.14	2.98	2.63
1998-99	2.70	2.63	2.65	2.22	1.74	2.04	3.39	2.65
1999-2000	2.46	2.56	2.52	2.18	1.42	1.85	3.11	2.48
2000-01	2.66	2.76	2.72	1.98	1.75	1.87	3.05	2.64
2001-02#	2.11	2.40	2.29	2.08	1.12	1.45	3.00	2.19
2002-03	2.11	2.33	2.25	2.04	1.95	1.99	2.78	2.24
2003-04	2.21	2.21	2.21	1.99	2.04	2.02	2.75	2.21
2004-05	2.14	2.06	2.09	2.02	2.03	2.03	2.88	2.13
2005-06	2.28	1.93	2.05	2.11	2.11	2.11	2.94	2.13
2006-07	1.98	1.67	1.77	1.88	2.11	2.06	2.78	1.91
2007-08	1.68	1.53	1.58	1.66	2.28	2.16	2.84	1.82
2008-09	1.57	1.46	1.50	1.70	2.24	2.12	2.75	1.73

* : First published balance sheet data of new private sector banks were available from the year ended March 1996.
\# : The sharp decline in the operating cost to total assets ratio of public sector banks in 2001-02 was on account of launch of voluntary retirement schemes by State Bank of India and nationalised banks during 2000-01.
Source: Upto 2006-07 from "Reports on Currency and Finance 2003-08 Vol - V" RBI , and the last two years computed from Statistical Tables Relating to Banks in India (RBI).

In case of foreign banks, labour costs have increased as they have been attracting the best talents in the industry with lucrative salaries and perks. They have also invested a good amount of resources on training and human resource management strategies to retain their workforce.

A comparison of cost to asset ratio across the bank groups shows that during 2008-09, the cost to asset ratio was the lowest for nationalised banks, followed by State Bank group, old private banks, and new private sector banks. It was the highest for foreign banks. The high ratio in respect of foreign banks could be somewhat misleading because of off-balance sheet exposures, which constitute a sizeable proportion of their total business. Although such business entails cost, it is not captured in the assets as a result of which the operating cost to asset ratio is inflated.

4.1.2 Cost to Income Ratio

This ratio is calculated by dividing the operating expenses by the total income generated i.e.net interest income plus the other income. The lower the ratio, the better it is for a bank as it would help prop up its profit and return ratios. In other words, it shows how profitably the funds have been deployed by the banks. It captures the impact of off-balance sheet operations and is, thus, a better measure of efficiency than the cost to assets ratio. For the industry as a whole, the cost to income ratio declined gradually from a peak level of 71.89 per cent in 1992-93 to 44.68 per cent in 2008-09 (Table 4.2). However, trends have varied across the bank groups. While the ratio moved up in the case of foreign and new private sector banks, it gradually declined for all other bank groups till 2006-07 after which it has declining trend for all groups.

As a result, the gap in the ratio amongst different bank groups narrowed down over the years. During 2008-09, the cost per unit of income continues to be the least in the case of foreign banks, implying this group is most efficient in the industry, followed by nationalised and old private sector banks. In terms of this ratio, State Bank and new private sector bank groups are the least efficient.

Table 4.2: Cost to Income Ratio of Commercial Banks in India								
	Domestic Banks							All Commercial Banks
	Public Sector Banks			Private Banks				
Year	State Bank Group	Nationalised Banks	All public Sector banks	Old Private Banks	New Private Banks	All Private Banks	Foreign Banks	
1	2	3	4	5	6	7	9	10
1991-92	47.44	67.51	58.41	58.96	*	58.96	30.91	55.3
1992-93	59.19	86.35	73.72	66.75	*	66.75	59.15	71.89
1993-94	64.84	79.09	73.08	57.33	*	57.33	41.22	68.1
1994-95	60.43	72.65	67.57	52.21	*	52.21	40.34	63.51
1995-96	59.53	71.98	66.66	54.39	39.42	51.53	45.36	63.25
1996-97	57.37	69.33	64.31	56.2	38.34	51.31	45.54	61
1997-98	56.85	66.61	62.72	53.8	37.21	48.47	43.04	58.88
1998-99	62.41	68.29	65.94	65.13	48.69	58.96	56.61	64.26
1999-2000	58.64	66.25	63.23	54.22	40.22	48.62	48.35	59.86
2000-01	65.15	68.22	67.01	53.15	50.13	51.75	49.9	63.37
2001-02#	52.11	56.65	54.93	43.47	47.95	45.61	48.76	53.01
2002-03	48.16	49.97	49.3	43.36	46.08	45.05	46.35	48.34
2003-04	45.76	45.03	45.3	43.51	49.22	47.13	42.92	45.38
2004-05	46.74	50.16	48.87	55.76	51.81	53.03	49.13	49.56
2005-06	51.19	52.69	52.11	58.69	53.97	55.19	46.79	52.11
2006-07	52.8	49.36	50.58	50.72	52.59	52.17	44.64	50.15
2007-08	49.35	47.45	48.12	47.31	52.14	51.31	42.43	48.04
2008-09	46.18	45.05	45.45	45.08	47.91	47.37	37.96	44.68

* : First published balance sheet data of new private sector banks were available from the year ended March 1996.
\# : The sharp decline in the operating cost to total assets ratio of public sector banks in 2001-02 was on account of launch of voluntary retirement schemes by State Bank of India and nationalised banks during 2000-01.
Source: Upto 2006-07 from "Reports on Currency and Finance 2003-08 Vol - V" RBI , and the last two years computed from Statistical Tables Relating to Banks in India (RBI).

As per the international best practice norm, banks should strive to achieve cost-income ratio of 40 per cent (Ghosh, C.R. et al., 2004). Therefore, India, with the cost to income ratio of 44.68 per cent, is not much worse but still needs to achieve international competitiveness and meet the best practice norm in rendering banking services.

Further to find out the relative importance received by labour / technology in the different banking systems, operating costs can be disaggregated into labour and non-labour operating costs. With increased integration of financial services and markets across the world, greater reliance on technology solutions has increased to achieve greater competitiveness and speed in providing financial services. It is expected that the non-labour operating costs would account for greater share than the labour costs.

4.1.3 Labour Cost per Unit of Earning Assets

Labour cost plays an important role in determining the profitability of banks as by the very nature banking industry is very much human capital intensive. Though in recent years reliance on technology solutions for improving productivity has increased, but still labour cost plays an important role in profit of banks. Therefore, at a disaggregated level of operating costs, labour cost (expenditure on salaries) per unit of earning assets (includes loans and advances, investments of all types, interest earning deposits with banks/ others and market lending to banks) assumes importance among the components of operating costs. The labour cost per unit of earning asset declined by more than one half for the industry as a whole from 2.30 per cent in 1991-92 to 1.03 per cent in 2009-09.

This has been mainly on account of decline in labour cost per unit of public sector banks and old private sector banks; the unit cost of new private sector banks and foreign banks increased (Table 4.3). The decline in the case of public sector banks has been largely on account of vigorous implementation of voluntary retirement scheme in 2000-02

The labour cost for new private sector banks during 2008-09 has been the lowest among all bank groups, as they apart from outsourcing most of the routine marketing jobs, essentially also rely more on technology for routine work than labour force. This is followed by Public Sector group and then Old Private banks group and SBI and its associate as there is very marginal difference. On the other hand, the labour cost of foreign banks, which was the lowest in the banking sector in 1991-92 at 1.08 per cent, increased to 1.65 per cent in 2008-09 mainly on account of much higher emoluments paid by them than industry norms. Foreign banks, which accounted for only 0.38 per cent of branch network and 1.45 per cent of staff strength of all commercial banks in 1991-92, accounted for 3.14 per cent of total expenditure on salaries among the commercial banks. The salary expenditure of foreign banks accounted for 8.52 per cent of total salary expenditure of all commercial banks, for only 3.11 per cent of total bank staff strength and 0.47 per cent of branch network in 2006-07.

4.1.3.1 Non-Labour Cost

Non-labour cost (Non-Labour Cost = Total Operating Cost − Labour Cost) per unit of earning assets increased for all bank groups in the early period of reforms (Table 4.4) However, from the mid-1990s, non-labour cost declined for all bank groups, barring foreign and new private sector banks. This is because of the increased emphasis on technological solutions for quicker processing of data and routine tasks, and for providing more "customer friendly" services, the non-labour costs of banks, in absolute terms, have been on the rise. Nonetheless, enhanced spending on technology intensive inputs is expected to enhance productivity and efficiency in the long-run with relatively faster expansion of earning assets compared to the non-labour costs. Non-labour costs of new private sector banks and foreign banks have been significantly higher than those of public sector banks and old private sector banks. One of the major reasons for high non-labour

cost of foreign bank group has been large off-balance sheet exposures, which are not captured in the denominator (total assets), while costs of conducting such business are reflected in the numerator (non-labour costs).

Table 4.3: Labour Cost per Unit of Earning Assets of Commercial Banks in India(per cent)								
	Domestic Banks							
	Public Sector Banks			Private Banks				
Year	State Bank Group	Nationalised Banks	All public Sector banks	Old Private Banks	New Private Banks	All Private Banks	Foreign Banks	All Banks
1	2	3	4	5	6	7	9	10
1991-92	2.41	2.34	2.36	2.86	*	2.86	1.08	2.3
1992-93	2.51	2.4	2.44	2.59	*	2.59	0.96	2.34
1993-94	2.51	2.38	2.43	2.22	*	2.22	1.1	2.31
1994-95	2.86	2.48	2.61	2.05	*	2.05	1.23	2.48
1995-96	3.22	2.89	3.01	2.29	0.37	1.91	1.37	2.8
1996-97	3.01	2.73	2.83	1.96	0.36	1.56	1.45	2.6
1997-98	2.75	2.51	2.59	1.81	0.38	1.38	1.31	2.37
1998-99	2.7	2.52	2.58	1.83	0.39	1.3	1.37	2.35
1999-2000	2.37	2.4	2.39	1.77	0.36	1.17	1.31	2.15
2000-01	2.55	2.62	2.59	1.53	0.4	0.99	1.24	2.28
2001-02#	1.93	2.11	2.04	1.54	0.47	0.93	1.33	1.83
2002-03	1.8	1.91	1.87	1.45	0.52	0.86	1.1	1.65
2003-04	1.78	1.8	1.79	1.35	0.56	0.84	1.17	1.58
2004-05	1.66	1.62	1.63	1.3	0.58	0.81	1.15	1.46
2005-06	1.79	1.46	1.57	1.38	0.62	0.83	1.34	1.4
2006-07	1.51	1.23	1.32	1.26	0.71	0.84	1.56	1.23
2007-08	1.2	1.03	1.09	1.09	0.84	0.66	1.61	1.03
2008-09	1.12	0.98	1.03	1.11	0.93	0.81	1.65	1.03
*: First published balance sheet data of new private sector banks was available from the year ended March 1996. Source: Upto 2006-07 "Reports on Currency and Finance 2003-08, Vol - V" RBI, and the last two years computed from Statistical Tables Relating to Banks in India (RBI).								

Moreover higher non-labour cost in the case of foreign and new private bank groups is also on account of expenditure incurred on branch expansion, technological up-gradation and infrastructure creation, which is expected to enhance their efficiency and productive

capacity in the long run. The non-labour cost for the industry has declined from 1.12 per cent in 1991-92 to 0.95 per cent in 2008-09, but it is very diverse in case of group wise. As in case of foreign banks, still it is highest with 2.51 per cent in 2008-09 which has increased from 2.18 per cent 1991-92. Whereas, it has declined for all other groups, for the Nationalised banks it has declined to 0.65 per cent in 2008-09 which is lowest from 1.05 per cent in 1991-92. State bank group is the second lowest in 2008-09 with 0.71 per cent followed by Old private banks.

Table 4.4: Non-Labour Costs per Unit of Earning Assets of Commercial Banks in India (Per cent)								
	Domestic Banks							All Commercial Banks
	Public Sector Banks			Private Banks				
Year	State Bank Group	Nationalised Banks	All public Sector banks	Old Private Banks	New Private Banks	All Private Banks	Foreign Banks	
1	2	3	4	5	6	7	9	10
1991-92	1.02	1.05	1.04	1.17	*	1.17	2.18	1.12
1992-93	0.98	1.05	1.03	1.1	*	1.1	2.89	1.17
1993-94	1.23	1.12	1.16	1.11	*	1.11	2.36	1.25
1994-95	1.09	1.21	1.17	1.05	*	1.05	2.53	1.26
1995-96	1.09	1.07	1.08	1.21	2.1	1.38	2.53	1.22
1996-97	1.14	1.03	1.07	1.25	2.12	1.47	2.67	1.24
1997-98	0.92	0.97	0.95	1.19	1.92	1.41	2.77	1.14
1998-99	1.09	0.91	0.98	1.07	1.88	1.36	3.27	1.2
1999-2000	0.94	0.86	0.89	1.01	1.48	1.21	2.63	1.06
2000-01	0.94	0.83	0.87	0.94	1.81	1.36	2.69	1.07
2001-02#	0.78	0.79	0.79	0.99	1.47	1.26	2.68	0.99
2002-03	0.73	0.79	0.77	0.95	1.88	1.54	2.38	1
2003-04	0.8	0.78	0.79	0.98	1.9	1.58	2.5	1.04
2004-05	0.8	0.75	0.77	1.09	1.83	1.58	2.58	1.02
2005-06	0.85	0.77	0.8	1.08	1.82	1.61	2.57	1.08
2006-07	0.79	0.7	0.73	0.96	1.8	1.6	2.36	1.03
2007-08	0.78	0.67	0.71	0.86	1.86	1.26	2.37	0.95
2008-09	0.71	0.65	0.67	0.85	1.69	1.49	2.51	0.95

*: First published balance sheet data of new private sector banks was available from the year ended March 1996.
Source: Upto 2006-07 from "Reports on Currency and Finance 2003-08 Vol - V" RBI, and the last two years computed from Statistical Tables Relating to Banks in India (RBI).

4.1.4 Intermediation Cost

An indicator of competitiveness in banking industry is the intermediation cost. But there is no one definition of intermediation cost. Although some researchers have used the difference between the lending and deposit rates as the definition of intermediation, RBI uses operating expenses as a proportion of total assets. The most commonly used definition of intermediation cost is the spread between cost of deposits and return on loan assets. It reflects the efficiency with which financial resources are intermediated by the banks from savers to investors. The intermediation costs are expected to decline with the increase in productivity/efficiency of the banking system, as more efficient financial systems are expected to facilitate easier fund mobility at lower transaction costs.

After financial sector reforms, the cost of intermediation has gradually declined in Indian banking industry. The intermediation cost at the industry level declined from 6.24 per cent during 1991-92 to 2.87 per cent in 2008-09 (Table 4.5). The decline in the intermediation cost is in sync with the decline in the cost to income ratio. The decline was noticed across all banks groups, reflecting increased competitive pressures.

During 2008-09, State bank group has the lowest intermediation cost with 1.82 per cent followed by Nationalised banks with 3.36 per cent. On the other hand, foreign banks seem to lead with highest intermediation cost of 4.35 per cent followed by New private banks with 3.96 per cent. High intermediation cost in the case of foreign banks has been partly due to their ability to raise low cost deposits. Intermediation cost in the Indian context, however, needs to be interpreted with caution. This is because a significant part of the resources mobilized is required to be deployed in the statutory reserve requirements in the form of CRR and SLR on which banks, in the past, earned lower than the market returns. This necessitated cross-subsidization by banks, resulting in a large wedge in the intermediation cost. The extent to which such resources are pre-empted has come down

significantly and banks also fetch market related interest rates on their investment in Government securities. So researchers argue that still in Indian context cross-subsidization cannot be ruled out and intermediation cost is more closely captured by Net Interest Margin.

Table 4.5: Intermediation Costs of Commercial Banks in India (per cent)								
	Domestic Banks						Forei gn Banks	All Commerci al Banks
	Public Sector Banks			Private Banks				
Year	State Bank Group	Nationali sed Banks	All public Sector banks	Old Private Banks	New Private Banks	All Private Banks		
1	2	3	4	5	6	7	9	10
1991-92	5.92	5.66	5.77	6.13	*	6.13	13.28	6.24
1992-93	4.05	4.26	4.22	5.54	*	5.54	12.81	4.82
1993-94	4.85	4.84	4.85	5.78	*	5.78	9.25	5.22
1994-95	3.54	4.17	3.95	5.06	*	5.06	7.3	4.27
1995-96	4.69	5.58	5.26	5.7	4	5.31	7.03	5.43
1996-97	5.83	6.18	6.06	6.19	7.93	6.62	7.45	6.28
1997-98	3.68	4.58	4.26	5	5.59	5.17	6.89	4.61
1998-99	3.49	4.23	3.96	3.86	4.36	4.03	6.32	4.19
1999-2000	2.69	3.88	3.45	3.71	3.57	3.68	4.88	3.59
2000-01	3.09	3.86	3.58	3.44	3.48	3.48	5.81	3.74
2001-02#	2.15	3.14	2.79	3.24	4.83	4.15	5.12	3.12
2002-03	1.79	3.33	2.78	3.06	4.77	4.07	5.22	3.17
2003-04	1.82	3.36	2.82	3.43	4.69	4.18	4.72	3.18
2004-05	2.04	2.86	2.58	3.33	3.96	3.68	4.35	2.87
2005-06	2.2	3.07	2.78	3.38	3.71	3.58	4.79	3.05
2006-07	2.97	3.32	3.2	3.63	3.61	3.61	5.5	3.43
2007-08	1.82	3.36	2.82	3.43	4.69	4.18	4.72	3.18
2008-09	2.04	2.86	2.58	3.33	3.96	3.68	4.35	2.87
*: First published balance sheet data of new private sector banks were available from the year ended March 1996. # : Figures have been adjusted for bank merger. Source: Upto 2006-07 from "Reports on Currency and Finance 2003-08 Vol - V" RBI and the last two years computed from Statistical Tables Relating to Banks in India (RBI).								

4.1.5 Net Interest Margin (NIM) or Spread

NIM is the difference between the interest income generated (loans etc) by banks and the interest paid out (for deposits etc), relative to the amount of their assets. In other words Net interest margin is defined as the difference between the total interest earned (including such items as investments) and total interest expended (including on such items as inter-bank borrowings), normalized by assets. This ratio indicates as to how effectively the banks deploy all their funds (both deposit and borrowings) to generate income from credit and investment operations. Lower the ratio, more efficient is the banking system. On the other hand, the higher ratio shows higher financial strength of the bank. Any decline in the ration may be adduced to large non-performing assets or bank is not strategically placed to take advantage of the movements in market interest rates.[2]

Historically, Indian banks had high NIM due mainly to lack of enough competition. After the initiation of reforms, which in turn increased the competitive pressures in the industry, a downward pressure on the spreads has been noticed. The NIM for the industry, which was 3.30 per cent in 1991-92 declined to 2.57 per cent in 2001-02. From 2002-03 onwards, with a pick-up in economic activity and unprecedented credit growth, NIM exhibited upward movement and reached to 2.87 per cent by 2003-04, and again it declined to 2.47 per cent in 2008-09. (Table 4.6)

Bank group-wise data reveal that in 1991-92, State bank group was in the second position after Old private sector banks in respect of Net Interest Margin. Foreign banks followed the sequence and with 3.90 per cent stood in the third position. While the NIM of foreign banks over the years declined only marginally, that of State bank group and Old private sector banks declined significantly. Trends in the case of new private sector banks

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[2] Analysis of Balance Sheets of Banks, Department of Banking Operations and Developments, RBI

showed large variations. The ratio which declined almost consistently between 1995-96 and 2001-02, increased significantly thereafter. During 2008-09 State bank group is at the lowest with 2.14 per cent followed by Nationalised banks with 2.26 per cent. Whereas, Foreign banks had the highest NIM, which was 3.91 per cent in the same period followed by New private banks with 2.79 per cent. Higher NIM in the case of foreign banks was on account of their large proportion of current accounts that enabled these banks to raise low cost deposits.

Table 4.6: Ratio of NIM to Total Assets of Commercial Banks in India (per cent)								
	Domestic Banks						Foreign Banks	All Commercial Banks
	Public Sector Banks			Private Banks				
Year	State Bank Group	Nationalised Banks	All public Sector banks	Old Private Banks	New Private Banks	All Private Banks		
1	2	3	4	5	6	7	9	10
1991-92	3.8	2.86	3.22	4.01	*	4.01	3.9	3.3
1992-93	3.01	2.02	2.39	2.92	*	2.92	3.57	2.51
1993-94	2.68	2.17	2.36	3.01	*	3.01	4.2	2.54
1994-95	3.27	2.73	2.92	3.07	*	3.07	4.27	3.03
1995-96	3.34	2.95	3.1	3.17	2.85	3.1	3.75	3.15
1996-97	3.48	2.97	3.16	2.96	2.94	2.95	4.13	3.22
1997-98	3.14	2.78	2.91	2.56	2.25	2.46	3.98	2.95
1998-99	2.85	2.78	2.81	2.17	2.01	2.11	3.52	2.79
1999-2000	2.76	2.67	2.7	2.33	1.87	2.13	3.85	2.72
2000-01	2.76	2.9	2.84	2.51	2.14	2.33	3.64	2.84
2001-02#	2.71	2.74	2.73	2.4	1.18	1.58	3.25	2.57
2002-03	2.77	2.99	2.91	2.46	1.68	1.96	3.36	2.77
2003-04	2.83	3.06	2.98	2.56	2.03	2.21	3.57	2.87
2004-05	3.06	2.82	2.91	2.65	2.18	2.34	3.34	2.83
2005-06	3.07	2.73	2.85	2.72	2.28	2.4	3.58	2.81
2006-07	2.79	2.58	2.65	2.74	2.36	2.45	3.74	2.69
2007-08	2.24	2.21	2.22	2.39	2.39	2.39	3.79	2.4
2008-09	2.14	2.26	2.22	2.57	2.79	2.74	3.91	2.47
*: First published balance sheet data of new private sector banks were available from the year ended March 1996.								
# : Figures have been adjusted for bank merger.								
Source: Upto 2006-07 from "Reports on Currency and Finance 2003-08 Vol - V" RBI and last two years computed from Statistical Tables Relating to Banks in India (RBI).								

The international experience shows that in a deregulated and competitive environment, net interest margin tends to decline. This is because as competition increases, competing banks offer comparatively higher rates of interest on deposits to attract funds, while at the same time, they tend to charge lower interest rates on loans so as to expand their business. The squeeze in margins in recent years could also be attributed to the flattening of the yield curve. The international experience shows that contracting yield spread may contribute to the lowering of net interest margins, particularly in economies where interest rate derivatives are not well developed and there are limited opportunities to earn non-interest income.

4.1.6 Other Operating Income to Total Income

The growing importance of other sources of income such as off-balance sheet exposures and non-traditional sources of income such as fees and commission has been captured by the ratio of other operating income (non-interest income) to total income which cannot be classified as an accounting measure per se. The ratio is an indicator of diversification of operations of banks.

The ratio of all bank groups, barring foreign banks, has undergone four different phases (Table 4.7). In the first phase between 1991-92 and 1995-96, non- interest sources of income increased sharply due mainly to buoyant primary capital market as banks were able to earn sizeable income from merchant banking activities. In the second phase from 1996-97 to 2000-01, rise in non-interest income got stalled mainly due to the decline of fee and commission based income due to the depressed capital market. In the third phase from 2001-02 and 2003-04, the non-interest income to income ratio rose sharply when banks offloaded high interest yielding government securities and earned large trading profits. In the fourth phase from 2004-05 to 2006- 07, however, the ratio of other

operating income to total income declined as some banks incurred trading losses on Government securities due to hardening of interest rates. Non-interest income to total income ratio of foreign banks, however, showed relatively less fluctuations.

During the period of 2008-09, maintaining the previous trend Foreign banks were at the top with 32.94 per cent followed by New private banks with 18.53 per cent. While with 12.55 per cent Nationalised banks were at the lowest position which was less than State bank group with 15.27 per cent. For the whole industry it has almost consistently increased from 11.82 per cent in 1991-92 to 16.22 per cent in 2008-09. The share of other income in total income has been significantly higher for both new private sector banks and foreign banks than public sector banks and old private sector banks. This was mainly on account of large size of off-balance sheet exposure of foreign and new private sector banks as compared with public and old private banks.

4.1.7   Business Per Employee

All the ratios used above so far assessed the performance in terms of cost or return as a proportion to total earning assets. But one of the most important factors in the productivity and efficiency of banking industry is labour productivity. To understand the trend in labour productivity devoid of the influence of various other aspects such as pricing of services rendered by the bank could be undertaken by using ratios such as business per employee and business per branch. The business (deposits plus credit) per employee of commercial banks in India has been consistently increasing since 1991-92. It has increased from Rs.46.66 lakh in 1991-92 to Rs.753.44 lakh in 2008-09 (Table 4.8). The rise in business per employee was observed across all the bank groups. The growth in business per employee was more pronounced for public sector banks and old private sector banks compared with other bank groups, due to their very low base during the early

1990s. However, despite this increase, productivity of these bank groups was still less than half of that enjoyed by foreign and new private sector banks.

Table 4.7: Share of Other Income to Total Income of Commercial Banks in India(Per cent)								
	Domestic Banks							
	Public Sector Banks			Private Banks				
Year	State Bank Group	National ised Banks	All public Sector banks	Old Private Banks	New Private Banks	All Private Banks	Foreign Banks	All Commer cial Banks
1	2	3	4	5	6	7	9	10
1991-92	12.31	9.73	10.74	9.62	*	9.62	22.72	11.82
1992-93	12.87	9.88	11.04	10.76	*	10.76	7.86	10.73
1993-94	14.44	11.88	12.83	12.88	*	12.88	18.2	13.34
1994-95	15.4	11.17	12.77	13.85	*	13.85	19.89	13.48
1995-96	16.79	10.85	13.13	14.1	16.02	14.46	18.31	13.72
1996-97	14.41	10.54	12.01	12.18	17.01	13.4	18.64	12.79
1997-98	14.72	11.6	12.75	14.66	21.09	16.59	21.98	14.08
1998-99	14.39	10.44	11.91	11.04	14.43	12.25	19.35	12.67
1999-2000	14.19	11.62	12.59	14.95	18.09	16.15	20.72	13.75
2000-01	13.6	11.16	12.09	11.43	14.13	12.65	20.93	12.96
2001-02#	13.44	14.5	14.1	20.29	20.75	20.51	25.2	15.93
2002-03	16.37	16.68	16.56	20.93	23.96	22.88	25.43	18.34
2003-04	21.05	19.97	20.38	21.01	23.94	22.88	29.76	21.49
2004-05	17.71	16.17	16.74	12.39	23.11	19.51	29.65	18.1
2005-06	16.19	12.26	13.71	11.25	21.6	18.68	30.41	16.02
2006-07	12.16	10.47	11.04	12.1	19.58	17.86	27.8	14.09
2007-08	14.37	12.82	13.34	13	20.82	19.33	30.25	16.37
2008-09	15.27	12.55	13.46	12.9	18.53	17.35	32.94	16.22
*: First published balance sheet data of new private sector banks were available from the year ended March 1996. # : In 2003-04, non-interest income to total income ratio rose sharply when banks offloaded high interest yielding government securities and earned large trading profits. Source: Upto 2006-07 from "Reports on Currency and Finance 2003-08 Vol - V" RBI and the last two years computed from Statistical Tables Relating to Banks in India (RBI).								

The business per employee of new private banks from the very beginning was significantly higher than that of other bank groups and they maintained their lead position until 2001-02, in the next period when the business per employee of foreign banks

exceeded that of new private sector banks. During 2008-09, business per employee was the highest for foreign banks, followed by new private sector banks, nationalized banks, state bank group and old private sector banks.

Higher economic growth rate and higher gross domestic savings coupled with lower penetration of other saving products resulted in rise in deposits and credit. Public sector banks benefited from the rationalization of workforce through VRS undertaken during the early 2000s and introduction of practices whereby some routine jobs were outsourced. Banks focussed on generation of banking services through human capital intensive processes in line with improved technologies rather than manpower intensive banking. More importantly expansion in business per employee of public sector banks and old private banks is the result of highly competitive environment that resulted because of the entry of new private sector banks which also introduced aggressive marketing strategies and hybrid products. This intense competition led to expansion in banking products, penetration of banking into unbanked areas, expansion of business through aggressive marketing strategies ably supported by technology such as core banking solutions. The rise was also discernable in the case of foreign banks, but not as sharp as that of public sector banks. The growth in business per employee of both the new private sector and foreign banks and of public sector banks continued to rise.

4.1.8 Business per Branch

Similar to the ratio of business per employee, business per branch is one of the measures to capture the productivity of labour. It has also risen steadily as business per employ for the banking industry and for all bank groups since the early 1990s. This may be attributed

Table 4.8: Business per Employee of Commercial Banks in India(Rs in Lakh)								
	Domestic Banks						Foreign Banks	All Commercial Banks
	Public Sector Banks			Private Banks				
Year	State Bank Group	National ised Banks	All public Sector banks	Old Private Banks	New Private Banks	All Private Banks	Foreign Banks	All Commerci al Banks
1	2	3	4	5	6	7	9	10
1991-92	42.99	46.37	45.15	33.48	*	33.48	199.47	46.66
1992-93	47.28	48.24	47.91	43.49	*	43.49	233.66	50.32
1993-94	49.65	41.69	44.1	55.26	*	55.26	287.39	47.57
1994-95	56.58	60.1	58.87	73.68	*	73.68	326.96	63.4
1995-96	65.65	67.52	66.86	83.39	734.57	99.74	393.63	73.42
1996-97	72.51	76.86	75.3	102.24	794.18	129.76	448.24	84.09
1997-98	84.43	91.91	89.2	124.12	908.73	165.91	480.99	100.04
1998-99	102.45	107.67	105.78	138.78	793.78	193.95	504.81	117.72
1999-2000	122.11	126.18	124.71	169.53	976.01	255.23	627	140.92
2000-01	158.83	160.18	159.69	196.62	758.99	296.39	720.19	179.43
2001-02#	181.54	197.59	191.57	218.1	651.21	333.86	773.4	213.97
2002-03	205.09	221.05	215.09	266.19	834.88	445.68	909.68	247.02
2003-04	232.9	255.74	247.22	316.86	898.08	527.85	952.5	286.9
2004-05	284.04	318.92	305.96	362.03	870.97	578.65	966.11	348.27
2005-06	337.79	383.07	366.61	419.53	904.3	670.67	955.41	419.77
2006-07	435.52	490.21	470.99	486.02	818.02	694.07	995.09	521.94
2007-08	549.22	618.28	594.24	569.32	831.96	751.42	1125.5	640.18
2008-09	650.22	783.16	734.35	638.43	787.15	743.85	1282.74	753.44

*: First published balance sheet data of new private sector banks were available from the year ended March 1996.

#: Figures have been adjusted for bank merger.

Source: Upto 2006-07 from "Reports on Currency and Finance 2003-08 Vol - V" RBI and the last two years computed from Statistical Tables Relating to Banks in India (RBI).

to expansion of new business, rationalization of branches by some banks, and evolution of new business strategies like sharing of ATMs so as to economize on cost and capitalize on technology. Business per branch in the case of public sector banks was not increased as sharp as in the case of business per employee, the rise in which, to an extent, was also due to voluntary retirement schemes introduced by public sector banks. Business per branch of foreign and new private sector banks, which was already high, grew faster than

that of public sector and old private sector banks. This accentuated the gaps in the relative

productivity levels across the various bank groups, measured by business per branch.

Table 4.9: Business per Branch of Commercial Banks in India(Rupees in crore)								
	Domestic Banks							
	Public Sector Banks			Private Banks				All Commercial Banks
Year	State Bank Group	Nationalised Banks	All public Sector banks	Old Private Banks	New Private Banks	All Private Banks	Foreign Banks	
1	2	3	4	5	6	7	9	10
1991-92	10.53	8.27	8.93	4.87	*	4.87	149.96	9.12
1992-93	11.52	9.03	9.76	6.01	*	6.01	179.39	10.08
1993-94	12.09	9.72	10.42	7.46	*	7.46	208.37	10.92
1994-95	13.84	11.34	12.08	9.86	*	9.86	160.22	12.72
1995-96	16.15	12.89	13.86	11.44	35.85	13.09	278.06	14.84
1996-97	17.91	14.29	15.36	13.86	45.57	16.69	312.23	16.72
1997-98	20.85	16.72	17.94	16.62	55	20.87	334.71	19.59
1998-99	24.92	19.23	20.9	19.04	66.34	25.24	349.04	22.75
1999-2000	29.03	22.12	24.15	22.35	95.61	32.46	389.2	26.58
2000-01	34.64	25.32	28.06	25.96	111.12	39.82	423.81	31.13
2001-02#	38.47	28.93	31.73	27.35	133.27	46.71	461.81	35.32
2002-03	43.08	32.05	35.27	33.88	182.42	65.33	672.42	40.56
2003-04	48.23	36.45	39.87	38.79	201.82	77.41	712.28	46.45
2004-05	58.05	44.53	48.42	43.11	220.23	88.92	759.19	55.81
2005-06	64.39	50.94	54.78	45.87	271.19	109.31	803.45	64.74
2006-07	77.14	62.78	66.83	52.31	293.96	133.16	1004.1	79.39
2007-08	86.29	73.46	77.15	59.12	252.04	143.35	1271.82	91
2008-09	103.38	88.52	92.86	66.78	227.08	141.94	1286.31	104.82
*: First published balance sheet data of new private sector banks were available from the year ended March 1996. # : Figures have been adjusted for bank merger. Source: Upto 2006-07 from "Reports on Currency and Finance 2003-08 Vol - V" RBI and the last two years computed from Statistical Tables Relating to Banks in India (RBI).								

During the period of 2008-09, the business per branch of foreign banks was 5 times more

than that of new private sector banks and more than 12 times that of the state bank group

and nationalized banks (Table 4.9). Presence of large proportion of rural branches where

the size of transaction is small in the case of public sector banks is one the cause for the

relatively low business per branch. On the other hand, foreign and new domestic private sector banks operate largely in urban areas which have high net worth individuals and premium corporate.

4.1.9 Return on Assets

The Return on Assets (RoA) is the ratio of the net profit to the total assets of a bank. In general it gives an indication as to how much profit a business unit (bank in this case) is able to generate per unit of its assets.

Table 4.10: Return on Assets of Commercial Banks in India (per cent)								
	Domestic Banks						Foreign Banks	All Commercial Banks
	Public Sector Banks			Private Banks				
Year	State Bank Group	Nationalised Banks	All public Sector banks	Old Private Banks	New Private Banks	All Private Banks		
1	2	3	4	5	6	7	9	10
1991-92	0.21	0.33	0.28	0.57	*	0.57	1.56	0.39
1992-93	0.22	-1.71	-0.99	0.34	*	0.34	-2.7	-1.07
1993-94	0.25	-1.98	-1.15	0.58	*	0.58	1.72	-0.84
1994-95	0.54	0.1	0.25	1.16	*	1.16	1.87	0.43
1995-96	0.42	-0.36	-0.07	1.03	1.89	1.2	1.59	0.15
1996-97	0.82	0.41	0.56	0.93	1.84	1.15	1.2	0.66
1997-98	1.04	0.62	0.77	0.8	1.6	1.04	0.97	0.81
1998-99	0.51	0.37	0.42	0.46	1.05	0.67	1.01	0.5
1999-2000	0.8	0.44	0.57	0.84	0.97	0.9	1.24	0.66
2000-01	0.55	0.33	0.42	0.62	0.81	0.71	1	0.5
2001-02#	0.77	0.69	0.72	1.08	0.44	0.66	1.35	0.76
2002-03	0.91	0.98	0.96	1.17	0.88	0.99	1.59	1
2003-04	1.02	1.19	1.12	1.16	0.84	0.95	1.64	1.13
2004-05	0.91	0.85	0.87	0.19	1.13	0.83	1.29	0.89
2005-06	0.86	0.8	0.82	0.54	1	0.87	1.54	0.88
2006-07	0.82	0.83	0.83	0.69	0.92	0.87	1.65	0.9
2007-08	0.97	1.01	1	1.14	1.13	1.13	2.09	1.12
2008-09	1.02	1.03	1.02	1.15	1.12	1.13	1.99	1.13
*: First published balance sheet data of new private sector banks were available from the year ended March 1996. Source: Upto 2006-07 from "Reports on Currency and Finance 2003-08 Vol - V" RBI and the last two years computed from Statistical Tables Relating to Banks in India (RBI).								

Higher value of this ratio is indicative of higher profitability, and hence, productivity. As per Basel –II norms, the ROA should be more than one per cent (Ghosh, C.R. et al; 2004)

Increased competition in the banking system in India enhanced the return on assets significantly from 0.39 per cent in 1991-92 to 1.13 per cent in 2003-04, with some fluctuations, again reached 1.13 per cent in 2008-09 (Table 4.10). The significant improvement in the profitability ratio is all the more significant as the intermediation cost of the bank declined during the same period.

Amongst the bank groups, the ratio improved significantly for the state bank group and nationalised banks. The ratio for nationalised banks had turned negative in the initial years of reforms, following the application of prudential norms, which revealed large NPAs and required huge provisioning by banks, resulting in net losses by some banks. In 1992-93, 13 banks reported net losses as against 3 in 1991-92. The RoA of all banks fluctuated widely during the 1990s. The RoA of public sector banks increased significantly during 1997-98 due to rise in net profit to total assets because of lower provisions on account of decline in NPAs. On the other hand, the ratio for new private banks declined during the year due to higher provisions on account of 'mark to market' losses on their investment portfolios. However, the RoA of old private sector banks declined sharply during the last three years of the 1990s. Overall, it may be observed that the RoA of public sector banks and private sector banks has almost converged, while that of foreign banks continues to be high, reflecting to a large extent profits generated from off-balance sheet business.

During 2008-09 the foreign bank group was at the top with 1.99 per cent followed by the old private banks. There is not much difference between the RoA of the old private banks aad new private sector banks. In case of the two groups of public sector banks i.e. SBI

bank group and nationalized banks also the ROAs have almost been the same during 2008-09.

4.1.10 Return on Equity

Return on Equity (RoE) is one of the most important for judging financial performance of banks. Even, in respect of public sector banks, the government as a shareholder expects adequate return on its investments and also looks forward to significant capital appreciation. The return on equity, defined as the ratio of net profits after tax to total equity capital, is, therefore, used as an alternative measure of profitability. However, there is a disadvantage of this measure as equity may vary significantly across the banks, even though their asset size may be identical. However, this problem is not encountered for various domestic bank groups as their equity level (as percentage of their risk-weighted assets) is not significantly different. The RoE indicates the amount of profits a business unit is generating for its equity investors. The ratio is widely used by equity investors in their decision making. Higher value of the ratio is indicative of higher profitability, and hence, productivity. At this juncture it may be pertinent to note that the return to asset ratio would impart upward bias to some foreign banks as they are able to generate large profits from off-balance sheet exposures.

The return on equity in the case of Indian banks exhibited almost similar trends as that of RoA. However, unlike RoA, RoE of public sector banks was comparable even with foreign banks. In fact, RoE of public sector banks, new private sector banks and foreign banks converged to around 14-15 per cent in 2006-07, while that of old private sector banks lagged behind somewhat (Table 4.11). The RoE declined drastically during 2000-01 due to fall in net profits in all bank groups except new private sector banks. Decline in case of public sector banks was particularly due to higher wage bills, *inter alia*, on

account of VRS payments during the period. During 2008-09 the SBI bank group was at the top with 16.43 per cent followed by nationalized banks. On the other hand, new private sector banks were at the bottom with 10.29 per cent and foreign bank group was a step ahead with 12.53 per cent.

	Domestic Banks						Foreign Banks	All Commercial Banks
	Public Sector Banks			Private Banks				
Year	State Bank Group	Nationalised Banks	All public Sector banks	Old Private Banks	New Private Banks	All Private Banks		
1	2	3	4	5	6	7	9	10
1991-92	12.72	10.45	11.02	26.77	*	26.77	42.26	14.77
1992-93	12.55	-52.44	-36.41	13.62	*	13.62	-47	-36.1
1993-94	7.44	-33.14	-22.91	19.04	*	19.04	24.44	-16.55
1994-95	15.23	1.31	4.28	29.76	*	29.76	19.73	7.07
1995-96	11.21	-5.46	-1.31	18.09	13.01	16.12	15.23	2.53
1996-97	17.02	6.16	9.37	15.51	19.5	16.88	10.73	10.25
1997-98	20.04	8.93	12.21	13.88	19.15	15.88	8.58	12.07
1998-99	11.1	6.26	7.78	8.41	16.66	11.7	10.96	8.59
1999-2000	17.25	7.98	11.1	15.19	14.23	14.73	12.97	11.83
2000-01	12.77	6.44	8.65	11.49	14.79	13.09	11.53	9.61
2001-02#	17.2	12.98	14.45	18.56	7.19	10.99	14.61	13.81
2002-03	19.5	18.34	18.75	19.56	13.93	15.86	14.15	17.59
2003-04	20.25	21.22	20.88	19.26	13.52	15.46	15.3	19.13
2004-05	17.32	14.55	15.46	3.18	14.66	11.5	10.51	14.02
2005-06	15.82	13.68	14.38	8.13	12.39	11.38	12.62	13.43
2006-07	15.3	14.65	14.86	10.32	13.57	12.81	13.86	14.24
2007-08	14.6	14.91	14.8	12.92	9.92	7.08	13.4	12.34
2008-09	16.43	15.92	16.1	13.78	10.29	9.55	12.53	13.74

Table 4.11: Return on Equity of Commercial Banks in India(per cent)

*: First published balance sheet data of new private sector banks were available from the year ended March 1996.
Source: Upto 2006-07 from "Reports on Currency and Finance 2003-08 Vol - V" RBI and the last two years computed from Statistical Tables Relating to Banks in India (RBI).

4.2 Concluding Remarks

Through the analysis of various accounting measures, we have found that there has been a significant improvement in the efficiency/productivity of the Indian banking sector in the post-reform period. The degree of improvement however, has not been uniform across the bank groups. The performance, especially of public sector banks, worsened in the initial years of reforms and improved thereafter gradually, especially in the beginning of 2001-02. The most significant improvement was observed in intermediation cost, which has declined significantly in the last few years, reflecting the impact of intensifying competitive pressures. Despite this, however, the profitability of banks has improved marginally as reflected in the return on assets. This was achieved due to increasing recourse to non-interest sources of income and efficiently minimizing the operating costs which measured by the non-interest income to total asset ratio and cost to income ratio, respectively. The reduction in statutory pre-emptions in the form of CRR and SLR and reduction in corporate tax rates also played a significant role in improving the profitability. As a result of significant improvement over the years, efficiency/productivity of the Indian banking sector as measured by the various ratios has improved significantly.

The improvement in different efficiency/ productivity measures, however, was different for different bank groups. Between 1991-92 and 2008-09, the largest decline in the NIM was noticed in the case of old private sector banks. However, it was nationalised bank group which showed the largest improvement in the cost to income ratio. The large increase in the business per employee and non-interest sources of income was observed in the case of foreign banks. The public sector banks exhibited the highest degree of improvement in the return on assets and return on equity. During 2008-09, State Banks

Group emerged as the most efficient in terms of intermediation cost (measured by net interest margin), followed by nationalised banks. However, the operating cost to income ratio was the lowest for nationalized banks and the highest for the foreign banks. Business per employee and business per branch of both foreign and new private bank groups were far better compared to those of public sector banks. This may be explained by the fact that public sector banks, unlike foreign and new private bank groups, maintain rural branches where the transaction size is small.

The profitability ratio of foreign bank group during 2008-09 was the highest on account of higher net interest margins combined with higher share of non-interest income. However, the return on equity during 2008-09 was the highest for the nationalised banks, followed by State Bank group (Table 4.12).

Table 4.12: A Snapshot of Productivity Ratios of Commercial Banks in India(per cent)									
		Domestic Banks						Foreign Banks	All Commercial Banks
		Public Sector Banks			Private Banks				
Ratio	Year	State Bank Group	Nationalised Banks	All public Sector banks	Old Private Banks	New Private Banks	All Private Banks		
1	2	3	4	5	6	7	8	10	11
Operating Cost to Assets	1991-92	2.48	2.67	2.6	2.97	*	2.97	2.26	2.59
	1998-99	2.7	2.63	2.65	2.22	1.74	2.04	3.39	2.65
	2008-09	1.57	1.46	1.5	1.7	2.24	2.12	2.75	1.73
Cost to Income Ratio	1991-92	47.44	67.51	58.41	58.96	*	58.96	30.91	55.3
	1998-99	62.41	68.29	65.94	65.13	48.69	58.96	56.61	64.26
	2008-09	46.18	45.05	45.45	45.08	47.91	47.37	37.96	44.68
Labour Cost per Unit of Earning Assets	1991-92	2.41	2.34	2.36	2.86	*	2.86	1.08	2.3
	1998-99	2.7	2.52	2.58	1.83	0.39	1.3	1.37	2.35
	2008-09	1.12	0.98	1.03	1.11	0.93	0.81	1.65	1.03
Non-Labour Cost per Unit of Earning Assets	1991-92	1.02	1.05	1.04	1.17	*	1.17	2.18	1.12
	1998-99	1.09	0.91	0.98	1.07	1.88	1.36	3.27	1.2
	2008-09	0.71	0.65	0.67	0.85	1.69	1.49	2.51	0.95
Intermediation Cost	1991-92	5.92	5.66	5.77	6.13	*	6.13	13.28	6.24
	1998-99	3.49	4.23	3.96	3.86	4.36	4.03	6.32	4.19
	2008-09	1.09	0.91	0.98	1.07	1.88	1.36	3.27	1.2
Net Interest Margin (spread)	1991-92	3.8	2.86	3.22	4.01	*	4.01	3.9	3.3
	1998-99	2.85	2.78	2.81	2.17	2.01	2.11	3.52	2.79
	2008-09	2.14	2.26	2.22	2.57	2.79	2.74	3.91	2.47
Other income (Non-interest) to Total Income	1991-92	12.31	9.73	10.74	9.62	*	9.62	22.72	11.82
	1998-99	14.39	10.44	11.91	11.04	14.43	12.25	19.35	12.67
	2008-09	15.27	12.55	13.46	12.9	18.53	17.35	32.94	16.22
Business per Employee (Rs.Lakh)	1991-92	42.99	46.37	45.15	33.48	*	33.48	199.47	46.66
	1998-99	102.45	107.67	105.78	138.78	793.78	193.95	504.81	117.72
	2008-09	650.22	783.16	734.35	638.43	787.15	743.85	1282.74	753.44
Business per Branch (Rs. Crore)	1991-92	10.53	8.27	8.93	4.87	*	4.87	149.96	9.12
	1998-99	24.92	19.23	20.9	19.04	66.34	25.24	349.04	22.75
	2008-09	103.38	88.52	92.86	66.78	227.08	141.94	1286.31	104.82
Return on Assets	1991-92	0.21	0.33	0.28	0.57	*	0.57	1.56	0.39
	1998-99	0.51	0.37	0.42	0.46	1.05	0.67	1.01	0.5
	2008-09	1.02	1.03	1.02	1.15	1.12	1.13	1.99	1.13
Return on Equity	1991-92	12.72	10.45	11.02	26.77	*	26.77	42.26	14.77
	1998-99	11.1	6.26	7.78	8.41	16.66	11.7	10.96	8.59
	2008-09	16.43	15.92	16.1	13.78	10.29	9.55	12.53	13.74

*:   First published balance sheet data of new private sector banks were available from the year ended March 1996.
Source: Upto 2006-07 from "Reports on Currency and Finance 2003-08 Vol - V" RBI and the last two years computed from Statistical Tables Relating to Banks in India (RBI).

CHAPTER V

TECHNICAL EFFICIENCY OF BANKS IN INDIA: AN EMPIRICAL ASSESSMENT

5.0 Methodology

In the last chapter we have examined efficiency/productivity of banks using accounting measures. Though accounting measures (ratio analysis) are frequently used by managers and regulators to assess the performance of banks, such measures have limitations. The choice of a single ratio as is the usual case, does not provide precise details about various dimensions of the performance of a bank, as banks use multiple inputs to produce multiple outputs. Another limitation is that the measures do not differentiate between efficiency and productivity clearly. These issues may be addressed better through economic measures that capture all aspects of banking operations.

Broadly there are four principal methods to assess efficiency / productivity of banks [(see Coelli. T., Rao.D.S.P, and Battese, G.E. (2003)]. These are (i) least square econometric production models, (ii) index numbers, (iii) data envelopment analysis (DEA) and (iv) stochastic frontier analysis (SFA). While (i) and (iv) are parametric, (ii) and (iii) are non-parametric. While (i) and (ii) analyze aggregate time series data to measure technical change, under the assumption that all the firms / banks are fully efficient, (iii) and (iv) consider a sample of firms / banks at one point of time to measure relative efficiency and do not assume that all firms / banks are technically efficient. In case of panel data, these approaches [(iii) and (iv)] analyze not only technical efficiency but also efficiency change over time. The basic idea underlying DEA and SFA is the notion of a frontier, and efficiency is measured with reference to the estimated frontier. While DEA employs mathematical programming technique, SFA is based on the econometric methods. In the

present study we employed DEA and SFA for measuring technical efficiency of public sector, private sector (Domestic) ad foreign banks in India during the period 1991-2009.

The modern concept of efficiency which started with the work of Farell (1957) who drew from the earlier work of Debreu (1951) and Koopmans (1951), defined the simple measure of efficiency which could account for multiple inputs. The concept of banking efficiency relates how well a bank employs its resources relative to existing production possibilities frontier. An upward change in efficiency measures the increment in output without a rise in input or the amount by which inputs may be reduced without reducing the output. Farell proposed that efficiency of a firm consists of two components namely, technical efficiency which reflects the ability of firm to obtain maximal output from a given set of inputs, and allocative efficiency which reflects the ability of a firm to use inputs in optimal proportions given their respective prices. Farell's original ideas are expressed in the input-output space, and hence provide input-oriented measures. Thus the question that is addressed in input-oriented measure was: "By how much input quantities be proportionately reduced without changing output quantities?". An alternative question would be: "By how much can output quantities be proportionately expanded without altering the input quantities used?". This gives the output oriented measures. Both DEA and SFA assume that the production frontier is known. In practice this is not the case, it must be estimated. Similarly efficiency measures may be obtained under the assumption of constant returns to scale or variable returns to scale for the frontier. In the present study we have confined to analysis of technical efficiency only, as consistent price data is not available for studying allocative efficiency. We now discuss the SFA methodology adopted in this study.

5.1 Stochastic Frontier Approach (SFA):

SFA approach is a structural approach to study efficiency. The stochastic frontier production function independently developed by Anger, Lovell and Schmidt (1977) and Meeusen and van den Broeck (1977), generates an efficiency frontier for the sample. The efficiency of each decision making unit (in the present case a bank) is then measured as the distance of its output to the frontier. This involves estimation of stochastic frontier production function, where the output of a firm is expressed as a function of a set of inputs, inefficiency and random error. The SFA treats the observed inefficiency of a bank as a combination of the inefficiency specific to the bank and a random error and tries to disentangle the two components by making explicit assumptions about the underlying inefficiency process.

The original specification of SFA involved estimation of production function for cross-sectional data, which had an error term having two components, one accounting for random factors and another for technical [in]efficiency.

Formally, the model may be specified as,

$$Q_i = x_i \beta + (v_i - u_i), \quad i = 1, 2, 3, \ldots, n \qquad \ldots (5.1)$$

Where Q_i represents the actual output for the sample bank i ;

x_i is a $k \times 1$ vector of inputs of the i-th bank;

β is a vector of unknown parameters that describe the transformation process;

v_i are random variables which are assumed to be iid $N(0, \sigma^2)$, and independent of the u_i which are one-sided (non-negative) random variables assumed to account for technical efficiency in production and generally assumed to be iid. $N(0, \sigma_u{}^2)$. If the operation of a bank is inefficient (efficient), its actual output is less than (equal to) the potential output.

Therefore, one can treat the ratio of the actual output to potential output as a measure of TE of a bank during the time period. The residual term u_i is zero when the bank produces the potential output (full TE) and is greater than zero when production is below the frontier (less than full TE).

Later the original specification has been altered and extended, to incorporate more general distribution assumptions for the u_i, such as truncated normal or two-parameter gamma distributions' for the consideration of panel data and time-varying technical efficiencies. It is also extended to estimate the cost function and of system of equations. We have adopted the specification of stochastic frontier production developed by Battese and Coelli (1992) for panel data which has firm effects and assumed to be distributed as truncated normal random variables, which may also vary systematically with time i.e. it capture time varying technical efficiency (TE). This may be expressed as,

$$Q_{it} = x_{it}\beta + (v_{it} - u_{it}) \quad i = 1, 2, 3, \ldots, n; \qquad t = 1, 2, 3, ..T; \qquad \ldots(5.2)$$

Where Q_{it} represents the actual output for the sample bank i in period t;

x_{it} is a $k \times 1$ vector of inputs of the sample bank i in period t ;

β is a vector of unknown parameters that describe the transformation process;

v_{it} are random variables which are assumed to be $N(0, \sigma^2)$, and independent of the u_{it}

Following, Battese and Coelli (1992), we can write:

$$u_{it} = u_i \exp\{-\eta(t - T_i)\} ; \quad i = 1, \ldots, n, t \in g(i) \qquad \ldots(5.3)$$

where $u_i's$ are non-negative random variables, assumed to be independently and identically distributed as truncated normal with mean μ and variance σ_u^2, η is an unknown parameter to be estimated and $g(i)$ is the set of T_i time periods for which

observations for bank i are available. Hence, the TE effect of bank i in period $t(i.e.\ u_{it})$ depends on η and number of remaining periods $(t-T_i)$. When $t=T_i$, u_{it} equals u_i which can be treated as the TE effect of bank i in the last period T_i. From Equation (5.3), one can show that as t increases, u_{it} decreases, remains constant, or increases, depending on whether η is greater than, equal to, or less than zero. Therefore, a bank's TE increases, remains the same, or decreases over time, according to whether η is positive, zero, or negative. Following the model specified in Equations (5.2) and (5.3), the conditional expectation of $\exp(-u_{it})$, given the composite error term $\varepsilon_{it}(= v_{it} - u_{it})$, that is $E[\exp(-\eta_{it}u_{it})/\varepsilon_{it}]$ would provide the measure of TE of bank i in period t.

The model given in equations (5.2) and (5.3) can be estimated by the maximum likelihood (ML) method. Various parametric restrictions in the model would lead to a number of interesting cases. Setting μ=0 reduces the model to the traditional half-normal distribution model.

If $\eta = 0$, then TE is time-invariant (i.e. banks never improve their TE). The value of $\gamma = \sigma_u^2/\sigma^2$ $(where\ \sigma^2 = \sigma_u^2 + \sigma_v^2)$ will lie between 0 and 1. In the event that $u_i = 0$ i.e., banks are fully efficient, then γ equals to zero and deviations from the frontier are entirely due to noise v_{it}. In this case, the Ordinary Least Squares (OLS) estimates of the remaining parameters are also ML estimates. When $\gamma = 1$, all deviations from the frontier are entirely due to technical inefficiency (in this case $\sigma_v^2 = 0$). One can test the null hypothesis that $\gamma = \eta = \mu = 0$ using the generalized likelihood-ratio test statistic, which equals twice the difference between the logarithmic likelihood values of the unrestricted and restricted $(\gamma = \eta = \mu = 0)$ ML estimates. The test statistic is a mixed χ^2 (with degrees of freedom equal to 3). If the null is not rejected, it implies that the banks are fully

technically efficient, do not exhibit changes in technical efficiency over time, and the error associated with the frontier being half normal distribution.

5.1.1 Data and Model Specification:

As noted earlier there are two ways of looking at measuring efficiency namely, the production approach and intermediation approach. The former approach considers that banks use capital, labour and other non-financial inputs to provide services for account holders (Ferrier and Lovell, 1990). In the latter approach, banks are assumed to intermediate funds between savers and investors and incur interest expenses and other operating expenses to provide revenue generating services. As a result advances, investments, and deposits are assumed as outputs. In this context it may be pertinent to note that there is no consensus on the choice of inputs and outputs of banks for evaluating their efficiency.

The Indian commercial banks are not entirely a profit oriented or completely social oriented banks. Although they are profit oriented, the regulatory agency (RBI) has set the objective of fostering economic growth and preserving the safety and soundness of the banking systems.

Considering the goals of Indian commercial banks and previous studies, we have considered four measures of outputs (Y_i) namely, net interest margin (total interest earned less total interest paid, reflecting the gain in financial intermediation process), other income (income as commission, brokerage, etc), credits, and investments. The first two would reflect profit goal while last two would reflect economic growth and safety. We have also considered two broader measures of outputs reflecting profit earning, and growth and safety of banking sector. The profit earning measure is obtained by adding the two outputs - net interest margin and other income. This measure (profit goal variable)

reflects profit orientation of banks. We also constructed banking growth variables by adding credits and investment outputs. This measure reflects the objective of growth of banking industry and safety of the system.

We have used deposits (D), borrowings (B), fixed assets (A) and labour (L) as inputs. The data on inputs and outputs of commercial banks in India from 1991 to 2009 have been compiled from the "Statistical tables relating to banks in India" published by the RBI. All monetary values have been converted into 2004-05 prices using implicit GDP deflator. For the estimation of stochastic frontier production function, functional form should be specified. In the present study we have employed the Cobb–Douglas functional form (as it is known to provide the best fit, and the same having been applied in the literature extensively). More specifically the production frontier is specified as

$$\ln Q_{it} = \beta_{0t} + \beta_{1t} \ln D_{it} + \beta_{2t} \ln B_{it} + \beta_{3t} \ln L_{it} + \beta_{4t} \ln A_{it} + v_{it} - \eta_{it} u_i \qquad \dots (5.4)$$

The variables used in the SFA are described in the following table.

Table: Variables Description used in SFA	
Variable Name	Description
Net Interest Margin	It is difference of total interest earned and total interest paid
Other Income	income from commissions, brokerage, etc
Credits	includes cash credit, over draft and loans
Investments	includes investment in government as well other securities and other investments
Profit Goal	Addition of net interest margin and other income
Banking Growth	Addition of credit and investments
Deposits	includes all types of deposit from all sources
Borrowings	it comprises borrowing from Reserve Bank of India, other banks and from other institutions and agencies,
Fixed Assets	comprises monetary value of premise, under construction and of other assets
Labour	number of total staffs,

5.2 Data Envelopment Analysis (DEA):

Data Envelopment Analysis (DEA) is a non-parametric mathematical programming approach to the frontier estimation. In SFA an explicit functional form and assumption about distribution of data have to be specified beforehand. In contrast in the DEA, there is no need to specify the functional form; hence it is less prone to functional misspecification. Further, DEA does not require inclusion of random error. This may mean that the problem of distribution for the error term is no longer there. DEA computes the efficiency of a bank in transforming inputs into outputs in relation to its peer group. Charnes *et al*. (1978) first developed the DEA approach based on the same concept of technical efficiency given by Farrell (1957). Thus as Siems and Thomas (1992) had put it ``DEA in essence is a linear programming technique that converts multiple inputs and outputs into a scalar measure of efficiency. This conversion is accomplished by comparing the mix and volume of services provided and the resources used by each bank compared with all other banks. Each bank is evaluated against a hypothetical bank with an identical output mix that is constructed as a combination of efficient banks. DEA identifies the most efficient banks in a population and provides a measure of inefficiency for all others. The most efficient banks are rated to have an efficiency score of one, while the less efficient banks score between zero and one. Though DEA does not give a measure of optimal efficiency, it however differentiates the least efficient banks from the set of all banks. Thus, the efficient institutions calculated using DEA establish the best practice frontier''.

Like in the case of SFA, under the DEA, both input-oriented and output-oriented technical efficiency measures are available. The technical efficiency may be measured under the assumptions of either constant returns to scale (CRS) or variable returns to scale

(VRS). In case of input orientation, output(s) combination is maximised for a given level of inputs, whereas in output orientation, input(s) is minimised to achieve a given level of output combination. These two methods provide the same value of TE under CRS, but unequal value when VRS is assumed. The input-oriented DEA methods are similar to their output-oriented counterparts. Both the methods estimate the same frontier, and hence would identify the same set of firms / banks being efficient. It is only the efficiency measure associated with inefficient firms / banks that might differ between the two methods. In the present study, we have adopted the input-oriented method.

The CRS assumption is only appropriate when all the banks are operating at an optimal scale. Imperfect competition, constraints on finances, and other limitations may hinder banks to operate at the optimal scale. An extension of the CRS DEA model to account for variable returns to scale has been suggested by Banker, Charnes and Cooper (1984). Use of CRS specification, when all banks are not operating at the optimal scale, might confound the measure of technical efficiency (TE) by scale efficiencies (SE). In this context, use of VRS specification would permit the calculation of TE devoid of these SE effects. While TE efficiency refers to manager's capability to utilize firms' given resources, SE refers to exploiting scale economies by operating at a point where the production frontier exhibits constant returns to scale. In the present study, we have used in addition to CRS, the VRS specification to measure TE and SE.

5.2.1   DEA Models:

The best way to explain DEA is by way of ratio form. The algebraic model for the   DEA developed by Charnes, Cooper and Rhodes (1978) (input based) in ratio form may be specified as follow:

Consider n decision-making units (DMU) (here DMU refers to commercial banks) producing s outputs using m inputs.

$$\text{Max } h_c = \sum_{r=1}^{s} u_r y_{rc} \Bigg/ \sum_{i=1}^{m} v_i x_{ic}$$

$$\text{s.t } \sum_{r=1}^{s} u_r y_{rj} \Bigg/ \sum_{i=1}^{m} v_i x_{ij} \leq 1 \qquad \qquad \ldots (5.5)$$

$$u_r, v_i \geq 0; \quad r = 1, 2, \ldots, s;$$

$$i = 1, 2, \ldots, m,$$

$$j = 1, 2, \ldots, n$$

where

c denotes specific bank to be evaluated

y_{rj} is the amount of output r from bank j

x_{ij} is the amount of input i to bank j

u_r is weight chosen for output r

v_i is weight chosen for input i

h_c is the objective function (defined as the ratio of weighted output and weighted input) of banks c

To measure efficiency, the objective function defined by h_c aims to maximise the ratio of weighted outputs to weighted inputs of the bank under consideration, subject to the constraint that any other bank in the sample cannot exceed unit efficiency by using the same weight. These weights are unknown but to be obtained through optimisation. To

measure technical efficiency optimisation has to be performed separately for each banks as an unit.

The problem setting in equation (5.5) is a fractional program, which can be transformed into a linear programming problem (LP) by restricting the denominator of the objective function h_c to unity, and adding this as constraint to the problem. This can be mathematically shown as:

$$\text{Max } h_c = \sum_{r=1}^{s} u_r y_{rc}$$

$$\text{s.t } \sum_{i=1}^{m} v_i x_{ic} = 1 \qquad \qquad \dots(5.6)$$

$$\sum_{i=1}^{m} u_{rc} y_{rj} - \sum_{i=1}^{m} v_{ic} x_{ij} \leq 0$$

$$r = 1, 2, \dots, s; \ i = 1, 2, \dots, m, \text{ and } j = 1, 2, \dots, n$$

The linear programming setting in equation (5.6) assumes constant returns to scale technologies. Here the formulation constrains the weighted sum of inputs to unity and maximizes the outputs, which is input-based efficiency measurement. An alternative formulation that constrains the sum of the weighted output to unity, and minimizes the inputs gives an output-based measurement of efficiency.

In the above formulation [equation (5.6)], the idea is to find values of u and v, such that the efficiency measure of the cth bank is maximized, subject to the constraints. The formulation given in equation (5.6) can have infinite number of solutions. To avoid this problem, equation (5.6) may be reformulated as follows. By denoting the input weights of bank c by θ_c and the input and output weights of other banks in the sample by λ_j, the dual form of the maximizing problem is formularized as follows:

$$\text{Min } \theta_c$$

$$\text{s.t } \sum_{j=i}^{n} \lambda_j y_{rj} - s_i^+ = y_{rc}$$

$$\sum_{j=i}^{n} \lambda_j x_{ij} - s_i^- = \theta_c x_{ic} \qquad \qquad ...(5.7)$$

$$\lambda_j, s_i^-, s_i^+ \geq 0;$$

$$j = 1, 2, ..., n$$

The bank c is regarded as efficient if the θ_c is equal to one and the slacks (s_i^+ and s_i^-) are zero. That is, if and only if $\theta_c^* = 1$ with $s_i^{+*} = s_i^{-*} = 0$ for all c and j,

where asterisk denotes optimal values of the variables in the above problem. A bank is regarded as inefficient if θ_c is less than one and/or positive slack variables. For these inefficient banks, the optimal values of λ_j construct a hypothetical bank, which is formed by the subset of the efficient banks.

The above formulation can be transformed for the variable returns to scale (VRS), as Banker, Charnes and Cooper (1984) suggested, by including $\sum_{j=1}^{n} \lambda_j = 1$ as an extra constraint to the model (5.7).

5.2.2 Calculation of Scale Efficiencies

Technical efficiencies (TE) scores obtained from a CRS DEA can be decomposed into two components, one due to scale inefficiency and one due to "pure" technical inefficiency. This is done by conducting both a CRS and VRS DEA upon the same data. If there is difference in the two TE scores for a particular bank, then this indicates that the bank has scale inefficiency, and that the scale inefficiency can be calculated from the difference between the VRS TE and the CRS TE score.

5.2.3 Input-Output Specifications for DEA:

The first step to measuring efficiency using DEA is to specify inputs and outputs of banks. But in the case of banks, there is no agreement on the inputs and outputs, because of dual nature of some of the services that banks provide. In the present study we have used two different combinations of inputs and outputs. The inputs considered are number of employees, establishment expenditure, non-establishment expenditure, non-interest expenditure and fixed assets. The outputs considered are deposits, advances, investments, net interest margin, total income, and other income. Explanation of variables and their combinations used in the DEA are given in the following table.

Variables Description used in DEA	
Variables as inputs	
Number of employees	it comprises total number of staffs in banks
Establishment Expenditure	in other words it may called employees' cost which includes the payments made to and provisions for employees
Non-establishment Expenditure	it is the difference of operating cost and establishment expenditure, where operating cost includes all other costs for running the business excluding interest expenditure, thus it may also called operational cost.
Non-interest expenditure	Expenditure incurred other than on interest comes under the head of non-interest expenditure.
Variables as outputs	
Deposits	it includes all types of deposit from all sources
Investments	includes investment in government as well other securities and other investments
Advances	
Net interest Margin	It is difference of total interest earned and total interest paid
Total income	it is sum of interest/discount earned, commission, exchange, brokerage and other operating income
Interest earned	it includes interest/discounts on advances/bills, income on investments, interest on balances with RBI and other inter-bank funds and other interest earned.
Other income	other income is sum of income from commission, exchange, brokerage and other operating income

Table: Input-Output Combinations/ Capital case refers Outputs and Small case for Inputs		
Combinations	Inputs	Outputs
First	Number of Employees, Establishment Expenditure, Non-establishment expenditure, Non-interest expenditure and Fixed Assets;	Deposits, Advances, Investments, Net Interest Margin and Other Income
Second	Number of Employees, Establishment Expenditure, Non-establishment expenditure, Non-interest expenditure and Fixed Assets;	Deposits, Advances, Investments, Net Interest Margin and Total Income

Table: 5.1 Descriptive Statistics of Variables considered for SFA

Bank Groups	SBI		Foreign		Public sector		Nationalised		Domestic Private		Private Sector		All	
Variables	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Interest Margin	6.1	1.5	4.1	2.0	6.5	1.2	6.7	0.9	5.4	1.4	4.7	1.8	5.3	1.9
Other Income	5.4	1.5	2.8	2.2	5.7	1.1	5.9	0.9	3.7	1.7	3.2	2.0	4.0	2.2
Credits	8.3	1.5	4.6	2.6	8.7	1.2	8.9	0.9	6.5	1.4	5.5	2.3	6.5	2.5
Investments	8.5	1.6	5.4	2.1	9.1	1.1	9.3	0.8	6.8	1.6	6.1	2.0	7.1	2.3
Borrowings	6.0	2.0	4.5	2.7	6.2	1.6	6.3	1.4	3.9	2.5	4.2	2.6	4.9	2.5
Deposits	9.4	1.6	5.9	2.3	10.0	1.2	10.2	0.8	7.8	1.5	6.8	2.2	7.8	2.4
Fixed Assets	4.4	1.6	2.3	2.2	5.4	1.4	5.7	1.0	3.7	1.6	3.0	2.1	3.7	2.2
Profit Goal	6.5	1.5	4.4	1.9	6.9	1.1	7.1	0.9	5.6	1.4	5.0	1.8	5.6	1.9
Banking Growth	9.1	1.5	5.9	2.1	9.6	1.1	9.8	0.8	7.4	1.5	6.6	2.0	7.6	2.3
Labour	36.9	69.0	0.6	1.2	29.9	39.6	27.0	15.7	3.1	4.7	1.7	3.5	10.9	26.3
Units of Measurement of all variables in Rs. Crore except labour (in thousands unit) Std. Dev. Refers standard deviation														

5.3 Empirical Results and Analysis:

5.3.0   Analysis of Results of SFA:

In tables, in the first column shows input variables and parameters of stochastic frontier function, whereas first row show the different outputs. In the tables, σ^2, γ, μ and η are parameters of stochastic frontier function. Where σ^2 is variance of composite error term i.e. Uit and Vit, if it is significant, then one can infer that the difference between actual output and frontier output is because of the factors which are in control of banks. Uit measure the technical effect of the banks and Vit (i.i.d normal with mean 0 and variance $\sigma^2 v$)   capture the effects of omitted variables/ measurement errors. The term γ is ratio of $\sigma^2 u$ and σ^2, which measures that how much of the difference between actual output and frontier output is because of technical inefficiency. μ is the mean of the distribution of the Uit, assuming that error term follow truncated normal distribution. If the μ is not significant then error term will follow half normal distribution. The parameter η show whether the technical efficiency is time varying or not. If it is significant technical efficiency of the bank will be time varying otherwise it will time invariant.

Log likelihood and χ^2 are the test statistic of the assumption that γ, μ and η are equal to zero.

As noted earlier, we have employed the stochastic frontier analysis technique for estimating efficiency. The methodological details are given in the methodology section. Tables 5.2 to 5.7 present the ML estimates of stochastic frontier function of the banks, group-wise as well as all the banks taken together. In table 5.2 estimates of SBI and its associate banks are reported. The estimates refer to the panel frontier. First we have estimated the model with μ and η unrestricted. Since the asymptotic t value of the estimated value of μ is not statistically significant at 5% level, it indicates that the error

term of the frontier does not follow truncated normal distribution rather it follows half normal distribution. Subsequently, we have imposed a restriction μ=0 then re-estimated the equations.

Table 5.2: ML Estimates of Stochastic Frontier Function for SBI Group Banks

	Interest margin(Y_1)	Investments (Y_2)	Credits(Y_3)	Other Income(Y_4)	Profit Goal(Y_5)	Banking Growth(Y_6)
Constant	-2.118	-0.366	-1.219	-3.113	0.099	-0.246
	(-6.701)	(-1.646)	(-5.171)	(-8.002)	(-0.802)	(-1.936)
Log L	0.012	0.032	0.006	0.018	0.005	0.023
	(-0.734)	(-6.803)	(-1.286)	(-4.74)	(-0.176)	(-3.237)
Log D	0.793	0.976	1.079	0.969	0.454	1.026
	(-12.761)	(-22.392)	(-23.891)	(-12.388)	(-21.742)	(-40.822)
Log B	0.019	-0.086	0.042	-0.080	0.018	-0.016
	(-0.953)	(-6.201)	(-2.967)	(-3.187)	(-0.941)	(-1.956)
Log A	0.175	0.042	-0.094	-0.022	0.482	-0.030
	(-3.006)	(-1.023)	(-2.352)	(-0.320)	(-25.766)	(-1.288)
σ^2	0.397	0.020	0.125	0.061	0.421	0.093
	(-1.866)	(-8.621)	(-4.405)	(-4.932)	(-1.775)	(-1.993)
γ	0.907	0.000	0.872	0.140	0.915	0.940
	(-17.53)	(-0.175)	(-34.768)	(-0.905)	(-18.322)	(-30.445)
μ	-		0.661			
			(-9.407)			
η	-0.418	0.398	-0.071	0.062	-0.514	-0.251
	(-5.316)	(-2.478)	(-5.113)	(-1.991)	(-6.445)	(-6.428)
Log Likelihood	28.973	79.177	83.071	71.216	49.635	168.802
χ^2	39.749	16.896	121.143	23.665	27.631	79.094
Iterations	30	52	28	20	31	32

Note: Values inside parentheses are t-statistics; σ^2 is error variance of frontier function; μ-is decision parameter concerning distribution of error terms

Column 2 provides estimates of interest margin (as output variable) where the error term follows half-normal distribution. All the inputs have positive effects except constant term. However, only effects of deposit and fixed assets are statistically significant at 5% level. The deposit variable is the dominant factor in determining the interest margin as its estimated coefficient has the largest (0.793) value. The significant η term indicates that

bank effects are time variant. σ^2 and γ terms are positive and statistically significant at 10% and 5% level respectively, indicating that the observed level of interest margin significantly differs from frontier level due to factors, which are within the control of banks. The estimated value of γ indicates that 90% of the differences between actual and potential output is due to technically inefficient performance of banks.

The ML estimates of other income ($\log Y_4$), investments ($\log Y_2$), credit ($\log Y_3$), profit goal (Y_5) and banking growth (Y_6) are shown in columns 5, 3, 4, 6 and 7 of the table. Notably, in all equations deposit plays a dominant role except in case of profit goal where fixed asset is a dominant factor. In case of banking development, borrowings and fixed assets are significant at 10% level and both have negative impact on banking growth. The likelihood ratio test rejects the null hypothesis of $\gamma = \mu = \eta = 0$ in all cases. Interestingly, σ^2 and γ are positive and statistically significant at 5% - 10% level in all cases, revealing inefficient performance of banks in producing these outputs. The μ is statistically insignificant at 5% level in all cases except in case of credit, indicating that u follows a half normal distribution except in case of credit where the error follows a truncated normal distribution, and η term statistically insignificant at 5% level in all cases, indicating that the bank specific effects associated with technical efficiency (TE) are time varying in all.

In table 5.3, ML estimates for the nationalized bank group are reported. The results suggest that the previous (as in SBI group) trend is repeated in case of deposits across all the output measures, and is significant at 5% level and has retained a positive and dominant effect. In case of net interest margin borrowings and fixed assets have negative effect and are significant at 10% and 5% levels respectively. The likelihood ratio test rejects the null hypothesis of $\gamma = \mu = \eta = 0$ in all cases. Interestingly, σ^2 and γ are positive

and statistically significant at 5%-10%level in all cases, revealing inefficient performance of banks in producing these outputs.

Table 5.3: ML Estimates of Stochastic Frontier Function for Nationalized Banks

	Interest margin(Y_1)	Investments(Y_2)	Credits(Y_3)	Other Income(Y_4)	Profit Goal(Y_5)	Banking Growth(Y_6)
Constant	-1.860	0.636	-2.156	-1.848	-1.892	-0.421
	(-3.512)	(-0.367)	(-6.425)	(-4.198)	(-5.056)	(-2.774)
Log L	0.320	0.052	0.004	0.006	0.423	0.003
	(-3.79)	(-1.237)	(-1.626)	(-0.27)	(-93.997)	(-1.714)
Log D	0.904	0.819	1.138	0.757	0.910	0.996
	(-15.054)	(-5.342)	(-27.19)	(-14.888)	(-22.727)	(-49.306)
Log B	-0.026	-0.024	0.056	0.011	-0.003	0.023
	(-1.717)	(-0.432)	(-4.931)	(-0.812)	(-0.306)	(-4.888)
Log A	-0.082	0.107	-0.141	0.039	-0.052	0.003
	(-2.239)	(-3.452)	(-5.137)	(-1.1)	(-1.964)	(-0.288)
σ^2	0.083	0.042	0.228	0.077	0.047	0.099
	(-6.63)	(-5.612)	(-3.038)	(-11.169)	(-13.125)	(-2.925)
γ	0.183	0.400	0.769	0.019	0.028	0.888
	(-1.453)	(-2.300)	(-9.908)	(-1.190)	(-0.914)	(-22.269)
μ				0.078		
				(-3.584)		
η	0.113	0.045	-0.034	0.115	0.154	-0.411
	(-6.924)	(-4.200)	(-2.177)	(-6.086)	(-6.213)	(-6.388)
Log Likelihood	-54.185	126.106	-4.491	-93.093	27.13	291.607
χ^2	108.542	26.524	112.83	45.164	66.428	70.008
Iterations	19	1	18	19	20	32

Note: Values inside parentheses are t-statistics; σ^2 is error variance of frontier function; μ-is decision parameter concerning distribution of error terms

The μ is statistically insignificant at 5% level in all cases except in case of other income and η term statistically insignificant at 5% level in all cases, indicating that the bank specific effects associated with technical efficiency (TE) are time varying in all.

The estimated results of domestic private bank group are reported in table 5.4. In case of net interest margin all the input variables are significant at 5% level and have positive effect. Fixed Assets is found to be a determining factor followed by borrowings. In this case the error term follows truncated normal distribution. In all other cases deposit

variable has positive and dominant effect. In case of banking growth, fixed assets are significant at 5% level and has negative effect. Again the likelihood ratio test rejects the null hypothesis of $\gamma = \mu = \eta = 0$ in all cases and σ^2 and γ are positive and statistically significant, revealing inefficient performance of banks in producing these outputs.

Table: 5 .4ML Estimates of Stochastic Frontier Function for Domestic Private Banks

	Interest margin(Y_1)	Investments(Y_2)	Credits(Y_3)	Other Income(Y_4)	Profit Goal(Y_5)	Banking Growth(Y_6)
Constant	0.087 (-0.634)	-1.192 (-14.498)	-1.131 (-1.131)	-2.966 (-14.317)	-1.4249 (-19.474)	-0.626 (-10.091)
Log L	1.300 (-3.722)	0.021 (-0.373)	0.432 (-7.5)	0.035 (-0.689)	0.210 (-3.207)	0.132 (-2.532)
Log D	1.517 (-22.394)	1.021 (-73.407)	1.043 (-11.043)	0.725 (-20.322)	0.841 (-62.53)	1.044 (-95.872)
Log B	2.183 (-9.686)	0.0039 (-0.621)	0.035 (-6.035)	0.131 (-9.53)	0.038 (-7.347)	0.014 (-3.402)
Log A	3.126 (-5.518)	0.019 (-1.549)	-0.149 (-6.149)	0.152 (-4.839)	0.078 (-7.325)	-0.036 (-4.107)
σ^2	0.338 (-10.913)	0.038 (-13.931)	0.201 (-10.201)	0.238 (-15.457)	0.043 (-5.736)	0.045 (-4.042)
γ	0.891 (-2.38)	0.002 (-0.437)	0.100 (-0.100)	0.002 (-0.667)	0.179 (-1.261)	0.544 (-4.743)
μ	1.352 (-3.94)					
η	1.082 (-3.366)	0.158 (-2.363)	3.500 (-5.600)	0.179 (-4.039)	-0.145 (-2.207)	-0.154 (-2.525)
Log Likelihood	286.181	96.685	-287.920	-362.351	122.569	251.562
χ^2	25.221	11.994	45.985	30.248	4.02	28.239
Iterations	21	27	30	27	16	22

Note: Values inside parentheses are t-statistics; σ^2 is error variance of frontier function; μ-is decision parameter concerning distribution of error terms

The η term is statistically insignificant at 5% level in all cases, indicating that the bank specific effects associated with technical efficiency (TE) are time varying in all.

The results of foreign banks group are provided in table 5.5. All inputs have positive effects and significant at 5% except labour. The deposit is the dominant factor in determining the interest margin, as its coefficient has the largest (0.52) value. The ML

estimates of other income (log Y4), investments (log Y2), credits (log Y3), profit goal (Y5) and banking growth (Y6) are shown in columns of the table.

Table: 5.5 ML Estimates of Stochastic Frontier Function for Foreign Private Banks

	Interest margin(Y_1)	Investments(Y_2)	Credits (Y_3)	Other Income(Y_4)	Profit Goal(Y_5)	Banking Growth(Y_6)
Constant	0.077	1.16	-0.023	-0.744	4.565	1.641
	(-0.634)	(-10.195)	(-0.109)	(-3.592)	(-5.945)	(-14.093)
Log L	0.312	0.007	0.023	0.322	11.000	0.010
	(-3.722)	(-0.164)	(-1.188)	(-5.077)	(-5.507)	(-0.107)
Log D	0.517	0.525	0.588	0.497	6.489	0.508
	(-27.394)	(-23.065)	(-13.649)	(-12.66)	(-26.654)	(-23.236)
Log B	0.183	0.219	0.288	0.148	8.177	0.268
	(-12.686)	(-12.838)	(-8.718)	(-5.097)	(-12.684)	(-16.456)
Log A	0.127	0.182	0.088	0.104	6.113	0.139
	(-6.518)	(-7.818)	(-1.902)	(-2.747)	(-5.884)	(-6.336)
σ^2	0.339	0.452	2.516	1.248	0.347	0.401
	(-10.913)	(-15.671)	(-6.353)	(-11.858)	(-9.857)	(-12.783)
γ	0.091	0.029	0.329	0.081	0.145	0.069
	(-1.38)	(-1.028)	(-3.047)	(-1.285)	(-1.801)	(-1.153)
μ	0.352					
	(-3.94)					
η	-0.082	0.117	-0.087	0.071	4.663	0.064
	(-2.366)	(-4.103)	(-2.712)	(-2.888)	(-0.367)	(-2.575)
Log Likelihood	-486.181	-601.06	-981.36	-876.871	-479.34	-550.083
χ^2	15.221	48.841	16.281	33.107	38.023	17.133
Iterations	17	19	16	15	17	15

Note: Values inside parentheses are t-statistics; σ^2 is error variance of frontier function; μ-is decision parameter concerning distribution of error terms

In all these cases, the coefficients of all inputs are positive. Notably, in all equations deposit plays a dominant role except in case of profit goal where labour is the dominant factor. The likelihood ratio test rejects the null hypothesis of $\gamma = \mu = \eta = 0$ in all cases. Interestingly, σ^2 and γ are positive and statistically significant at 5%-10% level in all cases, revealing inefficient performance of banks in producing these outputs. The μ is statistically insignificant at 5% level in all cases except in case of net interest margin, indicating that u follows a half normal distribution except in case of net interest margin, where truncated normal distribution is more relevant. The η term is statistically

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insignificant at 5% level in all cases, indicating that the bank specific effects associated with technical efficiency (TE) are time varying.

Table 5.6 provides the ML estimates of stochastic frontier function for the private sector banks. In case of net interest margin all inputs have positive effect and significant at 5% level. But the labor coefficient is zero. The deposit variable has been the dominant factor in determining the interest margin, as its coefficient retained the largest (0.60). The σ^2 and γ terms are positive and statistically significant at 5% level, indicating that the observed level of interest margin significantly differ from frontier level due to factors, which are within the control of banks.

The ML estimates of other income (log Y4), investments (log Y2), credits (log Y3), profit goal (Y5) and banking growth (Y6) are shown in the relevant columns of the table. In all these cases, coefficients of all inputs are positive. Notably, as in the previous cases, in all equations deposit plays a dominant role. The likelihood ratio test rejects the null hypothesis of $\gamma = \mu = \eta = 0$ in all cases. Interestingly, σ^2 and γ are positive and statistically significant at 5%-10% level in all cases, revealing inefficient performance of banks in producing these outputs.

The μ is statistically significant at 5% level in case of investment, profit goal and banking growth, indicating that u follows a truncated normal distribution while in other cases it follows half normal distribution and η term is statistically insignificant at 5% level in all cases, indicating that the bank specific effects associated with technical efficiency (TE) are time varying.

The ML Estimates of Stochastic Frontier Function for Public Sector Banks is reported in table 5.7. In case of interest margin, deposits and borrowings input variables are

significant; while deposit variable has positive effect, borrowing showed the other way, that is, negative impact on net interest margin.

Table:5.6 ML Estimates of Stochastic Frontier Function for Private Sector Banks

	Interest margin(Y_1)	Investments(Y_2)	Credits (Y_3)	Other Income(Y_4)	Profit Goal(Y_5)	Banking Growth(Y_6)
Constant	-0.078 (-1.129)	0.966 (-12.263)	-0.104 (-0.653)	-1.312 (-10.063)	0.372 (-5.739)	1.469 (-17.926)
Log L	0.302 (-4.021)	0.021 (-2.226)	0.005 (-0.024)	0.107 (-2.793)	0.200 (-4.882)	0.007 (-1.060)
Log D	0.593 (-47.295)	0.632 (-40.958)	0.756 (-26.149)	0.53 (-21.138)	0.564 (-46.804)	0.642 (-42.665)
Log B	0.11 (-14.71)	0.119 (-13.434)	0.122 (-7.118)	0.187 (-13.216)	0.126 (-16.66)	0.137 (-15.091)
Log A	0.148 (-11.618)	0.153 (-9.423)	0.09 (-3.149)	0.119 (-4.516)	0.134 (-10.242)	0.119 (-7.926)
σ^2	0.255 (-11.531)	0.305 (-21.575)	1.8 (-7.917)	0.799 (-22.845)	0.206 (-21.894)	0.292 (-13.746)
γ	0.199 (-2.925)	0.024 (-9.011)	0.408 (-5.246)	0.008 (-1.706)	0.011 (-1.535)	0.092 (-2.024)
μ		-0.170 (-2.836)			0.097 (-3.472)	-0.328 (-2.543)
η	0.002 (-3.149)	0.18 (-10.628)	-0.0739 (-3.663)	0.141 (-5.581)	0.069 (-4.014)	0.116 (-4.830)
Log Likelihood	-702.486	-919.32	-1590.1	-1428.262	-690.94	-845.81
χ^2	26.178	104.975	44.373	79.477	33.798	74.183
Iterations	11	16	15	22	17	14

Note: Values inside parentheses are t-statistics; σ^2 is error variance of frontier function; μ-is decision parameter concerning distribution of error terms

Though labour coefficient is positive, it has negligible effect as its coefficient is equal to zero. In case of investment all inputs have positive effect and significant at 5% level. Fixed assets have most determining effect on the investment output. While in case of credit, deposits and borrowings the effect is positive, fixed asset has negative effect; and deposit is a dominant factor. In case of profit goal and banking growth all inputs have positive effect and significant except that fixed assets and borrowings have negative effect.

The likelihood ratio test rejects the null hypothesis of $\gamma = \mu = \eta = 0$ in all cases. The μ is statistically significant at 5% level in case of interest margin, credit and other income,

indicating that u follows a truncated normal distribution while in other cases it follows

half normal distribution and η term is statistically insignificant at 5% level in all cases.

This indicates that the bank specific effects associated with TE are time varying.

Table:5.7 ML Estimates of Stochastic Frontier Function for Public Sector Banks

	Interest margin(Y_1)	Investments(Y_2)	Credits (Y_3)	Other Income(Y_4)	Profit Goal(Y_5)	Banking Growth(Y_6)
Constant	-2.525	1.870	-1.548	-2.191	-2.525	0.322
	(-13.996)	(-0.260)	(-8.643)	(-9.242)	(-4.532)	(-0.322)
Log L	0.450	0.790	0.027	0.456	3.450	3.120
	(-3.408)	(-3.452)	(-0.919)	(-3.879)	(-4.567)	(-4.560)
Log D	0.943	0.861	1.135	0.806	6.870	0.931
	(-30.165)	(-12.345)	(-36.753)	(-22.373)	(-1.007)	(-11.320)
Log B	-0.035	4.320	0.041	0.002	-3.210	1.200
	(-2.889)	(-7.890)	(-3.960)	(-0.115)	(-6.743)	(-13.000)
Log A	-0.007	6.345	-0.147	0.033	-1.650	1.230
	(-0.261)	(-8.986)	(-6.252)	(-1.115)	(-4.570)	(-4.562)
σ^2	0.127	0.039	0.155	0.086	0.088	0.018
	(-4.641)	(-0.039)	(-9.428)	(-9.614)	(-3.231)	(-0.018)
γ	0.463	0.300	0.699	0.112	0.400	0.300
	(-3.857)	(-0.300)	(-15.152)	(-1.402)	(-0.400)	(-0.300)
μ	-0.485		0.658	0.197		
	(-2.433)		(-5.892)	(-3.727)		
η	0.091	4.532	-0.026	0.059	1.210	2.340
	(-8.109)	(-8.675)	(-4.735)	(-6.752)	(-4.562)	(-4.320)
Log Likelihood	-74.034	172.549	16.572	-107.329	114.913	379.887
χ^2	149.539	28.604	209.44	151.484	70.998	30.605
Iterations	15	19	17	16	23	23

Note: Values inside parentheses are t-statistics; σ^2 is error variance of frontier function; μ-is decision parameter concerning distribution of error terms

The ML Estimates of Stochastic Frontier Function for all Banks is presented in table 5.8.

In case of net interest margin all inputs have positive effect and significant at 5% level.

But the labor coefficient is zero. The deposit is the dominant factor in determining the

interest margin, as its parameter is the largest (0.61). The significant σ^2 and γ terms are

positive and statistically significant at 5% level, indicating that the observed level of

interest margin significantly differ from frontier level due to factors, which are within the

control of the banks.

The ML estimates of other income (log Y_4), investments (log Y_2), credits (log Y_3), profit goal (Y_5) and banking growth (Y_6) are also given in the relevant columns of the table. In all cases, coefficients of all inputs are positive. Notably, in all equations deposits plays a dominant role. The likelihood ratio test rejects the null hypothesis of $\gamma = \mu = \eta = 0$ in all cases. Interestingly, σ^2 and γ are positive and statistically significant at 5% level in all cases, revealing inefficient performance of the banks in producing these outputs. The η term statistically significant at 5% level in all cases, indicating that the bank specific effects associated with technical efficiency (TE) is time varying.

Table: 5.8 ML Estimates of Stochastic Frontier Function for All Banks

	Interest margin(Y_1)	Investments(Y_2)	Credits (Y_3)	Other Income(Y_4)	Profit Goal(Y_5)	Banking Growth(Y_6)
Constant	-0.051	0.874	-0.259	-1.272	0.540	1.418
	(-0.852)	(-11.224)	(-2.212)	(-13.868)	(-6.413)	(-18.231)
Log L	0.104	0.506	0.008	0.408	0.102	0.701
	(-0.191)	(-3.303)	(-1.247)	(-3.782)	(-0.242)	(-3.460)
Log D	0.608	0.675	0.792	0.551	0.576	0.678
	(-50.654)	(-53.351)	(-37.23)	(-29.189)	(-49.066)	(-56.051)
Log B	0.092	0.098	0.126	0.186	0.106	0.122
	(-12.779)	(-13.750)	(-9.578)	(-23.181)	(-15.189)	(-17.537)
Log A	0.157	0.159	0.067	0.107	0.153	0.122
	(-13.574)	(-11.804)	(-3.029)	(-6.067)	(-13.013)	(-10.124)
σ^2	0.380	0.237	3.334	0.588	0.202	0.238
	(-8.112)	(-24.809)	(-4.211)	(-24.955)	(-15.483)	(-15.831)
γ	0.500	0.038	0.78	0.006	0.165	0.152
	(-7.912)	(-1.741)	(-13.842)	(-2.811)	(-3.799)	(-2.945)
μ			-3.225	0.118	0.365	
			(-3.947)	(-11.678)	(-3.723)	
η	0.023	0.112	-0.071	0.111	0.032	0.052
	(-5.128)	(-7.058)	(-6.528)	(-16.853)	(-4.049)	(-5.066)
Log Likelihood	-1045.96	-1146.19	-2073.7	-1880.494	-943.51	-1047.519
χ^2	413.183	149.208	95.028	108.191	279.201	63.306
Iterations	16	18	32	16	18	15

Note: Values inside parentheses are t-statistics; σ^2 is error variance of frontier function; μ-is decision parameter concerning distribution of error term.

The estimates of the frontier for all the banks are presented in table 5.8. Over all, it is observed that in all bank groups, deposits are the most important determining factor

which positively influences the output. The labour input seems to have almost a negligible effect. Bank specific effects associated with technical efficiency (TE) are found to be time varying.

From the above analysis of the frontier, the following findings emerge:

1. In all the bank groups, the deposit variable as an input has emerged as the most significant variable influencing the bank output. This finding is consistent across all alternative output measures..

2. On the other hand, the labour input has been found to have marginal influence on banking output

3. The bank specific effects associated with technical efficiencies are found to be time varying.

5.3.0.1 Technical Efficiency (TE) Estimates:

Technical efficiency estimates (average across the banks within a group) over the sample period are provided in the following tables. These measures indicate the average level of technical efficiency at a point of time (year in the present case) of all the member banks in a bank group. These measures are provided output-wise for each of the bank groups and also all banks put together. These measures help to assess the average behavior of the member banks together in a bank group, over a period of time, in respect of alternative output measures.

In table 5.9 time variant TE values of interest margin by bank group are presented. For all banks the TE in raising interest margin has increased from 61.42% in 1991 to 71.42% in 2009. Although it has decreased in case of SBI group, the public sector banks have shown better performance, as the TE has increased from 57.93% in 1991 to 73.54% in

2009. The highest increase in the TE in raising interest margin is realized in nationalised bank group and it also ranked first in 2009.

Table: 5.9 Mean Efficiency Value of Net Interest Margin -Aggregate Banking Sector

Year	SBI	Nationali sed	Private(D omestic)	Foreign	Private Sector	Public Sector	ALL
1991	69.97	54.14	69.82	72.52	69.52	57.93	61.42
1992	67.00	57.50	69.00	71.83	68.83	59.65	62.20
1993	64.00	60.75	69.00	71.16	68.16	61.30	62.75
1994	63.40	63.86	68.00	70.45	67.45	60.85	63.06
1995	67.00	66.81	68.74	69.25	66.25	62.28	63.73
1996	69.77	69.60	68.00	68.10	66.10	63.63	66.28
1997	69.64	72.22	69.00	67.28	65.28	64.91	66.80
1998	64.00	74.67	68.00	66.40	64.40	66.11	68.28
1999	65.00	76.95	67.00	65.46	63.46	67.23	68.78
2000	68.76	79.06	67.00	66.34	64.34	68.28	69.49
2001	68.13	68.01	65.00	65.04	63.04	69.27	69.72
2002	67.17	69.81	63.00	63.71	63.71	70.18	69.89
2003	65.75	71.45	64.00	62.59	61.59	71.04	67.81
2004	63.63	72.96	65.00	61.83	60.83	71.83	68.94
2005	60.53	72.94	64.00	59.04	58.04	70.98	69.84
2006	56.07	74.29	63.00	57.31	56.31	71.75	70.33
2007	49.81	75.53	61.00	55.56	54.56	72.47	70.47
2008	48.00	76.66	63.00	53.80	52.80	73.14	70.88
2009	49.00	77.69	64.00	52.12	51.12	73.54	71.42

Note: Mean efficiencies are in percentage term.

Whereas in case of domestic private as well as foreign banks, TE for raising net interest margin has declined over the period 1991 to 2009. In figure 5.1 the same has been depicted in the graphical form.

Similar efficiency measures for each bank group of raising investment is shown in table 5.10. It is observed from the table that in raising of investment, TE of all banks and for each bank group has gone up over the period of 1991 to 2009. In 1991 domestic private bank group was at the top with 69.54% and nationalised bank group was at the bottom with 44.14%. In 2009 domestic private bank group has been the second highest. Foreign bank group with 80.99% is ranked first in 2009.
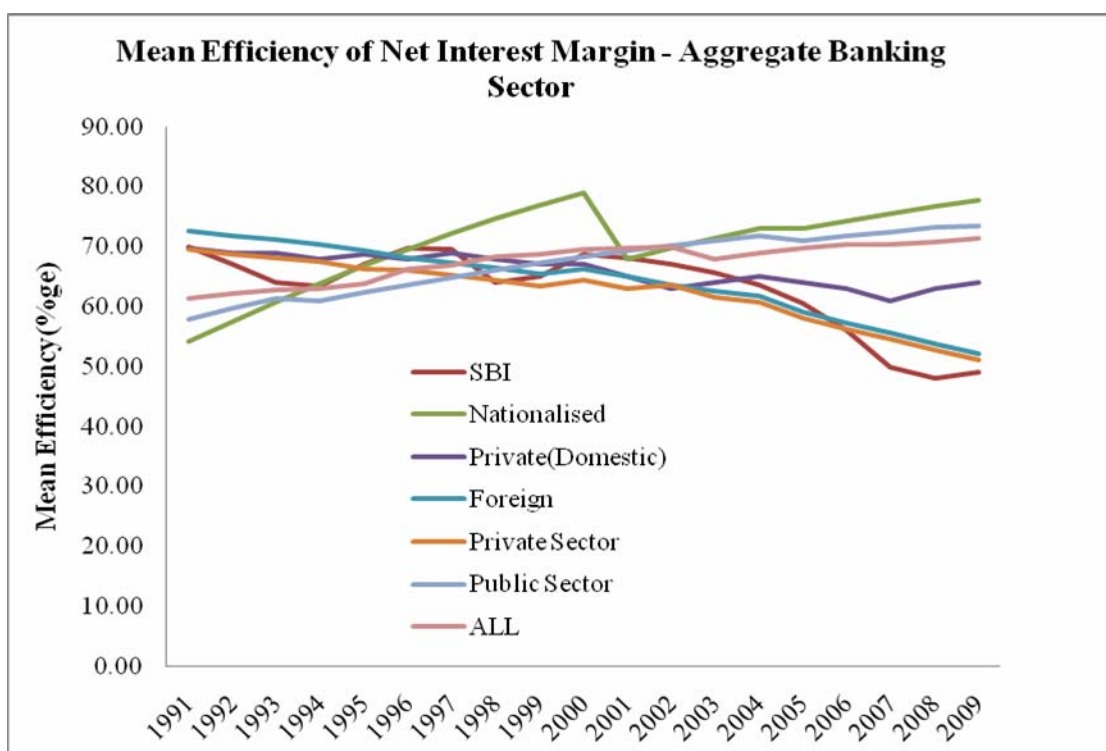
Figure 5.1

Table 5.10: Mean Efficiency of Investment -Aggregate Banking Sector

Year	SBI	Nationalised	Private(Domestic)	Foreign	Private Sector	Public Sector	ALL
1991	53.89	44.14	69.54	59.25	62.03	62.43	52.19
1992	58.78	40.75	71.04	58.63	60.80	62.43	54.71
1993	62.28	43.86	72.39	61.54	61.97	63.43	57.38
1994	64.73	46.81	73.57	64.32	62.79	64.46	57.81
1995	66.42	52.6	74.60	66.40	64.06	66.46	59.97
1996	67.58	55.22	75.28	68.50	66.20	65.46	62.49
1997	68.36	57.67	76.29	68.87	67.52	66.46	64.56
1998	68.90	59.95	76.78	68.28	67.90	67.46	64.67
1999	69.26	64.06	77.47	70.23	69.41	65.46	66.56
2000	69.50	53.01	77.92	72.38	73.70	66.46	68.4
2001	69.66	54.81	78.43	73.40	74.89	65.46	69.94
2002	70.90	56.45	78.8	72.09	76.00	66.46	71.05
2003	69.80	61.96	79.14	75.60	72.63	67.46	73.20
2004	69.90	61.94	79.43	77.02	75.56	67.46	74.17
2005	68.32	63.29	79.66	78.24	76.24	65.74	75.31
2006	69.95	64.53	79.85	77.91	77.00	66.74	76.27
2007	69.97	65.66	80.00	78.95	77.77	67.74	77.18
2008	71.00	66.69	80.14	80.23	78.29	67.74	77.86
2009	69.99	66.69	80.27	80.99	78.73	68.76	78.65

Note: Mean efficiencies are in percentage term.

In figure 5.2 it has been presented in graphical form.
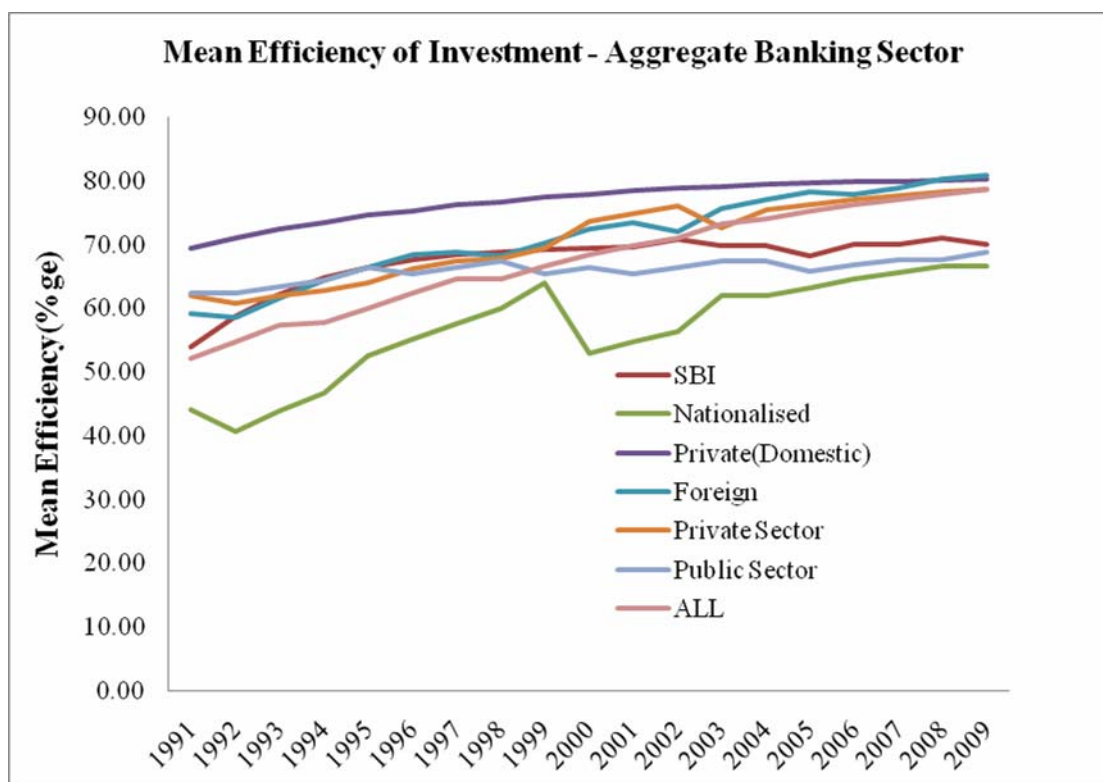
Figure 5.2

In table 5.11, TE of raising credit has been reported. In case of credit TE for all banks and also for each bank group has gone down over the period 1991 to 2009. In 1991 foreign banks group was at the top with 79.30% TE, while the public sector bank group was at the bottom with 65.85%. In 2009 nationalised bank is at the top with 67.12%.

The mean technical efficiency value in raising other income of all banks and each bank group is shown in table 4.12. The value of mean TE in raising other income for all banks as well as for each bank group has increased over the period of 1991 to 2009. In 1991 with 70.39% SBI bank group was at the top, followed by domestic private banks with 67.20%. On the other hand with 49.82% private sector bank group was at the bottom, followed by nationalised banks group with 51.41%. In 2009 private sector bank group with 93.60% is ranked first followed by private domestic banks with 92.20%. while for all banks it went up from 57.86% in 1991 to 85.32% in 2009. In figure 5.3 the same has been depicted in graphical form.

Table: 5.11 Mean Efficiency of Credit -Aggregate Banking Sector

Year	SBI	Nationalised	Private(Domestic)	Foreign	Private Sector	Public Sector	ALL
1991	71.47	78.00	72.01	79.3	75.15	65.85	77.44
1992	70.20	77.00	72.01	77.76	73.76	65.13	75.95
1993	68.85	78.00	69.29	76.70	72.88	64.41	75.17
1994	67.43	77.00	69.29	75.57	71.95	63.53	74.75
1995	65.93	76.00	69.29	73.13	69.78	62.78	72.80
1996	64.35	76.00	69.83	71.38	66.68	62.03	70.11
1997	62.70	76.18	61.95	70.08	65.63	61.27	69.04
1998	60.97	75.68	62.31	68.51	63.35	60.49	66.86
1999	59.15	75.16	63.00	66.63	61.96	59.71	65.65
2000	57.26	74.63	64.05	64.91	61.51	58.92	64.40
2001	55.29	74.09	67.00	63.58	60.78	58.12	63.98
2002	53.23	73.54	64.00	61.42	58.90	57.31	62.25
2003	51.10	72.97	71.00	59.82	62.12	56.49	66.01
2004	50.90	72.39	70.47	59.91	58.35	55.67	61.98
2005	48.63	69.75	67.00	55.38	57.24	53.83	59.21
2006	48.28	69.12	64.00	52.99	55.53	52.98	57.73
2007	45.88	68.46	62.66	50.75	54.71	52.13	56.78
2008	48.43	67.80	61.00	50.00	53.48	51.27	56.10
2009	45.24	67.12	62.00	50.00	51.14	49.82	54.18

Note: Mean efficiencies are in percentage term.
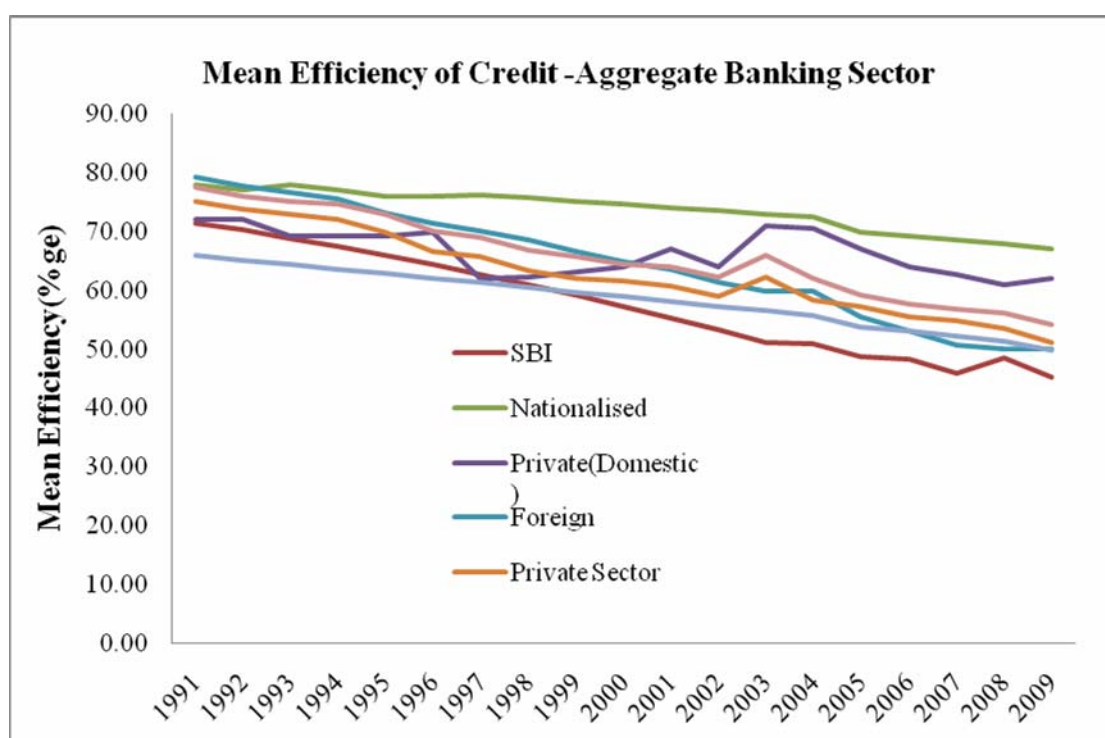
Figure 5.3

Table: 5.12 Mean Efficiency of Other Income -Aggregate Banking Sector

Year	SBI	Nationalised	Private(Domestic)	Foreign	Private Sector	Public Sector	ALL

1991	70.39	51.41	67.20	52.22	49.82	55.62	57.86
1992	71.29	55.03	71.47	53.12	52.62	57.44	60.36
1993	72.15	58.53	75.11	55.10	56.61	59.21	61.76
1994	72.97	58.88	78.42	57.05	60.46	60.94	63.08
1995	73.76	62.05	79.38	56.26	64.79	62.63	64.03
1996	74.51	65.05	80.44	57.82	68.66	64.27	65.65
1997	75.23	67.86	82.46	57.85	72.05	65.87	68.31
1998	75.92	70.49	82.67	60.53	74.8	67.41	70.47
1999	76.57	68.92	84.3	62.45	77.52	68.91	70.74
2000	77.19	71.18	85.81	64.27	80.04	70.36	72.87
2001	77.78	73.25	87.02	65.73	82.00	71.76	74.55
2002	78.34	75.16	88.11	67.39	84.18	73.10	76.41
2003	78.88	76.9	88.73	70.79	85.83	74.40	79.17
2004	79.38	78.49	89.79	74.25	87.73	75.65	80.59
2005	79.87	80.33	90.46	73.93	89.18	77.48	80.98
2006	80.32	81.61	91.03	74.88	90.51	78.60	82.12
2007	80.76	82.76	91.49	76.28	91.65	79.67	83.74
2008	81.17	83.81	91.85	78.06	92.70	80.70	84.66
2009	81.45	84.76	92.20	78.07	93.60	81.55	85.32

Note: Mean efficiencies are in percentage term.
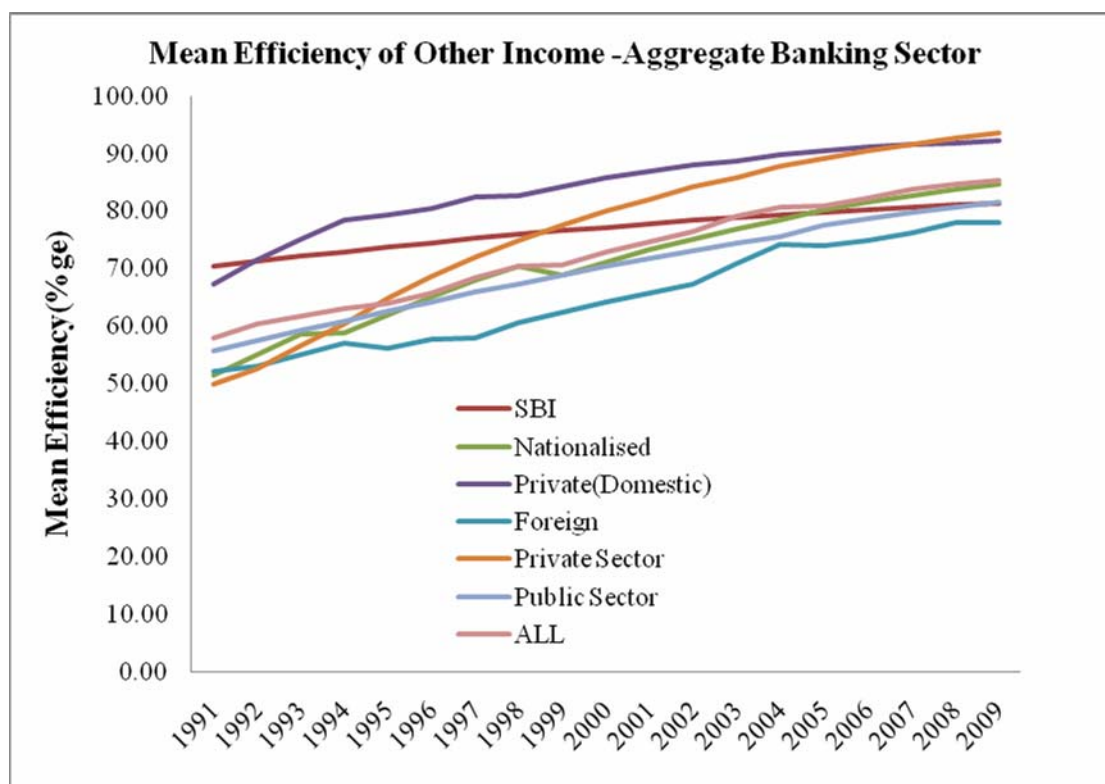
Figure 5.4

The mean technical efficiency of raising profit goal which basically takes into consideration interest income and other income is presented in table 5.13.

Table:5.13 Mean Efficiency of Profit Goal -Aggregate Banking Sector

Year	SBI	Nationalised	Private(Domestic)	Foreign	Private Sector	Public Sector	ALL
1991	74.51	60.14	53.41	85.80	70.96	59.93	50.14
1992	73.76	64.47	54.26	85.32	72.32	61.93	51.41
1993	72.97	68.48	54.98	85.24	73.85	60.93	52.45
1994	78.98	68.56	55.62	85.17	75.32	63.55	53.26
1995	78.97	69.97	59.13	83.85	76.53	67.55	54.37
1996	78.00	70.97	59.64	83.3	78.15	67.55	56.83
1997	77.00	71.81	62.11	83.17	79.40	69.55	57.81
1998	78.00	74.26	63.49	83.27	80.91	71.55	59.84
1999	78.00	76.44	65.82	83.36	82.04	71.55	60.77
2000	78.57	78.36	66.11	83.27	83.17	73.55	61.92
2001	78.29	80.04	66.36	83.06	84.05	73.55	62.28
2002	77.81	81.52	66.58	82.84	85.01	71.55	63.21
2003	77.03	82.80	67.79	83.27	85.61	71.55	62.05
2004	75.75	83.92	68.94	84.37	86.53	75.55	63.39
2005	73.68	85.04	72.09	82.71	87.36	75.19	64.5
2006	70.41	85.86	74.21	82.41	88.14	75.79	65.38
2007	65.43	86.58	76.32	82.32	88.81	77.79	66.13
2008	58.23	87.19	78.41	82.44	89.55	77.79	66.88
2009	55.06	87.80	78.49	82.10	90.17	79.46	67.98

Note: Mean efficiencies are in percentage term.

The mean TE of raising profit goal has increased for all banks as well as for each bank group except SBI bank group and foreign bank group. In 1991 foreign banks TE was 85.80%, this bank group stood first with respect to technical efficiency. Private sector banks with 90.17% ranked first in 2009. In all banks as well as for each bank group there is an almost smooth upward trend except in SBI bank group. For all banks TE has gone up from 50.14% in 1991 to 67.98% in 2009. It has been shown graphically in figure 5.5.

Similarly mean TE for raising banking growth has been shown in table 5.14. There is mixed trend in the mean TE values for raising banking growth which basically takes into consideration the objectives of fostering growth and safety of banking system.
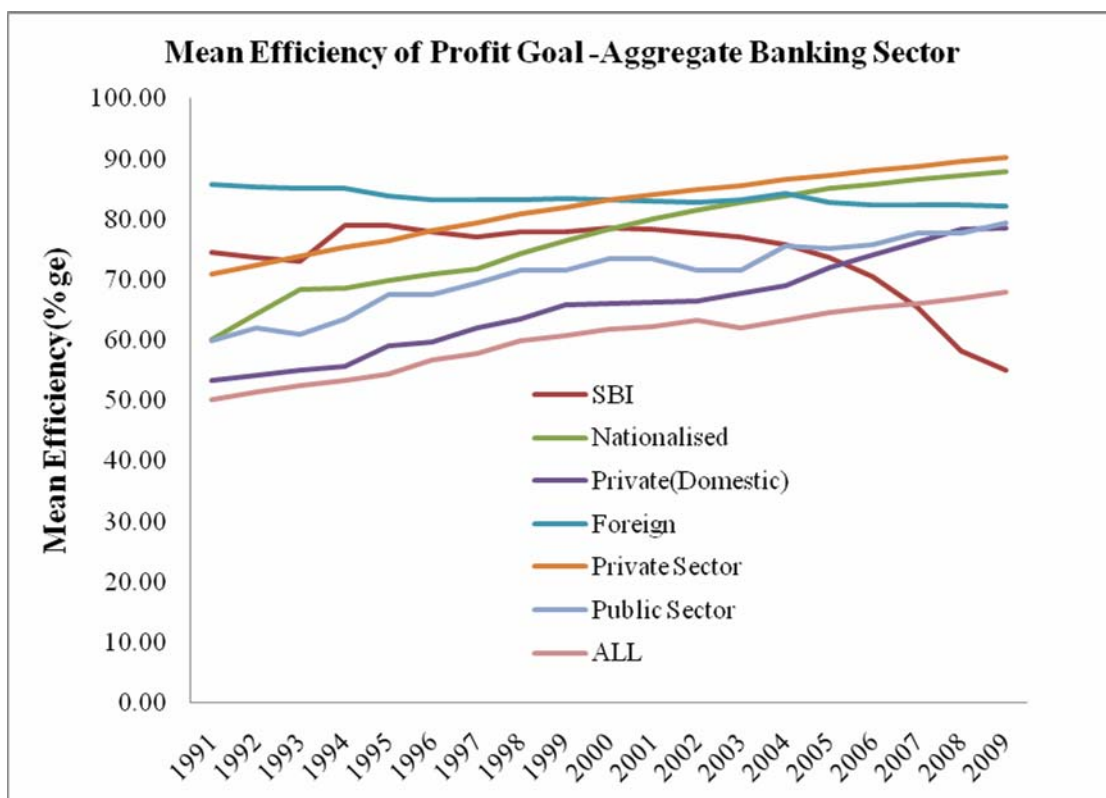
Figure 5.5

Table: 5.14 Mean Efficiency of Banking Growth -Aggregate Banking Sector

Year	SBI	Nationalised	Private(Domestic)	Foreign	Private Sector	Public Sector	ALL
1991	69.70	69.98	80.16	73.05	73.25	76.46	73.95
1992	69.61	67.98	81.04	74.22	75.2	66.79	74.65
1993	69.50	68.96	79.88	75.49	77.35	66.79	75.70
1994	68.35	65.94	79.70	76.71	79.36	65.79	76.74
1995	67.17	66.91	79.49	77.31	81.31	67.55	77.23
1996	67.93	65.87	79.27	77.80	82.15	67.19	77.79
1997	65.63	64.81	78.96	78.06	83.39	66.55	78.74
1998	64.24	63.71	78.66	78.27	82.96	67.55	77.98
1999	63.75	63.56	78.32	79.09	84.53	65.55	78.91
2000	63.11	64.34	77.86	80.18	86.03	66.55	79.89
2001	62.31	65.01	77.41	82.33	88.79	66.55	81.81
2002	61.28	63.51	76.83	83.08	89.30	65.55	82.17
2003	59.97	62.76	75.79	85.59	91.58	63.55	84.65
2004	69.32	62.64	75.36	86.50	92.5	63.55	84.77
2005	67.25	61.13	74.47	86.89	93.00	63.25	85.30
2006	64.66	60.77	73.46	87.21	93.73	59.55	85.97
2007	61.45	60.35	71.82	87.93	94.58	58.93	86.73
2008	57.50	56.51	70.43	88.98	95.19	57.93	87.37
2009	51.80	55.47	68.84	89.59	95.66	57.93	87.84

Note: Mean efficiencies are in percentage term.

This output is summation of credit and investment of the banks. For SBI bank group, nationalized bank group, domestic private banks and for public sector banks TE has declined over the period 1991-2009. On the other hand for all banks, foreign banks and for private sector banks TE has gone up. In 1991 with 80.16% private domestic banks were in the first place, followed by public sector banks with 76.46% .. The foreign bank group and private sector bank group has performed well and increased their mean TE for raising banking growth over the period of 1991 to 2009. This has been depicted in graph in figure 5.6.
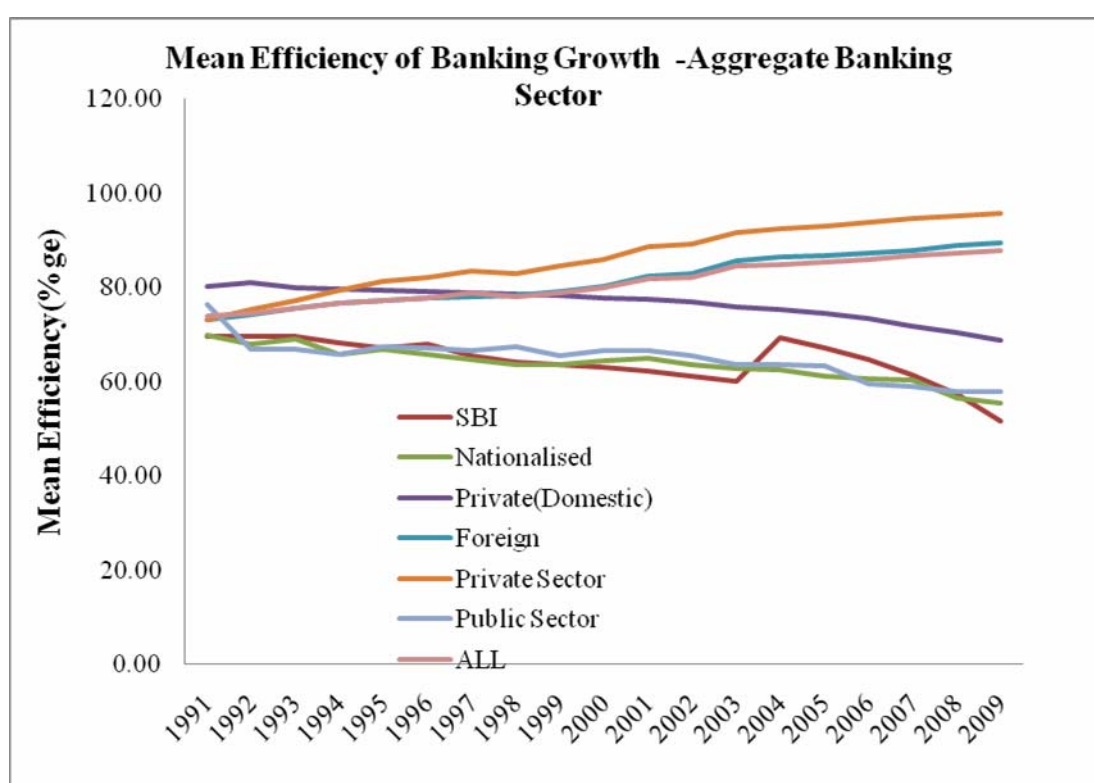
Figure 5.6

5.3.0.1.1   Technical estimates bank group wise for all outputs:

In previous section we have shown the mean TE, output wise for all banks as well for each bank group and analyzed how it varies over the period across the different bank groups. In this section we have shown   the TE scores for each bank group with reference to all outputs. The mean TE of SBI bank group has been depicted in table 5.15. The mean

TE for raising some outputs has increased, for some other outputs decreased over the period of 1991 to 2009. Mean TE for raising net interest margin has decreased from 69.97% in 1991 to 49% in 2009.

Table: 5.15 Mean Efficiency of Banks of SBI Bank Group

Year	Net interest Margin	Investme nt	Credit	Other Income	Profit Goal	Banking Growth
1991	69.97	53.89	71.47	70.39	74.51	69.70
1992	67.00	58.78	70.20	71.29	73.76	69.61
1993	64.00	62.28	68.85	72.15	72.97	69.50
1994	63.40	64.73	67.43	72.97	78.98	68.35
1995	67.00	66.42	65.93	73.76	78.97	67.17
1996	69.77	67.58	64.35	74.51	78.00	67.93
1997	69.64	68.36	62.70	75.23	77.00	65.63
1998	64.00	68.90	60.97	75.92	78.00	64.24
1999	65.00	69.26	59.15	76.57	78.00	63.75
2000	68.76	69.50	57.26	77.19	78.57	63.11
2001	68.13	69.66	55.29	77.78	78.29	62.31
2002	67.17	70.90	53.23	78.34	77.81	61.28
2003	65.75	69.80	51.10	78.88	77.03	59.97
2004	63.63	69.90	50.90	79.38	75.75	69.32
2005	60.53	68.32	48.63	79.87	73.68	67.25
2006	56.07	69.95	48.28	80.32	70.41	64.66
2007	49.81	69.97	45.88	80.76	65.43	61.45
2008	48.00	71.00	48.43	81.17	58.23	57.50
2009	49.00	69.99	45.24	81.45	55.06	51.80

Note: Mean efficiencies are in percentage term.

Regarding SBI bank group the mean TE for raising some outputs such as investment and other income increased during the period 1991-2009 while for some other outputs NIM, credit, profit goal and banking growth variables decreased for the same period. With reference to interest margin the TE fell from 69.97% in 1991 to 49.00% in 2009. The study observed a remarkable declining trend from 2007 onwards. With reference to investment the TE rose from 53.89% to 69.99%. The highest TE score i.e. 71.00% was registered in 2008. With regard to credit the TE continuously declined from 71.47% in 1991 to 45.245 in 2009. TE for raising other income almost continuously rose from

70.39% to 81.45%. In the case of profit goal the TE gradually increased from 74.51% in 1991 to 78.29% in 2001 and thereafter started declining and reached 55.06% in 2009. Considering the banking growth variable it gradually dripped down except in one or two years.
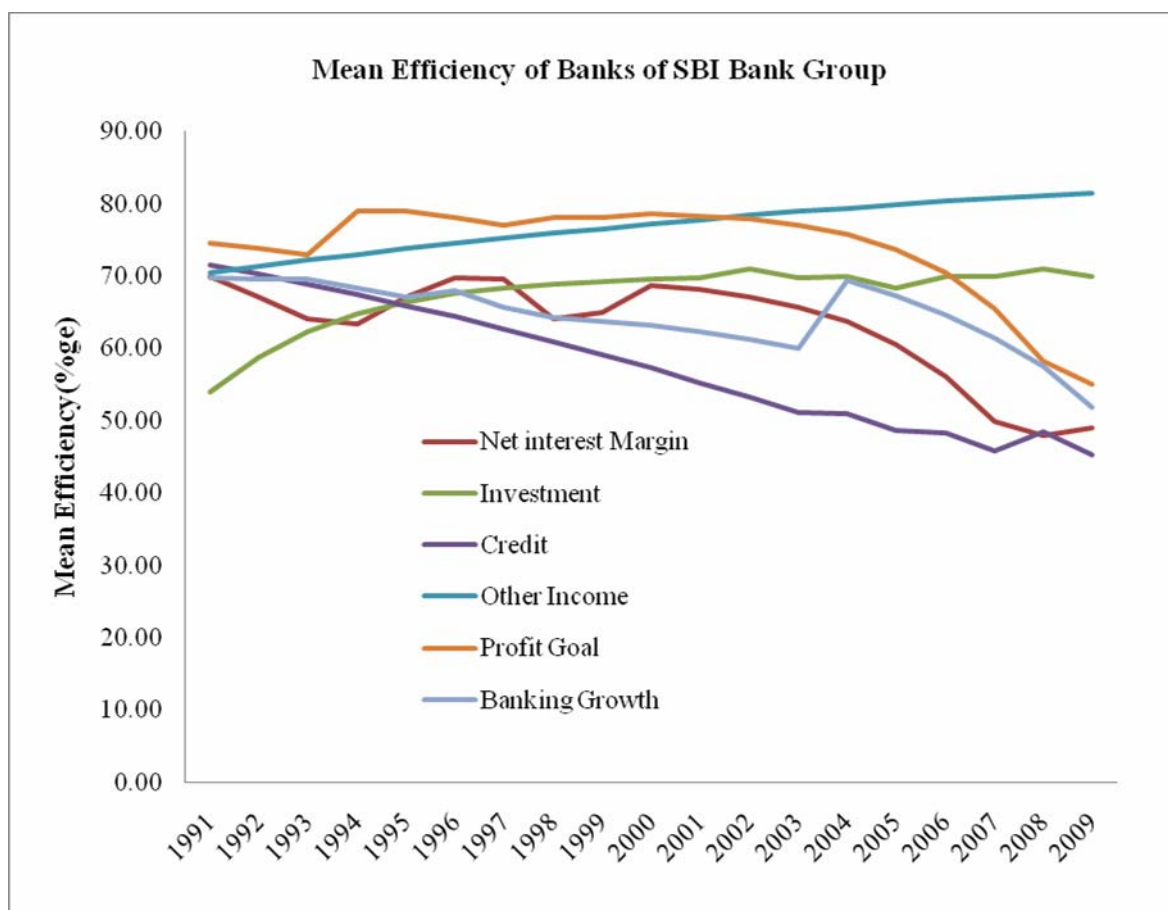
Figure 5.7

In the case of nationalized banks the mean TE scores for raising NIM increased from 54.14% in 1991 to 77.69% in 2009 except in the year 2001 where TE plunged and thereafter increasing trend continued. Similar trend was observed in the case of investment where the TE rose from 44.14% to 66.69% except for the year 2000 where TE dipped. There was almost a declining trend in raising credit from 78.00% to 67.12%. As regards other income TE rose from 51.41% to 84.76%. TE for raising profit goal continuously increased from 60.14% to 87.80%. With respect to banking growth there was a gradual decline. Therefore there was an increase in TE for raising NIM, investment,

other income, profit goal while a decline in TE was observed in the case of credit and

banking growth.

Table: 5.16 Mean Efficiency of Nationalised Banks

Year	Net interest Margin	Investment	Credit	Other Income	Profit Goal	Banking Growth
1991	54.14	44.14	78.00	51.41	60.14	69.98
1992	57.50	40.75	77.00	55.03	64.47	67.98
1993	60.75	43.86	78.00	58.53	68.48	68.96
1994	63.86	46.81	77.00	58.88	68.56	65.94
1995	66.81	52.60	76.00	62.05	69.97	66.91
1996	69.60	55.22	76.00	65.05	70.97	65.87
1997	72.22	57.67	76.18	67.86	71.81	64.81
1998	74.67	59.95	75.68	70.49	74.26	63.71
1999	76.95	64.06	75.16	68.92	76.44	63.56
2000	79.06	53.01	74.63	71.18	78.36	64.34
2001	68.01	54.81	74.09	73.25	80.04	65.01
2002	69.81	56.45	73.54	75.16	81.52	63.51
2003	71.45	61.96	72.97	76.90	82.80	62.76
2004	72.96	61.94	72.39	78.49	83.92	62.64
2005	72.94	63.29	69.75	80.33	85.04	61.13
2006	74.29	64.53	69.12	81.61	85.86	60.77
2007	75.53	65.66	68.46	82.76	86.58	60.35
2008	76.66	66.69	67.80	83.81	87.19	56.51
2009	77.69	66.69	67.12	84.76	87.80	55.47

Note: Mean efficiencies are in percentage term.
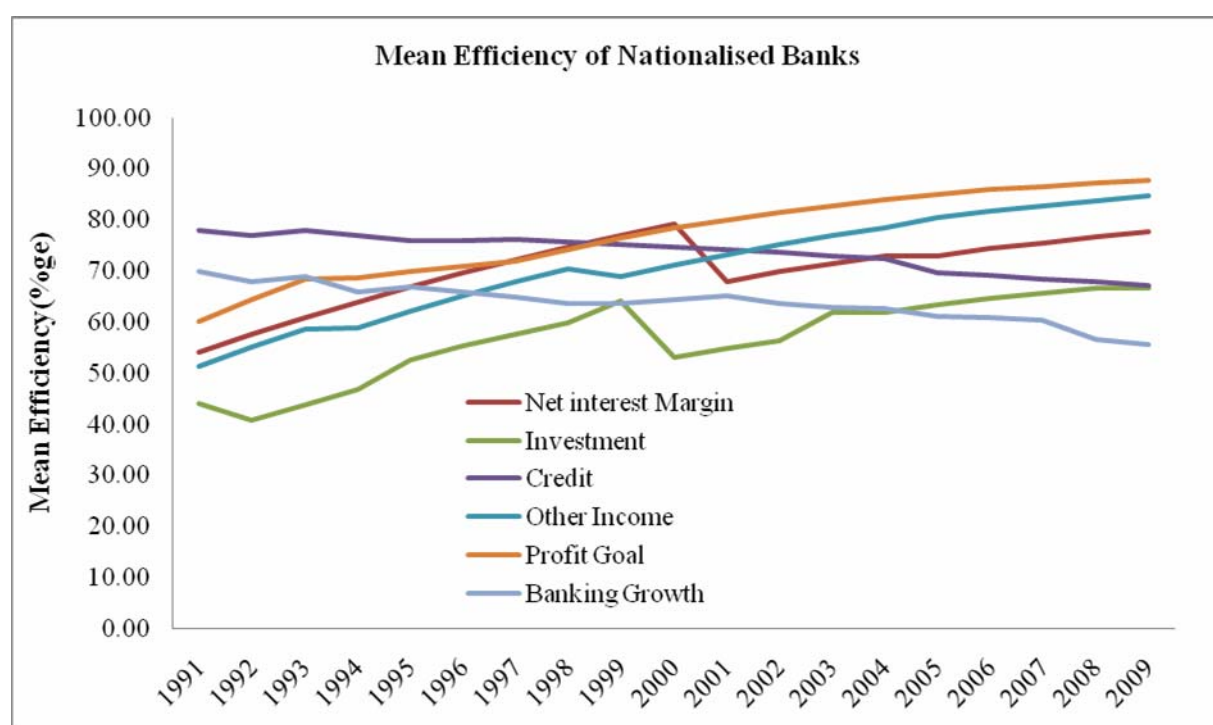
Figure 5.8

Table:5.17 Mean Efficiency of Domestic Private Banks

Year	Net interest Margin	Investment	Credit	Other Income	Profit Goal	Banking Growth
1991	69.82	69.54	72.01	67.20	53.41	80.16
1992	69.00	71.04	72.01	71.47	54.26	81.04
1993	69.00	72.39	69.29	75.11	54.98	79.88
1994	68.00	73.57	69.29	78.42	55.62	79.70
1995	68.74	74.60	69.29	79.38	59.13	79.49
1996	68.00	75.28	69.83	80.44	59.64	79.27
1997	69.00	76.29	61.95	82.46	62.11	78.96
1998	68.00	76.78	62.31	82.67	63.49	78.66
1999	67.00	77.47	63.00	84.30	65.82	78.32
2000	67.00	77.92	64.05	85.81	66.11	77.86
2001	65.00	78.43	67.00	87.02	66.36	77.41
2002	63.00	78.80	64.00	88.11	66.58	76.83
2003	64.00	79.14	71.00	88.73	67.79	75.79
2004	65.00	79.43	70.47	89.79	68.94	75.36
2005	64.00	79.66	67.00	90.46	72.09	74.47
2006	63.00	79.85	64.00	91.03	74.21	73.46
2007	61.00	80.00	62.66	91.49	76.32	71.82
2008	63.00	80.14	61.00	91.85	78.41	70.43
2009	64.00	80.27	62.00	92.20	78.49	68.84

Note: Mean efficiencies are in percentage terms.

Regarding domestic private banks the TE scores for raising NIM declined from 69.82%in 1991 to 63% in 2002. A marginal increase was observed in 2003 and 2004 and thereafter TE started to diminish up to 2007 and again increased till 2009. With regard to investment TE gradually escalated from 69.54% IN 1991 to 80.27% in 2009. In respect of credit there was a fluctuating trend. TE for rising other income mounted to 92.20% from 67.20%. TE scores for rising profit goal increased from 53.41% to 78.49%. With respect to banking growth TE gradually diminished.

Therefore TE scores for rising investment, other income and profit goal increased while for investment, credit and banking growth TE scores were reduced.
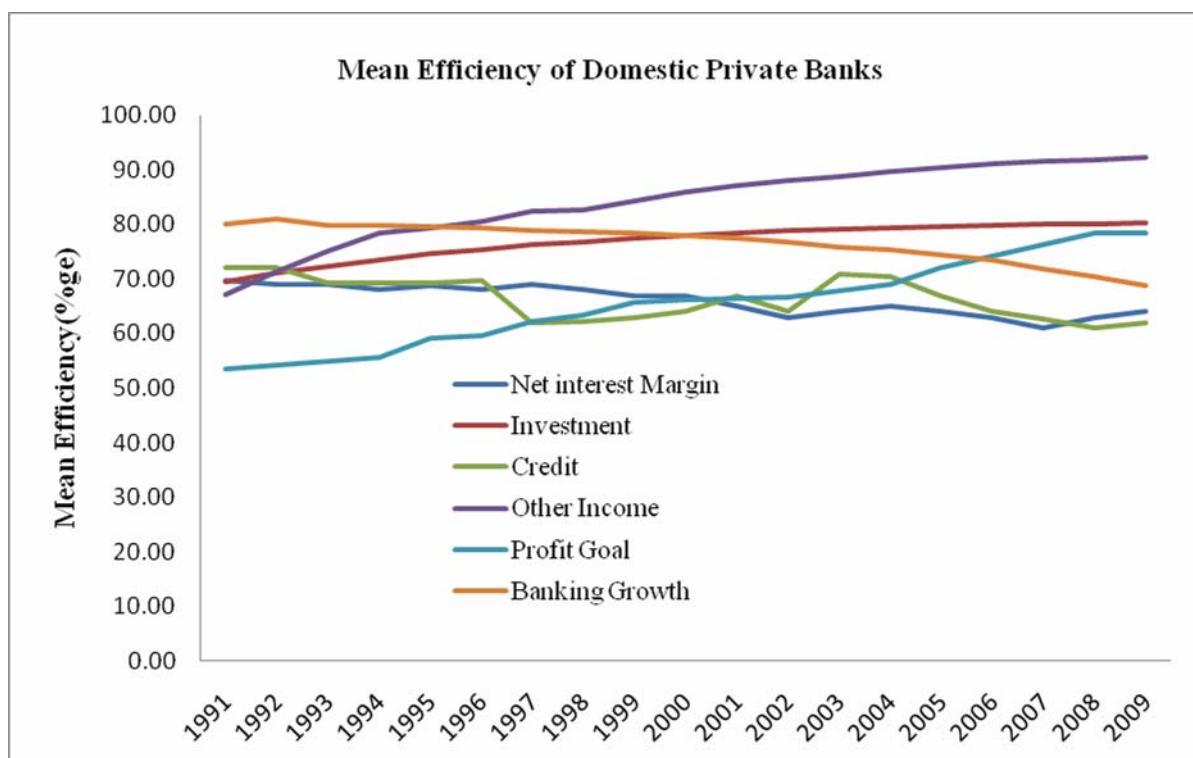
Figure 5.9

Table:5.18 Mean Efficiency of Foreign Banks

Year	Net interest Margin	Investment	Credit	Other Income	Profit Goal	Banking Growth
1991	72.52	59.25	79.30	52.22	85.80	73.05
1992	71.83	58.63	77.76	53.12	85.32	74.22
1993	71.16	61.54	76.70	55.10	85.24	75.49
1994	70.45	64.32	75.57	57.05	85.17	76.71
1995	69.25	66.40	73.13	56.26	83.85	77.31
1996	68.10	68.50	71.38	57.82	83.30	77.80
1997	67.28	68.87	70.08	57.85	83.17	78.06
1998	66.40	68.28	68.51	60.53	83.27	78.27
1999	65.46	70.23	66.63	62.45	83.36	79.09
2000	66.34	72.38	64.91	64.27	83.27	80.18
2001	65.04	73.40	63.58	65.73	83.06	82.33
2002	63.71	72.09	61.42	67.39	82.84	83.08
2003	62.59	75.60	59.82	70.79	83.27	85.59
2004	61.83	77.02	59.91	74.25	84.37	86.50
2005	59.04	78.24	55.38	73.93	82.71	86.89
2006	57.31	77.91	52.99	74.88	82.41	87.21
2007	55.56	78.95	50.75	76.28	82.32	87.93
2008	53.80	80.23	50.00	78.06	82.44	88.98
2009	52.12	80.99	50.00	78.07	82.10	89.59

Note: Mean efficiencies are in percentage terms.

In the case of foreign banks TE for rising NIM continuously diminished from 72.52% in 1991 to 52.12% in 'o9. The study found a boost in TE with regard to investment from 59.25% in 1991 to 80.99% in '09. With regard to credit the TE scores gradually tapered off from 79.30% to 50.00%. There was an augmentation in the scores for raising other income. With respect to profit goal TE scores continuously diminished except for one or two years. The scores for raising banking growth rose to 89.59% from 73.05%.

Overall for foreign banks TE scores for three outputs i.e. investment, other income and banking growth increased while for the other three outputs they decreased.
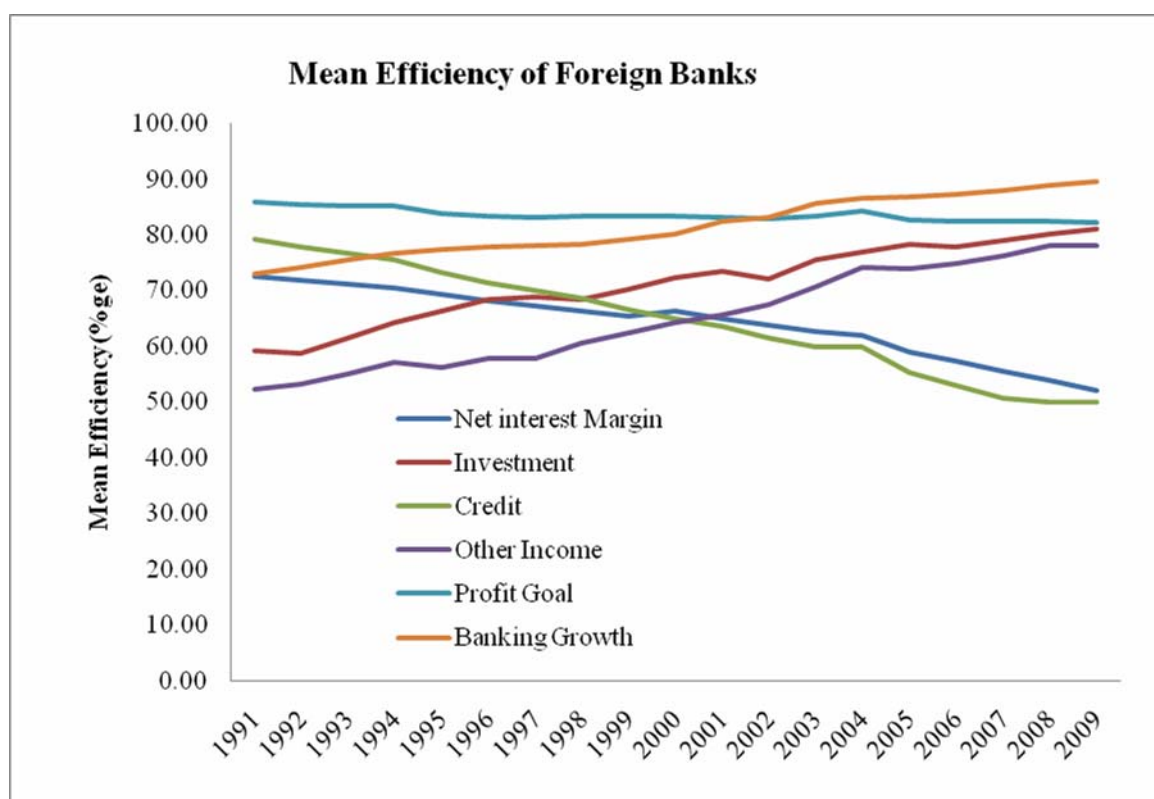
Figure 5.10

In the case of private sector banks the TE scores for raising NIM continuously dwindled from 69.52% in '91 to 51.12% in '09. With regard to investment TE mounted to 78.73% in 2009 from 62.03% in 1991 except for one or two years. TE scores for raising credit

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declined over the study period. TE for other income rose. There was a continuous escalation in TE scores with regard to profit goal from 70.96 5 to 90.17%. The study observed a rise in TE with regard to banking growth from 73.25% in '91 to 95.66% in '09.

Table: 5.19 Mean Efficiency of Private Sector Banks

Year	Net interest Margin	Investment	Credit	Other Income	Profit Goal	Banking Growth
1991	69.52	62.03	75.15	49.82	70.96	73.25
1992	68.83	60.80	73.76	52.62	72.32	75.20
1993	68.16	61.97	72.88	56.61	73.85	77.35
1994	67.45	62.79	71.95	60.46	75.32	79.36
1995	66.25	64.06	69.78	64.79	76.53	81.31
1996	66.10	66.20	66.68	68.66	78.15	82.15
1997	65.28	67.52	65.63	72.05	79.40	83.39
1998	64.40	67.90	63.35	74.80	80.91	82.96
1999	63.46	69.41	61.96	77.52	82.04	84.53
2000	64.34	73.70	61.51	80.04	83.17	86.03
2001	63.04	74.89	60.78	82.00	84.05	88.79
2002	63.71	76.00	58.90	84.18	85.01	89.30
2003	61.59	72.63	62.12	85.83	85.61	91.58
2004	60.83	75.56	58.35	87.73	86.53	92.50
2005	58.04	76.24	57.24	89.18	87.36	93.00
2006	56.31	77.00	55.53	90.51	88.14	93.73
2007	54.56	77.77	54.71	91.65	88.81	94.58
2008	52.80	78.29	53.48	92.70	89.55	95.19
2009	51.12	78.73	51.14	93.60	90.17	95.66

Note: Mean efficiencies are in percentage term.
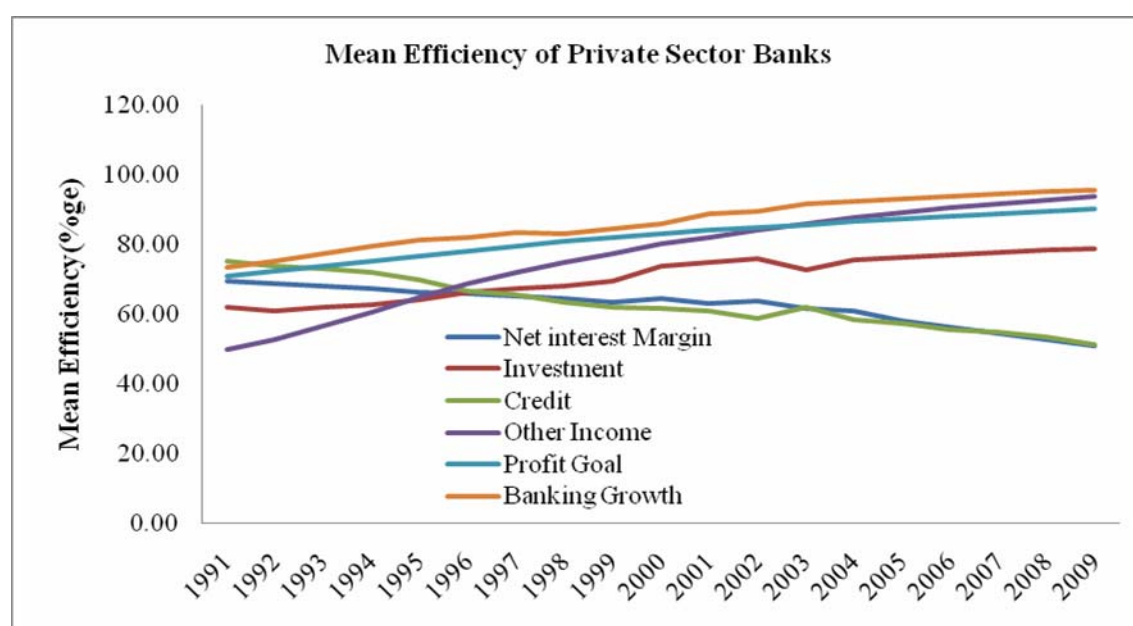
Figure 5.11

To sum up, for investment, other income, profit goal, banking growth TE scores improved while for other two outputs they were reduced.

Table:5.20 Mean Efficiency of Public Sector Banks

Year	Net interest Margin	Investment	Credit	Other Income	Profit Goal	Banking Growth
1991	57.93	62.43	65.85	55.62	59.93	76.46
1992	59.65	62.43	65.13	57.44	61.93	66.79
1993	61.30	63.43	64.41	59.21	60.93	66.79
1994	60.85	64.46	63.53	60.94	63.55	65.79
1995	62.28	66.46	62.78	62.63	67.55	67.55
1996	63.63	65.46	62.03	64.27	67.55	67.19
1997	64.91	66.46	61.27	65.87	69.55	66.55
1998	66.11	67.46	60.49	67.41	71.55	67.55
1999	67.23	65.46	59.71	68.91	71.55	65.55
2000	68.28	66.46	58.92	70.36	73.55	66.55
2001	69.27	65.46	58.12	71.76	73.55	66.55
2002	70.18	66.46	57.31	73.10	71.55	65.55
2003	71.04	67.46	56.49	74.40	71.55	63.55
2004	71.83	67.46	55.67	75.65	75.55	63.55
2005	70.98	65.74	53.83	77.48	75.19	63.25
2006	71.75	66.74	52.98	78.60	75.79	59.55
2007	72.47	67.74	52.13	79.67	77.79	58.93
2008	73.14	67.74	51.27	80.70	77.79	57.93
2009	73.54	68.76	49.82	81.55	79.46	57.93

Note: Mean efficiencies are in percentage term.
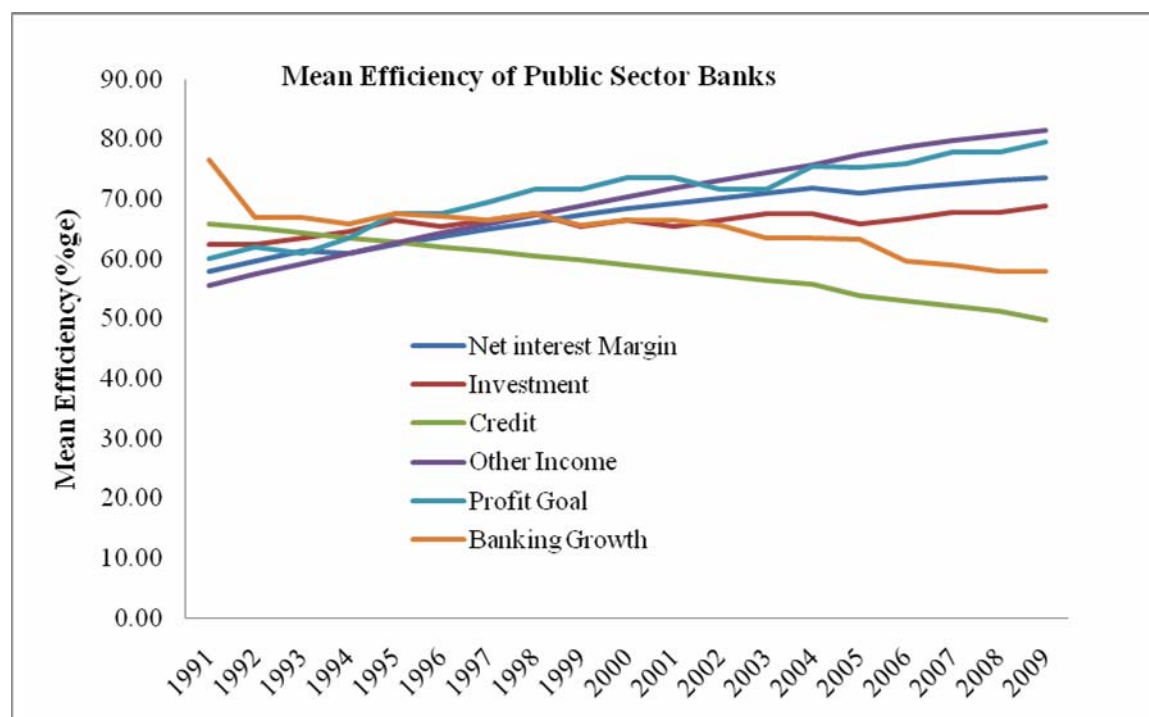
Figure 5.12

With regard to public sector banks TE for raising NIM mounted to73.54% in 2009 from 57.93% in 1991. With regard to investment there was a continuous raise in TE from 62.43% to 68.76% except for one or two years. The study found a declining trend in TE with reference to credit from 65.85% to 49.82%. TE scores for raising other income were boosted up from 55.62% in '91 to 81.55% in '09. There was a gradual increase in TE score for raising profit goal. The study found a decreasing trend in TE score with respect to banking growth from 76.46% to 57.93%.

Table: 5.21 Mean Efficiency of All Banks

Year	Net interest Margin	Investment	Credit	Other Income	Profit Goal	Banking Growth
1991	61.42	52.19	77.44	57.86	50.14	73.95
1992	62.2	54.71	75.95	60.36	51.41	74.65
1993	62.75	57.38	75.17	61.76	52.45	75.7
1994	63.06	57.81	74.75	63.08	53.26	76.74
1995	63.73	59.97	72.8	64.03	54.37	77.23
1996	66.28	62.49	70.11	65.65	56.83	77.79
1997	66.8	64.56	69.04	68.31	57.81	78.74
1998	68.28	64.67	66.86	70.47	59.84	77.98
1999	68.78	66.56	65.65	70.74	60.77	78.91
2000	69.49	68.4	64.4	72.87	61.92	79.89
2001	69.72	69.94	63.98	74.55	62.28	81.81
2002	69.89	71.05	62.25	76.41	63.21	82.17
2003	67.81	73.2	66.01	79.17	62.05	84.65
2004	68.94	74.17	61.98	80.59	63.39	84.77
2005	69.84	75.31	59.21	80.98	64.5	85.3
2006	70.33	76.27	57.73	82.12	65.38	85.97
2007	70.47	77.18	56.78	83.74	66.13	86.73
2008	70.88	77.86	56.1	84.66	66.88	87.37
2009	71.42	78.65	54.18	85.32	67.98	87.84

Note: Mean Efficiencies are in percentage term

5.3.0.1.2 Mean efficiency of all banks

The TE in raising NIM escalated from 61.42% to 71.42% for 2003. As regards investment a continuous raise in TE was observed from 52.19% to 78.65%. TE for raising credit gradually tapered off from 77.44% to 54.18% in 2009 except in 2003. With

reference to other income TE escalated from 57.86% in '91 to85.32% in '09. TE for raising profit goal gradually improved from 50.14% to 67.98%. There was a raise in TE with regard to banking growth.
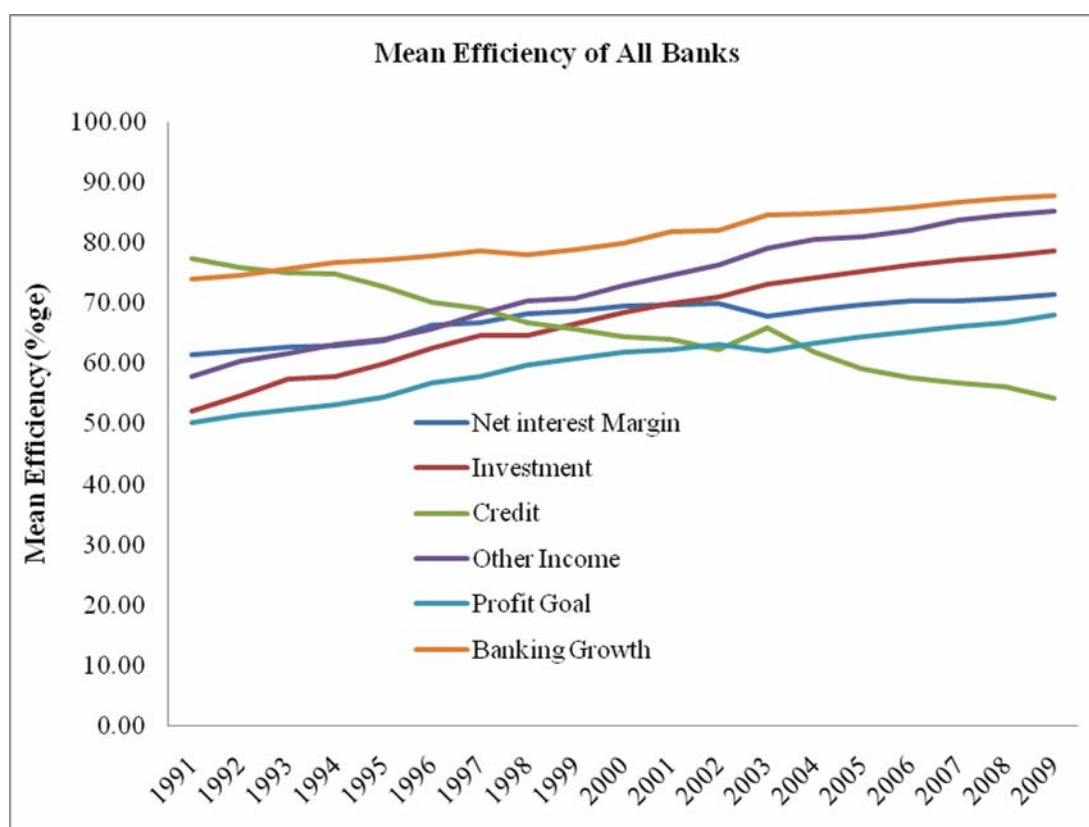
Figure 5.13

On the whole it may be observed that in the entire banking sector technical efficiency registered an increasing trend in rising three outputs except for credit. In the public sector banks the study found that a similar trend was observed. The study observed a mixed trend in case of private sector and foreign banks.

If we take in to consideration the TE scores for rising profit goal both public and private sector banks performed efficiently followed by foreign banks. There was a wide spread increase in efficiency for the entire banking sector from 50.14 % to 67.98% between1991 and 2009.

It can be concluded that with regard to profit goal both public sector and private sector bank's efficiency has increased from 1991 to 2009 where as there is a decline in efficiency of foreign banks. Therefore it can be said that public sector and private sector banks are more efficient when compared to foreign banks. The efficiency of the entire banking sector has improved 50.14% in 1991 to 67.98% in 2009. Therefore the efficiency of the entire banking sector has gradually improved in the study period i.e., 1991 to 2009.

5.3.1 Analysis of Results of DEA:

The DEA scores are shown in tables 5.22 to 5.29 for the two alternative input-output combinations. The efficiency scores are given for the year 1991, 1996, 2001, 2006 and 2009. Though scores are generated for all the years in the sample period, results for the select years mentioned above are given the table, for two reasons namely, space constraint and the results being reflecting a similar trend for the intervening years. It may be noted that banks with efficiency score one are said to be on frontier and regarded as technically efficient. Efficiency score less than one indicates technical inefficiency. A score being zero indicates that the bank is totally technically inefficient. As the score of a bank, moves away from 1 it will be away from the frontier.

The results are presented for two alternative combinations of input-output. The first combination has inputs: number of employees, establishment expenditure, non-establishment expenditure, Non-interest expenditure and fixed assets. The corresponding outputs are: deposits, advances, investments, net interest margin and other income. The second (alternative) combination has the same inputs, but in the output, the output variable 'other income' is replaced by 'total income'. These details are provided in the respective tables as foot notes.

Table 5.22, shows the DEA estimate of efficiency score of public sector bank group for the first combination. In the year 1991, under the assumption of variable returns to scale (VRS), out of 27 banks 18 banks are on the frontier having efficiency score one. These banks regarded as technically efficient banks. But the number of such banks is reduced to 10 when the scores are estimated on the assumption of constant returns to scale (CRS). This difference in the finding may be attributed to factors such as size of banks, branch locations and financial constraints, which are not considered in case of CRS. State bank of Bikaner and Jaipur with efficiency score 0.896 has been found to be the most technically inefficient bank when VRS is considered. While in case of CRS and scale efficiency score, State Bank of Indore with 0.796 is shown to be the most technically inefficient bank. In the year 1996, number of banks with efficiency score one, increased to 21 in case of VRS technical efficiency and to 16 in case of CRS and scale efficiency score. While Vijaya bank with 0.886 VRS technical efficiency score is the most inefficient bank, going by (CRS technical efficiency and scale efficiency) State Bank of Indore is most inefficient. 19 banks and 12 banks out of 27 banks are at the frontier that is having technical efficiency score one in case of VRS and CRS assumption respectively. Vijaya bank is the most inefficient bank when CRS technical efficiency score is taken into account and in case of VRS Allahabad bank is the most inefficient bank. But, in the year 2006, the number of banks operating on the frontier in both cases that is VRS and CRS technical efficiency score. State Bank of Mysore is most technically inefficient bank in years 2006 and 2009 for all the three efficiency score. The score of all three efficiency have increased in the year 2009.

For the other input-output combination, DEA estimates are shown in table 5.23. From the table by and large, a similar trend is observed. Vijaya bank with VRS technical efficiency scores 0.863 and 0.887 is found to be inefficient in the years 1991 and 1996 respectively.

While Sate Bank of Indore with CRS technical efficiency scores of 0.842 and 0.834 is found inefficient in the year 1991 and 1996 respectively. In the year 2001, Allahabad Bank is found most inefficient with VRS and CRS technical efficiency scores of 0.812 and 0.804 respectively. Bank of India and Punjab and Sind Bank are the most inefficient ones in the year 2006 according to VRS and CRS technical efficiency measure respectively. Most interestingly in the year 2009, State Bank of Mysore is the most inefficient as it was in the earlier case.

Banks\Year	1991			1996			2001			2006			2009		
	Crste	vrste	scale	crste	vrste	scale	crste	vrste	scale	crste	vrste	scale	crste	vrste	scale
STATE BANK OF INDIA	1	1	1	1	1	1	0.849	1	0.849	1	1	1	1	1	1
STATE BANK OF BIKANER & JAIPUR	0.947	0.961	0.986	1	1	1	1	1	1	1	1	1	0.964	0.979	0.985
STATE BANK OF HYDERABAD	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
STATE BANK OF INDORE	0.882	1	0.882	0.834	1	0.834	1	1	1	1	1	1	1	1	1
STATE BANK OF MYSORE	0.897	0.987	0.91	1	1	1	1	1	1	0.947	0.989	0.958	0.802	0.922	0.87
STATE BANK OF PATIALA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
STATE BANK OF SAURASHTRA	0.957	1	0.957	1	1	1	1	1	1	1	1	1	1	1	1
STATE BANK OF TRAVANCORE	0.992	1	0.992	1	1	1	1	1	1	1	1	1	-	-	-
ALLAHABAD BANK	1	1	1	0.948	0.972	0.975	0.804	0.812	0.99	1	1	1	1	1	1
ANDHRA BANK	0.911	0.911	1	1	1	1	1	1	1	1	1	1	1	1	1
BANK OF BARODA	1	1	1	1	1	1	0.906	1	0.906	0.899	0.978	0.92	1	1	1
BANK OF INDIA	1	1	1	1	1	1	1	1	1	0.899	0.909	0.989	1	1	1
BANK OF MAHARASHTRA	0.972	0.982	0.989	1	1	1	1	1	1	1	1	1	0.995	1	0.995
CANARA BANK	0.973	1	0.973	0.966	1	0.966	1	1	1	1	1	1	1	1	1
CENTRAL BANK OF INDIA	0.946	0.989	0.957	0.988	1	0.988	0.893	0.978	0.914	0.951	1	0.951	1	1	1
CORPORATION BANK	0.886	0.981	0.903	1	1	1	1	1	1	1	1	1	1	1	1
DENA BANK	1	1	1	1	1	1	0.82	0.885	0.927	1	1	1	0.895	0.941	0.951
INDIAN BANK	1	1	1	0.907	0.911	0.995	1	1	1	0.976	1	0.976	1	1	1
INDIAN OVERSEAS BANK	0.989	0.996	0.993	1	1	1	0.9	0.915	0.983	1	1	1	1	1	1
ORIENTAL BANK OF COMMERCE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
PUNJAB AND SIND BANK	0.956	1	0.956	0.879	0.944	0.932	0.891	0.947	0.941	0.897	0.918	0.978	1	1	1
PUNJAB NATIONAL BANK	1	1	1	0.927	1	0.927	0.945	1	0.945	0.987	1	0.987	1	1	1
SYNDICATE BANK	0.957	1	0.957	0.897	0.962	0.932	0.885	1	0.885	0.958	0.958	1	1	1	1
UCO BANK	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
UNION BANK OF INDIA	0.933	1	0.933	0.88	0.943	0.933	0.97	1	0.97	1	1	1	1	1	1
UNITED BANK OF INDIA	1	1	1	1	1	1	1	1	1	1	1	1	0.913	0.934	0.977
VIJAYA BANK	0.842	0.863	0.975	0.838	0.887	0.945	0.8	0.844	0.947	0.968	0.994	0.974	0.959	0.977	0.982
IDBI BANK LTD.	-	-	-	-	-	-	-	-	-	1	1	1	1	1	1
Mean	**0.964**	**0.988**	**0.976**	**0.965**	**0.986**	**0.979**	**0.95**	**0.977**	**0.972**	**0.982**	**0.991**	**0.99**	**0.983**	**0.991**	**0.991**

*These results refer to Combinations: - inputs: Number of Employees, Establishment Expenditure, Non-establishment Expenditure, Non-interest Expenditure and Fixed Assets; Outputs: Deposits, Advances, Investments, Net Interest Margin and Other Income.

<p style="text-align:center">Table: 5.23 DEA Estimates of Technical Efficiencies for Public Sector Bank Group*</p>

Banks\Year	1991			1996			2001			2006			2009		
	crste	vrste	scale	crste	vrste	scale	crste	vrste	scale	crste	vrste	scale	crste	vrste	scale
STATE BANK OF INDIA	0.977	1	0.977	1	1	1	0.809	1	0.809	1	1	1	0.92	1	0.92
STATE BANK OF BIKANER & JAIPUR	0.83	0.896	0.926	1	1	1	0.857	0.879	0.975	1	1	1	0.908	0.917	0.991
STATE BANK OF HYDERABAD	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
STATE BANK OF INDORE	0.796	1	0.796	0.783	1	0.783	0.824	1	0.824	0.923	1	0.923	1	1	1
STATE BANK OF MYSORE	0.84	0.984	0.853	0.992	1	0.992	1	1	1	0.732	0.83	0.882	0.798	0.865	0.923
STATE BANK OF PATIALA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
STATE BANK OF SAURASHTRA	0.888	1	0.888	1	1	1	1	1	1	1	1	1	1	1	1
STATE BANK OF TRAVANCORE	0.999	1	0.999	1	1	1	1	1	1	1	1	1	-	-	-
ALLAHABAD BANK	1	1	1	0.935	0.949	0.986	0.804	0.812	0.99	0.99	1	0.99	1	1	1
ANDHRA BANK	0.897	0.909	0.986	1	1	1	1	1	1	1	1	1	1	1	1
BANK OF BARODA	1	1	1	1	1	1	0.906	1	0.906	0.885	0.977	0.905	1	1	1
BANK OF INDIA	1	1	1	1	1	1	1	1	1	0.847	0.89	0.951	1	1	1
BANK OF MAHARASHTRA	0.978	0.992	0.985	1	1	1	1	1	1	1	1	1	0.995	1	0.995
CANARA BANK	0.978	1	0.978	0.912	1	0.912	0.994	1	0.994	1	1	1	1	1	1
CENTRAL BANK OF INDIA	0.94	0.984	0.955	0.974	1	0.974	0.893	0.978	0.914	0.951	1	0.951	1	1	1
CORPORATION BANK	0.839	0.982	0.855	1	1	1	1	1	1	1	1	1	1	1	1
DENA BANK	1	1	1	1	1	1	0.866	0.906	0.956	0.924	0.926	0.998	0.895	0.941	0.951
INDIAN BANK	1	1	1	0.906	0.911	0.994	0.985	0.997	0.987	0.966	1	0.966	1	1	1
INDIAN OVERSEAS BANK	0.934	0.955	0.978	1	1	1	0.9	0.915	0.983	1	1	1	0.99	1	0.99
ORIENTAL BANK OF COMMERCE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
PUNJAB AND SIND BANK	0.959	1	0.959	0.886	0.944	0.938	0.854	0.947	0.902	0.897	0.918	0.978	1	1	1
PUNJAB NATIONAL BANK	1	1	1	0.943	1	0.943	0.945	1	0.945	0.98	1	0.98	1	1	1
SYNDICATE BANK	0.946	1	0.946	0.897	0.962	0.932	0.885	1	0.885	0.958	0.958	1	1	1	1
UCO BANK	0.986	0.988	0.999	1	1	1	1	1	1	1	1	1	1	1	1
UNION BANK OF INDIA	0.931	1	0.931	0.88	0.943	0.933	0.97	1	0.97	1	1	1	1	1	1
UNITED BANK OF INDIA	1	1	1	1	1	1	1	1	1	1	1	1	0.913	0.934	0.977
VIJAYA BANK	0.848	0.902	0.94	0.839	0.888	0.945	0.8	0.844	0.947	0.968	0.994	0.974	0.95	0.957	0.992
IDBI BANK LTD.	-	-	-	-	-	-	-	-	-	1	1	1	1	1	1
Mean	**0.947**	**0.985**	**0.961**	**0.961**	**0.985**	**0.975**	**0.937**	**0.973**	**0.962**	**0.965**	**0.982**	**0.982**	**0.977**	**0.986**	**0.99**

*These results refer to Combinations: - inputs: Number of Employees, Establishment Expenditure, Non-establishment Expenditure, Non-interest Expenditure and Fixed Assets; Outputs: Deposits, Advances, Investments, Net Interest Margin and Total Income.

From the above discussion, it is clear that the technical efficiency profile has varied over the years, and also across the CRS-VRS assumptions. More specifically, public sector banks such as State Bank of Indore, State Bank of Saurashtra, State Bank of Travancore from the SBI group which were technically inefficient in the year 1991, have progressively moved forward to achieve technical efficiency by the year 2009. The SBI however has shown mixed results across the two input-output combinations. Coming to the other public sector banks, Andhra Bank, Canara Bank, Central Bank of India, Corporate Bank, India overseas Bank, Punjab and Sind Bank, Syndicate Bank, Union Bank of India, have also progressed towards achieving technical efficiency by the year 2009. A few reversals in case of Dena Bank, United Bank of India and Vijaya Bank are also noted.

For the private (domestic) bank group DEA scores for the first combination are given in table 5.24. From the table it is evident that in the year 1991, 14 and 9 banks out of 22 are on the frontier, that is having technical efficiency score of one under tha VRS and CRS assumptions of scale respectively. The numbers have increased comparatively in the following year. Out of 33 banks 24 and 18 banks are on the frontier, that is technically efficient under the VRS and CRS assumptions respectively. Based on the VRS technical efficiency score, Nedungadi Bank, and Bank of Madura are found to be the most technically inefficient banks in the year 1991 and 1996 respectively. Lord Krishna Bank with CRS technical efficiency score 0.743 is the most inefficient in the year 1991 and in the year 1996 Bank of Madura is most inefficient with 0.697 CRS technical efficiency score. In the year 2001 with VRS and CRS technical efficiency score 0.652 and 0.645 respectively, Bank of Rajasthan is found to be the most technically inefficient bank. Out of 30 banks, 19 and 15 banks respectively are efficient based on the VRS and CRS technical efficiency scores respectively. In the year 2006, out of 27 and 22 banks, 19 and

17 banks respectively are operating on the frontier according to VRS technical efficiency score. Development Credit Bank is the most inefficient bank in the years 2006 and 2009 based on the VRS and CRS scores, and more interestingly both VRS and CRS score have shown declining trend in the year 2009.

For the second input-output combination, DEA scores are given in table 5.25. In this combination, an interesting observation has been that the number of banks operating at the frontier have increased year after year under both VRS and CRS assumptions. It is also further observed that the number of efficient banks is more in the initial years than in later years. More interestingly both VRS and CRS technical efficiency scores, reveal that the same banks are technically inefficient all through the period except in the year 1996, in case of first combination. In the year 1996 with 0.846 and 0.752 VRS and CRS technical efficiency score, Catholic Syrian Bank and ICICI bank respectively exhibited lowest level of technical inefficiency.

Thus the DEA scores depict interesting scenario for the private domestic bank. Banks such as Catholic Syrian Bank, Lakshami Vilas Bank and Dhanlakshami Bank which were in existence from 1991, either never improved their performance or showed a decline as reflected in their scores. Quite a few banks such as City Union Bank, Federal Bank, Jammu and Kashmir Bank, Karnataka Bank, Nainital Bank, Ratnakar Bank, South Indian Bank, Tamil Nadu Merchantile Bank have consistently high level of technical efficiency. Axis Bank, Yes Bank which were started in the 2000s, have shown impressive performance. On the contrary the Development Credit bank which started off well in 1996 with a DEA score of one has ended with relatively poor score of 0.542 (VRS) in the year 2009. Thus the evidences are quite mixed enough, restraining us to draw any general conclusion.

Banks\Year	1991			1996			2001			2006			2009		
	crste	vrste	scale	crste	vrste	scale	crste	vrste	scale	crste	vrste	scale	crste	vrste	scale
AXIS BANK	-	-	-	-	-	-	-	-	-	1	1	1	1	1	1
BANK OF MADURA	1	1	1	0.841	0.87	0.967	-	-	-	-	-	-	-	-	-
BANK OF PUNJAB	-	-	-	1	1	1	1	1	1	-	-	-	-	-	-
BANK OF RAJASTHAN	1	1	1	0.876	0.879	0.997	0.65	0.653	0.996	0.709	0.717	0.989	1	1	1
BAREILLY CORPORATION BANK	0.959	1	0.959	1	1	1	-	-	-	-	-	-	-	-	-
BENARES STATE BANK	1	1	1	1	1	1	-	-	-	-	-	-	-	-	-
BHARAT OVERSEAS BANK	1	1	1	1	1	1	0.743	0.799	0.93	0.884	0.999	0.885	-	-	-
CATHOLIC SYRIAN BANK	0.895	0.935	0.957	0.812	0.846	0.96	0.989	1	0.989	0.834	0.84	0.993	0.79	0.791	1
CENTURION BANK	-	-	-	0.756	1	0.756	0.762	0.774	0.984	-	-	-	-	-	-
CENTURION BANK OF PUNJAB	-	-	-	-	-	-	-	-	-	0.666	0.689	0.966	-	-	-
CITY UNION BANK	0.972	1	0.972	1	1	1	1	1	1	1	1	1	1	1	1
DEVELOPMENT CREDIT BANK	-	-	-	1	1	1	0.849	0.859	0.989	0.42	0.528	0.796	0.518	0.533	0.972
DHANALAKSHMI BANK	1	1	1	1	1	1	0.668	0.761	0.877	0.562	0.664	0.846	0.798	0.867	0.921
FEDERAL BANK	0.925	1	0.925	0.979	1	0.979	0.986	1	0.986	1	1	1	1	1	1
GANESH BANK OF KURUNDWAD	-	-	-	0.772	1	0.772	0.86	1	0.86	-	-	-	-	-	-
GLOBAL TRUST BANK	-	-	-	1	1	1	0.914	1	0.914	-	-	-	-	-	-
HDFC BANK	-	-	-	1	1	1	1	1	1	1	1	1	0.87	1	0.87
ICICI BANK	-	-	-	0.752	0.783	0.96	0.934	1	0.934	1	1	1	1	1	1
IDBI BANK	-	-	-	1	1	1	0.966	0.974	0.991	-	-	-	-	-	-
INDUSIND BANK	-	-	-	1	1	1	1	1	1	1	1	1	0.968	0.997	0.971
ING VYSYA BANK	-	-	-	-	-	-	-	-	-	0.694	0.727	0.955	0.737	0.785	0.938
JAMMU & KASHMIR BANK	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
KARNATAKA BANK	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
KARUR VYSYA BANK	1	1	1	1	1	1	0.841	0.853	0.986	0.954	0.956	0.998	1	1	1
KOTAK MAHINDRA BANK				-	-	-	-	-	-	0.956	1	0.956	1	1	1
LAKSHMI VILAS BANK	1	1	1	0.95	0.956	0.993	1	1	1	1	1	1	0.861	0.879	0.98
LORD KRISHNA BANK	1	1	1	1	1	1	1	1	1	0.729	0.93	0.784	-	-	-
NAINITAL BANK	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
NEDUNGADI BANK	0.908	0.912	0.995	1	1	1	0.709	0.765	0.927	-	-	-	-	-	-
RATNAKAR BANK	1	1	1	0.947	1	0.947	1	1	1	1	1	1	1	1	1
SANGLI BANK	1	1	1	0.853	0.864	0.987	1	1	1	1	1	1	-	-	-
SBI COMM. & INTERNATIONAL BANK				-	-	-	0.985	1	0.985	1	1	1	1	1	1
SOUTH INDIAN BANK	0.906	0.998	0.909	1	1	1	1	1	1	0.934	0.955	0.977	1	1	1

TAMILNAD MERCANTILE BANK	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
TIMES BANK				0.911	1	0.911	-	-	-	-	-	-	-	-	-
UNITED WESTERN BANK	1	1	1	0.973	1	0.973	1	1	1	0.624	0.642	0.972	-	-	-
UTI BANK				1	1	1	1	1	1	-	-	-	-	-	-
VYSYA BANK	1	1	1	1	1	1	0.787	0.867	0.908	-	-	-	-	-	-
YES BANK				-	-	-	-	-	-	1	1	1	1	1	1
Mean	**0.98**	**0.993**	**0.987**	**0.952**	**0.976**	**0.976**	**0.921**	**0.943**	**0.975**	**0.888**	**0.913**	**0.967**	**0.934**	**0.948**	**0.984**

*These results refer to Combinations: - inputs: Number of Employees, Establishment Expenditure, Non-establishment Expenditure, Non-interest Expenditure and Fixed Assets; Outputs: Deposits, Advances, Investments, Net Interest Margin and Other Income.

Table: 5. 25 DEA Estimates of Technical Efficiencies for Private (Domestic) Bank Group*

Banks\Year	1991			1996			2001			2006			2009		
	crste	vrste	scale	crste	vrste	scale	crste	vrste	scale	crste	vrste	scale	crste	vrste	scale
AXIS BANK	-	-	-	-	-	-	-	-	-	1	1	1	1	1	1
BANK OF MADURA	0.854	0.902	0.947	0.697	0.732	0.953	-	-	-	-	-	-	-	-	-
BANK OF PUNJAB	-	-	-	1	1	1	1	1	1	-	-	-	-	-	-
BANK OF RAJASTHAN	0.895	0.954	0.938	0.876	0.879	0.997	0.645	0.652	0.989	0.709	0.717	0.989	1	1	1
BAREILLY CORPORATION BANK	0.947	1	0.947	1	1	1	-	-	-	-	-	-	-	-	-
BENARES STATE BANK	1	1	1	0.964	0.993	0.971	-	-	-	-	-	-	-	-	-
BHARAT OVERSEAS BANK	1	1	1	1	1	1	0.702	0.797	0.881	0.884	0.999	0.885	-	-	-
CATHOLIC SYRIAN BANK	0.844	0.934	0.904	0.814	0.846	0.962	0.88	0.913	0.964	0.845	0.849	0.996	0.62	0.638	0.972
CENTURION BANK	-	-	-	0.756	1	0.756	0.762	0.774	0.984	-	-	-	-	-	-
CENTURION BANK OF PUNJAB	-	-	-	-	-	-	-	-	-	0.572	0.587	0.974	-	-	-
CITY UNION BANK	0.897	0.977	0.918	1	1	1	1	1	1	1	1	1	1	1	1
DEVELOPMENT CREDIT BANK	-	-	-	1	1	1	0.856	0.862	0.993	0.481	0.582	0.827	0.529	0.542	0.977
DHANALAKSHMI BANK	1	1	1	1	1	1	0.667	0.761	0.876	0.563	0.664	0.848	0.783	0.841	0.931
FEDERAL BANK	0.895	1	0.895	0.905	1	0.905	0.986	1	0.986	1	1	1	1	1	1
GANESH BANK OF KURUNDWAD	-	-	-	0.772	1	0.772	0.86	1	0.86	-	-	-	-	-	-
GLOBAL TRUST BANK	-	-	-	1	1	1	0.908	1	0.908	-	-	-	-	-	-
HDFC BANK	-	-	-	1	1	1	1	1	1	1	1	1	0.835	1	0.835
ICICI BANK	-	-	-	0.752	0.783	0.96	0.934	1	0.934	1	1	1	1	1	1
IDBI BANK	-	-	-	1	1	1	0.966	0.974	0.991	-	-	-	-	-	-
INDUSIND BANK	-	-	-	1	1	1	1	1	1	1	1	1	0.966	1	0.966
ING VYSYA BANK	-	-	-	-	-	-	-	-	-	0.694	0.727	0.955	0.732	0.785	0.932
JAMMU & KASHMIR BANK	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
KARNATAKA BANK	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
KARUR VYSYA BANK	1	1	1	0.975	1	0.975	0.841	0.853	0.986	0.908	0.929	0.978	1	1	1
KOTAK MAHINDRA BANK	-	-	-	-	-	-	-	-	-	0.937	0.964	0.972	1	1	1
LAKSHMI VILAS BANK	0.86	0.861	0.998	0.84	0.844	0.995	0.952	0.97	0.981	1	1	1	0.835	0.869	0.96
LORD KRISHNA BANK	0.743	1	0.743	1	1	1	1	1	1	0.733	0.93	0.788	-	-	-
NAINITAL BANK	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
NEDUNGADI BANK	0.778	0.837	0.93	0.829	0.865	0.958	0.668	0.73	0.915	-	-	-	-	-	-
RATNAKAR BANK	1	1	1	0.947	1	0.947	1	1	1	1	1	1	1	1	1
SANGLI BANK	0.937	1	0.937	0.852	0.864	0.986	1	1	1	1	1	1	-	-	-
SBI COMM. & INTERNATIONAL BANK	-	-	-	-	-	-	1	1	1	1	1	1	1	1	1
SOUTH INDIAN BANK	0.902	0.998	0.904	1	1	1	1	1	1	0.932	0.955	0.976	1	1	1

Table 5.25 Continued…

TAMILNAD MERCANTILE BANK	0.858	0.885	0.969	1	1	1	1	1	1	1	1	1	1	1	1
TIMES BANK	-	-	-	0.911	1	0.911	-	-	-	-	-	-	-	-	-
UNITED WESTERN BANK	1	1	1	0.822	0.907	0.907	1	1	1	0.632	0.646	0.978	-	-	-
UTI BANK	-	-	-	1	1	1	1	1	1	-	-	-	-	-	-
VYSYA BANK	0.957	1	0.957	1	1	1	0.791	0.837	0.945	-	-	-	-	-	-
YES BANK	-	-	-	-	-	-	-	-	-	1	1	1	1	1	1
Mean	**0.926**	**0.97**	**0.954**	**0.931**	**0.961**	**0.968**	**0.914**	**0.937**	**0.973**	**0.885**	**0.909**	**0.969**	**0.923**	**0.94**	**0.981**

*These results refer to Combinations: - inputs: Number of Employees, Establishment Expenditure, Non-establishment Expenditure, Non-interest Expenditure and Fixed Assets; Outputs: Deposits, Advances, Investments, Net Interest Margin and Total Income.

Going by the mean levels of technical efficiency, it may be noted that the private sector (domestic) banks have began at a lower level but gradually emerged stronger over the years. This trend is more or less reflected across both the combinations. When compared to the public sector banks, the private domestic banks however have not fared well, as the former have started with a higher level of DEA scores only to sustain the same over period. Thus there is no evidence in favour of the hypothesis that private sector banks are relatively more efficient compared to the public sector banks.

The DEA efficiency scores of foreign bank group for the first combination of inputs and outputs are given in table 5.26. In the year 1991, 22 banks are functional, out of which 18 and 12 banks are on the frontier based on VRS and CRS technical efficiency scores respectively. Hong Kong and Shangahi Banking Corporation Bank with 0.681 and 0.342 VRS and CRS technical efficiency score respectively, is found to be the most inefficient bank. In the following year number of efficient banks increased to 22 out of 29 functional banks based on the VRS efficiency score, but decreased to 10 banks even number of functional banks increased, based on CRS technical efficiency score. Banque Nationale de Paris and Citi Bank turned out to be the most technically inefficient banks in 1996 based on the VRS and CRS technical efficiency measure respectively. In the year 2001, out of 37 functional banks, 21 and 11 banks are operating at the frontier that is, operating technically efficient based on the VRS and CRS technical efficiency measure. ING Bank and American Express Banking Corporation are the most inefficient banks with 0.357 and 0.290 VRS and CRS technical efficiency score respectively. Relatively more number of efficient banks compared to other years is functional in the year 2006 based on both VRS and CRS scores. Out of 29 functional banks 24 and 14 banks are operating as technically efficient based on VRS and CRS technical efficiency measure. But the number of efficient banks has decreased based on both VRS and CRS technical efficiency score. Out

of 31 operational banks only 19 and 12 banks are operating as technically efficient, based on the VRS and CRS technical efficiency score respectively. American Express Banking Corporation bank is the most inefficient bank in 2006 and 2009 based on the VRS and CRS technical efficiency score. The VRS and CRS technical efficiency score in year 2009 decreased to 0.130 and 0.130 from 0.446 and 0.265 in 2006 respectively. This pattern is repeated in case of scale efficiency during the study period.

The DEA scores for the second input-output combination of foreign bank group are given in table 5.27. The scores indicate a similar pattern as observed for the first combination of input-output, except that the number of efficient banks has increased over the years. More interestingly technically most inefficient banks in all the years considered are also the same based on the VRS technical efficiency score, except in the year 2001, which registered higher efficiency scores. Coming to the CRS technical efficiency, most technically inefficient banks in the years 1991 and 2006 are the same. In the year 2001 Bank of Muscat International and State Bank of Mauritius are the most technically inefficient bank instead of ING and American Express Banking Corporation based on the VRS and CRS technical efficiency score respectively. The pattern of scale efficiency score has been the same as observed in the first combination of input-output results.

The evidences for the foreign banks are also mixed as in the case of private domestic banks. Though the score may not permit to comment on the evolution of foreign banks in respect of technical efficiency, it may be said that the overall (average level) level of technical efficiency of foreign banks has been on the lower side when compared to the private banks. Thus the evidences generated here tend to reject the hypothesis that foreign banks are technically more efficient compared to their counterparts in the domestic sector in India.

Table: 5.26 DEA Estimates of Technical Efficiencies for Foreign Bank Group*

Banks\Year	1991			1996			2001			2006			2009		
	crste	vrste	scale	crste	vrste	scale	crste	vrste	scale	crste	vrste	scale	crste	vrste	scale
AB BANK	-	-	-	-	-	-	-	-	-	-	-	-	0.47	0.489	0.962
ABN AMRO BANK	1	1	1	0.897	1	0.897	0.794	1	0.794	0.559	1	0.559	0.437	1	0.437
ABU DHABI COMMERCIAL BANK	1	1	1	1	1	1	1	1	1	0.912	1	0.912	0.727	0.747	0.972
AMERICAN EXPRESS BANKING CORP.	1	1	1	0.507	1	0.507	0.772	1	0.772	0.373	0.586	0.638	0.283	0.351	0.806
ANTWERP DIAMOND BANK	-	-	-	-	-	-	-	-	-	1	1	1	1	1	1
ARAB BANGLADESH BANK	-	-	-	-	-	-	0.911	1	0.911	1	1	1	-	-	-
BANK OF INTERNATIONAL INDONESIA	-	-	-	-	-	-	0.466	0.879	0.531	0.536	1	0.536	1	1	1
BANK MUSCAT INTERNATIONAL	-	-	-	-	-	-	0.426	0.52	0.82	-	-	-	-	-	-
BANK OF AMERICA	1	1	1	0.746	1	0.746	1	1	1	0.993	1	0.993	1	1	1
BANK OF BAHRAIN & KUWAIT	1	1	1	0.951	1	0.951	0.636	0.646	0.986	1	1	1	0.632	0.635	0.995
BANK OF CEYLON	-	-	-	-	-	-	1	1	1	1	1	1	1	1	1
BANK OF NOVA SCOTIA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
BANK OF TOKYO	1	1	1	1	1	1	-	-	-	-	-	-	-	-	-
BANK OF TOKYO-MITSUBISHI-UFJ	-	-	-	-	-	-	1	1	1	0.779	0.784	0.995	1	1	1
BANQUE NATIONALE DE PARIS	0.74	0.819	0.904	0.562	0.564	0.997	-	-	-	-	-	-	-	-	-
BARCLAYS BANK	0.854	1	0.854	1	1	1	0.538	0.573	0.938	1	1	1	0.56	1	0.56
BNP PARIBAS	-	-	-	-	-	-	0.423	0.698	0.607	0.544	0.581	0.936	0.687	0.79	0.87
BRITISH BANK OF MIDDLE EAST	1	1	1	1	1	1	-	-	-	-	-	-	-	-	-
CALYON BANK	-	-	-	-	-	-	-	-	-	0.706	0.81	0.871	1	1	1
CHASE MANHATTAN BANK	-	-	-	0.509	1	0.509	-	-	-	-	-	-	-	-	-
CHINATRUST COMMERCIAL BANK	-	-	-	-	-	-	0.691	0.758	0.912	1	1	1	0.457	0.489	0.934
CHO HUNG BANK	-	-	-	-	-	-	1	1	1	1	1	1	-	-	-
CITIBANK	1	1	1	1	1	1	1	1	1	0.966	1	0.966	0.711	1	0.711
COMMERZ BANK AG	-	-	-	0.133	0.762	0.175	1	1	1	-	-	-	-	-	-
CREDIT AGRICOLE INDOSUEZ	1	1	1	1	1	1	0.512	0.552	0.928	-	-	-	-	-	-
CREDIT LYONNAIS	1	1	1	1	1	1	1	1	1	-	-	-	-	-	-
DBS BANK	-	-	-	0.438	1	0.438	0.962	0.986	0.975	1	1	1	1	1	1
DEUTSCHE BANK	1	1	1	0.923	1	0.923	1	1	1	0.575	1	0.575	0.55	1	0.55
DRESDNER BANK	-	-	-	0.342	0.795	0.43	1	1	1	-	-	-	-	-	-
GRINDLAYS BANK	0.769	1	0.769	0.454	1	0.454	-	-	-	-	-	-	-	-	-
HONG KONG & SHANG BANK. CORP.	0.573	0.777	0.738	0.465	1	0.465	0.581	1	0.581	0.649	1	0.649	0.53	1	0.53
ING BANK	-	-	-	0.62	0.932	0.666	0.537	0.584	0.921	-	-	-	-	-	-
JP MORGAN CHASE BANK	-	-	-	-	-	-	-	-	-	1	1	1	1	1	1

Table: 5.26 Continued….

JSC VTB BANK	-	-	-	-	-	-	-	-	-	-	-	-	0.367	0.462	0.795
KBC BANK	-	-	-	-	-	-	0.814	0.844	0.964	-	-	-	-	-	-
KRUNG THAI BANK	-	-	-	-	-	-	0.844	1	0.844	1	1	1	1	1	1
MASHREQ BANK	1	1	1	1	1	1	0.885	0.909	0.974	0.86	1	0.86	0.471	0.645	0.731
MIZUHO CORPORATE BANK	-	-	-	-	-	-	-	-	-	0.779	0.813	0.957	0.628	0.631	0.995
MORGAN GUARANTY BANK	-	-	-	-	-	-	1	1	1	-	-	-	-	-	-
OMAN INTERNATIONAL BANK	1	1	1	1	1	1	0.797	0.871	0.915	0.903	1	0.903	0.7	0.731	0.958
OVERSEA CHINESE BANK	-	-	-	-	-	-	0.745	1	0.745	-	-	-	-	-	-
SAKURA BANK	1	1	1	1	1	1	-	-	-	-	-	-	-	-	-
SANWA BANK	-	-	-	1	1	1	-	-	-	-	-	-	-	-	-
SHINHAN BANK	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1
SIAM COMMERCIAL BANK	-	-	-	-	-	-	0.908	1	0.908	-	-	-	-	-	-
SOCIETE GENERALE	1	1	1	1	1	1	0.602	0.608	0.99	1	1	1	0.566	0.569	0.995
SONALI BANK	1	1	1	1	1	1	1	1	1	0.445	1	0.445	0.727	1	0.727
STANDARD CHARTERED BANK	1	1	1	0.284	1	0.284	0.726	1	0.726	0.763	1	0.763	0.417	1	0.417
STATE BANK OF MAURITIUS	-	-	-	1	1	1	0.419	1	0.419	1	1	1	1	1	1
SUMITOMO BANK	-	-	-	-	-	-	1	1	1	-	-	-	-	-	-
TORONTO DOMINION BANK	-	-	-	-	-	-	0.45	0.58	0.776	-	-	-	-	-	-
UBS AG	-	-	-	-	-	-	-	-	-	-	-	-	0.272	0.373	0.729
Mean	**0.95**	**0.98**	**0.97**	**0.79**	**0.97**	**0.81**	**0.8**	**0.9**	**0.89**	**0.84**	**0.95**	**0.88**	**0.72**	**0.84**	**0.86**

*These results refer to Combinations: - inputs: Number of Employees, Establishment Expenditure, Non-establishment Expenditure, Non-interest Expenditure and Fixed Assets; Outputs: Deposits, Advances, Investments, Net Interest Margin and Other Income.

Table: 5. 27 DEA Estimates of Technical Efficiencies for Foreign Bank Group*

Banks\Year	1991			1996			2001			2006			2009		
	crste	vrste	scale	crste	vrste	scale	crste	vrste	scale	crste	vrste	scale	crste	vrste	scale
AB BANK	-	-	-	-	-	-	-	-	-	-	-	-	0.357	0.377	0.947
ABN AMRO BANK	0.93	1	0.93	0.496	0.753	0.658	0.709	1	0.709	0.494	1	0.494	0.437	1	0.437
ABU DHABI COMMERCIAL BANK	1	1	1	1	1	1	1	1	1	1	1	1	0.727	0.747	0.972
AMERICAN EXPRESS BANKING CORP.	1	1	1	0.495	1	0.495	0.29	0.404	0.717	0.265	0.446	0.594	0.13	0.13	0.998
ANTWERP DIAMOND BANK	-	-	-	-	-	-				1	1	1	1	1	1
ARAB BANGLADESH BANK	-	-	-	-	-	-	0.811	1	0.811	0.854	1	0.854	-	-	-
BANK OF INTERNATIONAL INDONESIA	-	-	-	-	-	-	0.333	0.727	0.459	0.535	1	0.535	1	1	1
BANK MUSCAT INTERNATIONAL	-	-	-	-	-	-	0.422	0.488	0.866	-	-	-	-	-	-
BANK OF AMERICA	1	1	1	0.599	1	0.599	1	1	1	0.938	1	0.938	1	1	1
BANK OF BAHRAIN & KUWAIT	1	1	1	0.951	1	0.951	0.567	0.62	0.915	1	1	1	0.56	0.63	0.888
BANK OF CEYLON	-	-	-	-	-	-	1	1	1	1	1	1	1	1	1
BANK OF NOVA SCOTIA	1	1	1	0.962	1	0.962	1	1	1	1	1	1	1	1	1
BANK OF TOKYO	1	1	1	1	1	1				-	-	-	-	-	-
BANK OF TOKYO-MITSUBISHI-UFJ	-	-	-	-	-	-	0.564	0.754	0.748	0.716	0.719	0.995	1	1	1
BANQUE NATIONALE DE PARIS	0.619	0.701	0.883	0.464	0.554	0.837				-	-	-	-	-	-
BARCLAYS BANK	0.476	1	0.476	0.876	0.884	0.991	0.463	0.491	0.943	1	1	1	0.56	1	0.56
BNP PARIBAS	-	-	-	-	-	-	0.412	0.689	0.598	0.544	0.581	0.937	0.687	0.79	0.87
BRITISH BANK OF MIDDLE EAST	1	1	1	1	1	1				-	-	-	-	-	-
CALYON BANK	-	-	-	-	-	-				0.744	0.847	0.879	1	1	1
CHASE MANHATTAN BANK	-	-	-	0.175	1	0.175				-	-	-	-	-	-
CHINATRUST COMMERCIAL BANK	-	-	-	-	-	-	0.691	0.758	0.912	1	1	1	0.457	0.489	0.934
CHO HUNG BANK	-	-	-	-	-	-	1	1	1	1	1	1	-	-	-
CITIBANK	1	1	1	0.687	1	0.687	0.885	1	0.885	0.966	1	0.966	0.667	1	0.667
COMMERZ BANK AG	-	-	-	0.124	0.762	0.163	1	1	1	-	-	-	-	-	-
CREDIT AGRICOLE INDOSUEZ	1	1	1	1	1	1	0.512	0.552	0.928	-	-	-	-	-	-
CREDIT LYONNAIS	1	1	1	1	1	1	1	1	1	-	-	-	-	-	-
DBS BANK	-	-	-	0.43	1	0.43	0.943	0.96	0.983	1	1	1	1	1	1
DEUTSCHE BANK	0.768	0.963	0.797	0.585	0.921	0.636	0.771	1	0.771	0.529	1	0.529	0.55	1	0.55

Table: 5.27 Continued…															
DRESDNER BANK	-	-	-	0.342	0.795	0.43	1	1	1	-	-	-	-	-	-
GRINDLAYS BANK	0.595	1	0.595	0.362	1	0.362				-	-	-	-	-	-
HONG KONG & SHANGH BANK. CORP.	0.342	0.681	0.503	0.341	1	0.341	0.407	1	0.407	0.625	1	0.625	0.53	1	0.53
ING BANK	-	-	-	0.572	0.89	0.643	0.29	0.357	0.813	-	-	-	-	-	-
JP MORGAN CHASE BANK	-	-	-	-	-	-				1	1	1	1	1	1
JSC VTB BANK	-	-	-	-	-	-				-	-	-	0.367	0.462	0.795
KBC BANK	-	-	-	-	-	-	1	1	1	-	-	-	-	-	-
KRUNG THAI BANK	-	-	-	-	-	-	0.844	1	0.844	1	1	1	1	1	1
MASHREQ BANK	0.911	1	0.911	1	1	1	0.885	0.909	0.973	1	1	1	0.337	0.531	0.635
MIZUHO CORPORATE BANK	-	-	-	-	-	-				0.748	0.81	0.924	0.612	0.614	0.998
MORGAN GUARANTY BANK	-	-	-	-	-	-	0.401	0.417	0.961	-	-	-	-	-	-
OMAN INTERNATIONAL BANK	1	1	1	0.931	1	0.931	0.492	0.537	0.918	0.903	1	0.903	0.7	0.731	0.958
OVERSEA CHINESE BANK	-	-	-	-	-	-	0.745	1	0.745	-	-	-	-	-	-
SAKURA BANK	0.788	0.844	0.933	1	1	1				-	-	-	-	-	-
SANWA BANK	-	-	-	0.844	1	0.844				-	-	-	-	-	-
SHINHAN BANK	-	-	-	-	-	-				-	-	-	1	1	1
SIAM COMMERCIAL BANK	-	-	-	-	-	-	0.908	1	0.908	-	-	-	-	-	-
SOCIETE GENERALE	0.918	1	0.918	1	1	1	0.341	0.366	0.933	1	1	1	0.566	0.569	0.995
SONALI BANK	1	1	1	1	1	1	0.514	1	0.514	0.376	1	0.376	0.457	1	0.457
STANDARD CHARTERED BANK	0.814	1	0.814	0.231	1	0.231	0.556	1	0.556	0.745	1	0.745	0.375	1	0.375
STATE BANK OF MAURITIUS	-	-	-	1	1	1	1	1	1	1	1	1	1	1	1
SUMITOMO BANK	-	-	-	-	-	-	0.456	0.58	0.786	-	-	-	-	-	-
TORONTO DOMINION BANK	-	-	-	-	-	-	1	1	1	-	-	-	-	-	-
UBS AG	-	-	-	-	-	-				-	-	-	0.272	0.373	0.729
Mean	**0.871**	**0.963**	**0.898**	**0.706**	**0.95**	**0.737**	**0.701**	**0.832**	**0.843**	**0.827**	**0.945**	**0.872**	**0.689**	**0.821**	**0.848**

*These results refer to Combinations: - inputs: Number of Employees, Establishment Expenditure, Non-establishment Expenditure, Non-interest Expenditure and Fixed Assets; Outputs: Deposits, Advances, Investments, Net Interest Margin and Total Income.

Technical efficiency score of all the Indian commercial banks put together (Public Sector, Private (domestic) and Foreign Banks) are reported in table 5.28 and 5.29 respectively for the first and second input-output combinations. Since DEA efficiency score of a bank is measured relative all other banks in the sample, we have estimated the scores of all the banks together. From the results given in table 5.28 one may observe that in the years 2001, 2006 and 2009 there is a similar trend in terms of ratio of banks operating at frontier that is technical efficient banks to total operational banks in that year. In the year 1991, out of 71 functional banks 39 and 21 banks are at the frontier based on the VRS and CRS technical efficiency scores respectively which are comparatively lower than other years. Hong Kong and Shanghai Banking Corporation has emerged as the most technically inefficient bank with 0.628 and 0.333 VRS and CRS scores respectively. In 1996, compared to the year 1991 number of efficient banks has increased. Out of 89 functional banks, 47 and 18 banks are at frontier based on the VRS and CRS technical efficiency score. Lakshami Vilas Bank and Commerz Bank AG are the most inefficient banks with 0.496 and 0.116 VRS and CRS technical efficiency score respectively. In the years 2001, 2006, and 2009 American Express Banking Corporation is the most inefficient bank with 0.290, 0.265 and 0.130 CRS technical efficiency score respectively and in the year 2006 and 2009 with 0.400 and 0.130 VRS technical efficiency score respectively. ING Bank is the most inefficient in the year 2001 with 0.357 VRS technical efficiency score. On the basis of scale efficiency score, Commerz Bank AG, Hong Kong and Shanghai Banking Corporation, Sonali Bank and ABN Amro are the most inefficient in year 1996, 2001, 2006 and 2009 respectively.

The DEA estimates of efficiency of all banks group for the second combination of input and output are given in table 5.29. As the results of other bank groups, there is almost a similar pattern as observed in terms of efficient banks that is compared to first

combination of input-output. The numbers have increased over the years considered in the study. But in contrast to the first combination, in this case the most technically inefficient banks are different in each year except in 1991. But interestingly in case of first combination of input-output, American Express Banking Corporation Bank is the most inefficient in the year 2006 and 2009 based on the both VRS and CRS technical efficiency scores, whereas in the second combination, Development Credit Bank is found the most inefficient bank in the year 2006 and 2009 and also in year 1996, based on both VRS and CRS efficiency scores. In the year 2001, Bank Muscat International and BNP Paribus Bank with 0.519 and 0.422 VRS and CRS technical efficiency score respectively are the most inefficient banks. Based on scale efficiency score, in the year 1991 and 2006 the same banks are the most inefficient as found in the first input-output combination.

5.4   Summary:

The technical efficiency score of a bank is measured relative to the banks included in the group at a particular point of time (say year). As discussed earlier also, so we cannot compare efficiency score over the time for one group bank or across the bank group in an explicit way as the number of banks keeps changing because of entry of new banks and exit of some of old banks. In the backdrop of this and based on the scores, it may observed that the public sector banks are more technically efficient than the private sector banks. Further, the foreign banks are only next to the private sector banks in respect of technical efficiency. These general observations hold good even when alternative input-output combination are considered, and across the CRS, VRS assumptions.

Table: 5. 28 DEA Estimates of Technical Efficiencies for All Bank Group*

Banks\Year	1991			1996			2001			2006			2009		
	crste	vrste	scale	crste	vrste	scale	crste	vrste	scale	crste	vrste	scale	crste	vrste	scale
AB BANK	-	-	-	-	-	-	-	-	-	-	-	-	0.48	0.505	0.951
ABN AMRO BANK	1	1	1	0.878	0.939	0.935	0.787	1	0.787	0.561	1	0.561	0.436	1	0.436
ABU DHABI COMMERCIAL BANK	1	1	1	1	1	1	1	1	1	0.909	1	0.909	0.723	0.744	0.972
ALLAHABAD BANK	1	1	1	0.695	0.951	0.731	0.684	0.775	0.884	0.915	1	0.915	0.924	1	0.924
AMERICAN EXPRESS BANKING CORP.	1	1	1	0.506	1	0.506	0.774	1	0.774	0.379	0.549	0.69	0.281	0.351	0.799
ANDHRA BANK	0.818	0.909	0.9	0.887	1	0.887	1	1	1	0.868	1	0.868	0.842	1	0.842
ANTWERP DIAMOND BANK	-	-	-	-	-	-	-	-	-	1	1	1	1	1	1
ARAB BANGLADESH BANK	-	-	-	-	-	-	0.936	1	0.936	0.981	1	0.981	-	-	-
AXIS BANK	-	-	-	-	-	-	-	-	-	1	1	1	0.727	1	0.727
BANK MUSCAT INTERNATIONAL	-	-	-	-	-	-	0.424	0.519	0.817	-	-	-	-	-	-
BANK OF AMERICA	1	1	1	0.734	1	0.734	1	1	1	0.991	1	0.991	1	1	1
BANK OF BAHRAIN & KUWAIT	1	1	1	0.956	1	0.956	0.653	0.661	0.988	0.893	1	0.893	0.613	0.616	0.996
BANK OF BARODA	1	1	1	0.7	1	0.7	0.777	1	0.777	0.793	0.948	0.837	0.972	1	0.972
BANK OF CEYLON	-	-	-	-	-	-	1	1	1	1	1	1	1	1	1
BANK OF INDIA	1	1	1	0.85	1	0.85	0.907	1	0.907	0.813	0.909	0.894	0.98	1	0.98
BANK OF INTERNATIONAL INDONESIA	-	-	-	-	-	-	0.44	0.885	0.498	0.536	1	0.536	1	1	1
BANK OF MADURA	0.94	1	0.94	0.489	0.546	0.896	-	-	-	-	-	-	-	-	-
BANK OF MAHARASHTRA	0.854	0.966	0.884	1	1	1	1	1	1	1	1	1	0.881	0.924	0.953
BANK OF NOVA SCOTIA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
BANK OF PUNJAB	-	-	-	0.514	0.658	0.781	1	1	1	-	-	-	-	-	-
BANK OF RAJASTHAN	0.917	0.959	0.956	0.737	0.79	0.933	0.579	0.625	0.928	0.708	0.711	0.996	0.815	0.816	0.999
BANK OF TOKYO	1	1	1	1	1	1	-	-	-	-	-	-	-	-	-
BANK OF TOKYO-MITSUBISHI-UFJ	-	-	-	-	-	-	1	1	1	0.776	0.78	0.994	1	1	1
BANQUE NATIONALE DE PARIS	0.749	0.797	0.94	0.562	0.562	0.999	-	-	-	-	-	-	-	-	-
BARCLAYS BANK	0.837	1	0.837	1	1	1	0.543	0.582	0.934	1	1	1	0.561	0.995	0.564
BAREILLY CORPORATION BANK	0.92	0.926	0.994	1	1	1	-	-	-	-	-	-	-	-	-
BENARES STATE BANK	1	1	1	0.621	0.621	1	-	-	-	-	-	-	-	-	-
BHARAT OVERSEAS BANK	0.869	0.901	0.965	0.598	0.608	0.984	0.539	0.622	0.866	0.663	0.693	0.957	-	-	-
BNP PARIBAS	-	-	-	-	-	-	0.422	0.587	0.719	0.544	0.58	0.937	0.687	0.79	0.87
BRITISH BANK OF MIDDLE EAST	1	1	1	1	1	1	-	-	-	-	-	-	-	-	-
CALYON BANK	-	-	-	-	-	-	-	-	-	0.703	0.81	0.868	1	1	1
CANARA BANK	0.853	1	0.853	0.769	1	0.769	0.88	1	0.88	1	1	1	0.906	1	0.906
CATHOLIC SYRIAN BANK	0.802	0.861	0.931	0.763	0.786	0.97	0.911	0.975	0.934	0.745	0.755	0.987	0.613	0.622	0.986

CENTRAL BANK OF INDIA	0.829	0.989	0.839	0.837	1	0.837	0.831	0.978	0.849	0.95	1	0.95	1	1	1
CENTURION BANK	-	-	-	0.529	0.708	0.746	0.743	0.744	0.999	-	-	-	-	-	-
CENTURION BANK OF PUNJAB	-	-	-	-	-	-	-	-	-	0.482	0.579	0.834	-	-	-
CHASE MANHATTAN BANK	-	-	-	0.498	1	0.498	-	-	-	-	-	-	-	-	-
CHINATRUST COMMERCIAL BANK	-	-	-	-	-	-	0.743	0.814	0.913	0.989	1	0.989	0.455	0.486	0.937
CHO HUNG BANK	-	-	-	-	-	-	1	1	1	1	1	1	-	-	-
CITIBANK	1	1	1	0.961	1	0.961	1	1	1	0.964	1	0.964	0.711	1	0.711
CITY UNION BANK	0.833	0.859	0.969	0.791	0.792	0.998	0.936	0.942	0.994	0.981	1	0.981	0.924	1	0.924
COMMERZ BANK AG	-	-	-	0.116	0.76	0.153	1	1	1	-	-	-	-	-	-
CORPORATION BANK	0.789	0.875	0.901	0.827	1	0.827	0.902	1	0.902	0.809	1	0.809	1	1	1
CREDIT AGRICOLE INDOSUEZ	1	1	1	1	1	1	0.512	0.552	0.927	-	-	-	-	-	-
CREDIT LYONNAIS	1	1	1	1	1	1	1	1	1	-	-	-	-	-	-
DBS BANK	-	-	-	0.44	1	0.44	0.974	0.998	0.976	1	1	1	1	1	1
DENA BANK	0.93	1	0.93	0.791	0.99	0.799	0.611	0.786	0.777	0.846	1	0.846	0.842	0.865	0.973
DEUTSCHE BANK	1	1	1	0.797	0.906	0.879	1	1	1	0.575	1	0.575	0.55	1	0.55
DEVELOPMENT CREDIT BANK	-	-	-	0.435	0.478	0.909	0.54	0.705	0.766	0.341	0.344	0.991	0.315	0.319	0.986
DHANALAKSHMI BANK	1	1	1	1	1	1	0.529	0.53	0.998	0.516	0.525	0.983	0.638	0.639	0.999
DRESDNER BANK	-	-	-	0.328	0.796	0.412	1	1	1	-	-	-	-	-	-
FEDERAL BANK	0.847	0.905	0.937	0.803	0.923	0.87	0.857	1	0.857	1	1	1	0.955	1	0.955
GANESH BANK OF KURUNDWAD	-	-	-	0.619	1	0.619	0.75	1	0.75	-	-	-	-	-	-
GLOBAL TRUST BANK	-	-	-	1	1	1	0.727	1	0.727	-	-	-	-	-	-
GRINDLAYS BANK	0.772	1	0.772	0.456	1	0.456	-	-	-	-	-	-	-	-	-
HDFC BANK	-	-	-	0.649	0.791	0.821	0.755	1	0.755	0.891	1	0.891	0.456	1	0.456
HONG KONG & SHANG BANK. CORP.	0.57	0.76	0.749	0.455	1	0.455	0.576	1	0.576	0.65	1	0.65	0.53	1	0.53
ICICI BANK	-	-	-	0.502	0.533	0.942	0.726	1	0.726	0.949	1	0.949	0.625	1	0.625
IDBI BANK	-	-	-	0.726	1	0.726	0.506	0.76	0.665	-	-	-	-	-	-
IDBI BANK LTD.	-	-	-	-	-	-	-	-	-	1	1	1	1	1	1
INDIAN BANK	0.784	1	0.784	0.672	0.9	0.747	0.776	1	0.776	0.887	1	0.887	1	1	1
INDIAN OVERSEAS BANK	0.978	0.996	0.982	0.841	1	0.841	0.791	0.915	0.864	1	1	1	0.872	1	0.872
INDUSIND BANK	-	-	-	1	1	1	1	1	1	1	1	1	0.643	0.699	0.92
ING BANK	-	-	-	0.595	0.933	0.638	0.533	0.581	0.919	-	-	-	-	-	-
ING VYSYA BANK	-	-	-	-	-	-	-	-	-	0.448	0.617	0.727	0.506	0.535	0.945
JAMMU & KASHMIR BANK	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
JP MORGAN CHASE BANK	-	-	-	-	-	-	-	-	-	1	1	1	1	1	1
JSC VTB BANK	-	-	-	-	-	-	-	-	-	-	-	-	0.366	0.429	0.853

Bank															
KARNATAKA BANK	0.984	1	0.984	1	1	1	1	1	1	1	1	1	0.984	1	0.984
KARUR VYSYA BANK	0.798	0.889	0.898	0.708	0.721	0.981	0.663	0.735	0.902	0.805	0.906	0.888	0.866	0.941	0.92
KBC BANK	-	-	-	-	-	-	0.823	0.849	0.969	-	-	-	-	-	-
KOTAK MAHINDRA BANK	-	-	-	-	-	-	-	-	-	0.466	0.594	0.785	0.428	0.952	0.449
KRUNG THAI BANK	-	-	-	-	-	-	0.816	1	0.816	1	1	1	1	1	1
LAKSHMI VILAS BANK	0.917	0.998	0.919	0.494	0.527	0.937	0.824	0.889	0.928	0.751	0.764	0.983	0.666	0.668	0.998
LORD KRISHNA BANK	1	1	1	0.766	0.771	0.993	0.704	0.758	0.928	0.508	0.514	0.99	-	-	-
MASHREQ BANK	1	1	1	1	1	1	0.88	0.906	0.971	0.849	1	0.849	0.482	0.635	0.759
MIZUHO CORPORATE BANK	-	-	-	-	-	-	-	-	-	0.751	0.787	0.954	0.629	0.629	1
MORGAN GUARANTY BANK	-	-	-	-	-	-	1	1	1	-	-	-	-	-	-
NAINITAL BANK	0.99	0.993	0.997	1	1	1	0.87	0.962	0.905	1	1	1	1	1	1
NEDUNGADI BANK	0.865	0.882	0.981	0.628	0.632	0.994	0.667	0.669	0.998	-	-	-	-	-	-
OMAN INTERNATIONAL BANK	1	1	1	0.982	0.983	1	0.786	0.789	0.997	0.879	1	0.879	0.607	0.647	0.939
ORIENTAL BANK OF COMMERCE	0.906	1	0.906	0.9	1	0.9	0.941	1	0.941	0.886	1	0.886	1	1	1
OVERSEA CHINESE BANK	-	-	-	-	-	-	0.926	1	0.926	-	-	-	-	-	-
PUNJAB AND SIND BANK	0.871	0.95	0.917	0.767	0.854	0.898	0.746	0.874	0.853	0.863	0.889	0.971	1	1	1
PUNJAB NATIONAL BANK	0.956	1	0.956	0.765	1	0.765	0.864	1	0.864	0.965	1	0.965	0.945	1	0.945
RATNAKAR BANK	1	1	1	0.742	0.861	0.862	1	1	1	0.816	0.88	0.927	1	1	1
SAKURA BANK	1	1	1	1	1	1	-	-	-	-	-	-	-	-	-
SANGLI BANK	0.933	0.965	0.966	0.785	0.801	0.981	0.98	0.983	0.997	0.818	0.882	0.927	-	-	-
SANWA BANK	-	-	-	1	1	1	-	-	-	-	-	-	-	-	-
SBI COMM. & INTERNATIONAL BANK	-	-	-	-	-	-	0.609	0.627	0.972	1	1	1	1	1	1
SHINHAN BANK	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1
SIAM COMMERCIAL BANK	-	-	-	-	-	-	0.969	1	0.969	-	-	-	-	-	-
SOCIETE GENERALE	1	1	1	1	1	1	0.601	0.608	0.988	1	1	1	0.567	0.569	0.995
SONALI BANK	1	1	1	1	1	1	1	1	1	0.447	1	0.447	0.733	1	0.733
SOUTH INDIAN BANK	0.877	0.936	0.936	0.832	0.833	0.999	1	1	1	0.8	0.805	0.994	0.986	1	0.986
STANDARD CHARTERED BANK	1	1	1	0.284	1	0.284	0.727	1	0.727	0.767	1	0.767	0.417	1	0.417
STATE BANK OF BIKANER & JAIPUR	0.869	0.937	0.928	0.844	0.977	0.864	0.936	1	0.936	0.778	0.966	0.805	0.817	0.907	0.901
STATE BANK OF HYDERABAD	0.888	1	0.888	0.741	0.915	0.809	0.923	1	0.923	0.9	1	0.9	1	1	1
STATE BANK OF INDIA	0.879	1	0.879	0.832	1	0.832	0.703	1	0.703	0.973	1	0.973	0.837	1	0.837
STATE BANK OF INDORE	0.765	0.847	0.902	0.616	0.664	0.928	0.854	1	0.854	0.75	0.87	0.862	0.926	1	0.926
STATE BANK OF MAURITIUS	-	-	-	1	1	1	1	1	1	1	1	1	1	1	1
STATE BANK OF MYSORE	0.809	0.885	0.914	0.865	1	0.865	1	1	1	0.669	0.751	0.891	0.725	0.749	0.968
STATE BANK OF PATIALA	1	1	1	0.94	1	0.94	1	1	1	1	1	1	1	1	1

Table: 5.28 Continued…

STATE BANK OF SAURASHTRA	0.871	0.925	0.942	0.91	1	0.91	0.766	0.985	0.778	1	1	1	-	-	-
STATE BANK OF TRAVANCORE	0.855	0.967	0.884	0.791	0.969	0.816	1	1	1	0.935	1	0.935	0.925	1	0.925
SUMITOMO BANK	-	-	-	-	-	-	0.447	0.588	0.76	-	-	-	-	-	-
SYNDICATE BANK	0.824	1	0.824	0.763	0.962	0.793	0.867	1	0.867	0.951	0.957	0.993	0.957	1	0.957
TAMILNAD MERCANTILE BANK	0.848	0.886	0.957	0.607	0.622	0.975	0.89	0.982	0.906	1	1	1	0.818	0.936	0.874
TIMES BANK	-	-	-	0.577	0.617	0.934	-	-	-	-	-	-	-	-	-
TORONTO DOMINION BANK	-	-	-	-	-	-	1	1	1	-	-	-	-	-	-
UBS AG	-	-	-	-	-	-	-	-	-	-	-	-	0.27	0.369	0.733
UCO BANK	1	1	1	0.966	1	0.966	0.989	1	0.989	1	1	1	1	1	1
UNION BANK OF INDIA	0.855	1	0.855	0.698	0.943	0.74	0.833	1	0.833	0.974	1	0.974	0.886	1	0.886
UNITED BANK OF INDIA	0.991	1	0.991	1	1	1	0.954	1	0.954	1	1	1	0.87	0.878	0.991
UNITED WESTERN BANK	1	1	1	0.781	0.807	0.968	1	1	1	0.602	0.605	0.996	-	-	-
UTI BANK	-	-	-	0.931	1	0.931	1	1	1	-	-	-	-	-	-
VIJAYA BANK	0.695	0.79	0.879	0.655	0.821	0.798	0.702	0.78	0.9	0.865	0.945	0.916	0.92	0.929	0.99
VYSYA BANK	0.87	0.942	0.923	0.975	1	0.975	0.648	0.82	0.79	0.753	0.769	0.979	-	-	-
YES BANK	-	-	-	-	-	-	-	-	-	-	-	-	0.691	0.822	0.84
Mean	**0.92**	**0.97**	**0.95**	**0.78**	**0.9**	**0.86**	**0.82**	**0.91**	**0.9**	**0.84**	**0.91**	**0.92**	**0.8**	**0.89**	**0.9**

*These results refer to Combinations: - inputs: Number of Employees, Establishment Expenditure, Non-establishment Expenditure, Non-interest Expenditure and Fixed Assets; Outputs: Deposits, Advances, Investments, Net Interest Margin and Other Income.

Table: 5.29 DEA Estimates of Technical Efficiencies for All Bank Group*

Banks\Year	1991			1996			2001			2006			2009		
	crste	vrste	scale	crste	vrste	scale	crste	vrste	scale	crste	vrste	scale	crste	vrste	scale
AB BANK	-	-	-	-	-	-	-	-	-	-	-	-	0.357	0.377	0.947
ABN AMRO BANK	1	1	1	0.491	0.601	0.816	0.706	1	0.706	0.494	1	0.494	0.437	1	0.437
ABU DHABI COMMERCIAL BANK	1	1	1	1	1	1	1	1	1	1	1	1	0.724	0.746	0.971
ALLAHABAD BANK	1	1	1	0.7	0.943	0.742	0.684	0.786	0.87	0.906	1	0.906	0.918	1	0.918
AMERICAN EXPRESS BANKING CORP.	1	1	1	0.495	1	0.495	0.29	0.373	0.778	0.265	0.4	0.661	0.13	0.13	0.998
ANDHRA BANK	0.749	0.894	0.838	0.885	1	0.885	0.999	1	0.999	0.862	1	0.862	0.833	1	0.833
ANTWERP DIAMOND BANK	-	-	-	-	-	-	-	-	-	1	1	1	1	1	1
ARAB BANGLADESH BANK	-	-	-	-	-	-	0.805	1	0.805	0.854	1	0.854	-	-	-
AXIS BANK	-	-	-	-	-	-	-	-	-	1	1	1	0.726	1	0.726
BANK MUSCAT INTERNATIONAL	-	-	-	-	-	-	0.42	0.486	0.864	-	-	-	-	-	-
BANK OF AMERICA	1	1	1	0.599	1	0.599	1	1	1	0.938	1	0.938	1	1	1
BANK OF BAHRAIN & KUWAIT	1	1	1	0.951	1	0.951	0.565	0.62	0.912	0.878	1	0.878	0.547	0.615	0.889
BANK OF BARODA	0.924	1	0.924	0.679	1	0.679	0.776	1	0.776	0.781	0.947	0.824	0.961	1	0.961
BANK OF CEYLON	-	-	-	-	-	-	1	1	1	1	1	1	1	1	1
BANK OF INDIA	1	1	1	0.804	1	0.804	0.891	1	0.891	0.806	0.888	0.908	0.967	1	0.967
BANK OF INTERNATIONAL INDONESIA	-	-	-	-	-	-	0.333	0.727	0.459	0.535	1	0.535	1	1	1
BANK OF MADURA	0.772	0.827	0.934	0.384	0.509	0.754	-	-	-	-	-	-	-	-	-
BANK OF MAHARASHTRA	0.83	0.976	0.851	1	1	1	0.999	1	0.999	1	1	1	0.877	0.923	0.949
BANK OF NOVA SCOTIA	1	1	1	0.962	1	0.962	1	1	1	1	1	1	1	1	1
BANK OF PUNJAB	-	-	-	0.499	0.646	0.772	1	1	1	-	-	-	-	-	-
BANK OF RAJASTHAN	0.781	0.867	0.9	0.675	0.79	0.855	0.582	0.626	0.929	0.708	0.711	0.996	0.815	0.816	0.999
BANK OF TOKYO	1	1	1	1	1	1	-	-	-	-	-	-	-	-	-
BANK OF TOKYO-MITSUBISHI-UFJ	-	-	-	-	-	-	0.554	0.719	0.77	0.712	0.713	0.998	1	1	1
BANQUE NATIONALE DE PARIS	0.604	0.649	0.93	0.464	0.554	0.837	-	-	-	-	-	-	-	-	-
BARCLAYS BANK	0.476	1	0.476	0.876	0.884	0.991	0.463	0.491	0.943	1	1	1	0.56	0.995	0.564
BAREILLY CORPORATION BANK	0.904	0.919	0.984	1	1	1	-	-	-	-	-	-	-	-	-
BENARES STATE BANK	1	1	1	0.597	0.603	0.99	-	-	-	-	-	-	-	-	-
BHARAT OVERSEAS BANK	0.798	0.887	0.9	0.6	0.609	0.985	0.527	0.57	0.925	0.658	0.693	0.949	-	-	-
BNP PARIBAS	-	-	-	-	-	-	0.412	0.578	0.712	0.544	0.581	0.937	0.687	0.79	0.87
BRITISH BANK OF MIDDLE EAST	1	1	1	1	1	1	-	-	-	-	-	-	-	-	-
CALYON BANK	-	-	-	-	-	-	-	-	-	0.737	0.839	0.878	1	1	1
CANARA BANK	0.833	1	0.833	0.751	1	0.751	0.844	1	0.844	1	1	1	0.901	1	0.901
CATHOLIC SYRIAN BANK	0.755	0.816	0.926	0.703	0.784	0.897	0.837	0.846	0.989	0.75	0.756	0.993	0.602	0.604	0.997

Table: 5.29 Continued…

Bank															
CENTRAL BANK OF INDIA	0.799	0.984	0.812	0.805	1	0.805	0.83	0.978	0.849	0.95	1	0.95	1	1	1
CENTURION BANK	-	-	-	0.531	0.733	0.725	0.693	0.696	0.997	-	-	-	-	-	-
CENTURION BANK OF PUNJAB	-	-	-	-	-	-	-	-	-	0.465	0.56	0.83	-	-	-
CHASE MANHATTAN BANK	-	-	-	0.174	1	0.174	-	-	-	-	-	-	-	-	-
CHINATRUST COMMERCIAL BANK	-	-	-	-	-	-	0.688	0.758	0.908	1	1	1	0.457	0.489	0.934
CHO HUNG BANK	-	-	-	-	-	-	1	1	1	1	1	1	-	-	-
CITIBANK	1	1	1	0.665	1	0.665	0.885	1	0.885	0.966	1	0.966	0.667	1	0.667
CITY UNION BANK	0.714	0.743	0.961	0.709	0.709	1	0.892	0.894	0.997	0.983	1	0.983	0.923	1	0.923
COMMERZ BANK AG	-	-	-	0.116	0.761	0.152	1	1	1	-	-	-	-	-	-
CORPORATION BANK	0.73	0.833	0.877	0.83	0.954	0.87	0.859	1	0.859	0.807	1	0.807	1	1	1
CREDIT AGRICOLE INDOSUEZ	1	1	1	1	1	1	0.512	0.552	0.928	-	-	-	-	-	-
CREDIT LYONNAIS	1	1	1	1	1	1	1	1	1	-	-	-	-	-	-
DBS BANK	-	-	-	0.43	1	0.43	0.943	0.96	0.983	1	1	1	1	1	1
DENA BANK	0.895	1	0.895	0.738	0.991	0.745	0.629	0.841	0.748	0.799	0.899	0.889	0.842	0.865	0.973
DEUTSCHE BANK	0.768	0.962	0.798	0.541	0.837	0.646	0.771	1	0.771	0.529	1	0.529	0.55	1	0.55
DEVELOPMENT CREDIT BANK	-	-	-	0.411	0.481	0.853	0.537	0.725	0.741	0.344	0.364	0.945	0.318	0.323	0.987
DHANALAKSHMI BANK	1	1	1	1	1	1	0.49	0.493	0.994	0.515	0.525	0.979	0.624	0.627	0.995
DRESDNER BANK	-	-	-	0.328	0.795	0.413	1	1	1	-	-	-	-	-	-
FEDERAL BANK	0.787	0.866	0.908	0.692	0.919	0.753	0.854	1	0.854	1	1	1	0.953	1	0.953
GANESH BANK OF KURUNDWAD	-	-	-	0.558	1	0.558	0.828	1	0.828	-	-	-	-	-	-
GLOBAL TRUST BANK	-	-	-	1	1	1	0.67	1	0.67	-	-	-	-	-	-
GRINDLAYS BANK	0.616	1	0.616	0.361	1	0.361	-	-	-	-	-	-	-	-	-
HDFC BANK	-	-	-	0.649	0.783	0.829	0.735	1	0.735	0.889	1	0.889	0.457	1	0.457
HONG KONG & SHANG. BANK. CORP.	0.333	0.628	0.531	0.334	1	0.334	0.406	0.94	0.432	0.625	1	0.625	0.53	1	0.53
ICICI BANK	-	-	-	0.493	0.522	0.946	0.73	1	0.73	0.898	1	0.898	0.622	1	0.622
IDBI BANK	-	-	-	0.474	1	0.474	0.568	0.787	0.722	-	-	-	-	-	-
IDBI BANK LTD.	-	-	-	-	-	-	-	-	-	1	1	1	1	1	1
INDIAN BANK	0.731	1	0.731	0.634	0.9	0.705	0.757	0.998	0.759	0.886	1	0.886	1	1	1
INDIAN OVERSEAS BANK	0.883	0.932	0.948	0.833	1	0.833	0.791	0.915	0.864	1	1	1	0.876	1	0.876
INDUSIND BANK	-	-	-	1	1	1	1	1	1	1	1	1	0.636	0.693	0.917
ING BANK	-	-	-	0.572	0.89	0.643	0.29	0.357	0.813	-	-	-	-	-	-
ING VYSYA BANK	-	-	-	-	-	-	-	-	-	0.448	0.617	0.726	0.501	0.535	0.938
JAMMU & KASHMIR BANK	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
JP MORGAN CHASE BANK	-	-	-	-	-	-	-	-	-	1	1	1	1	1	1
JSC VTB BANK	-	-	-	-	-	-	-	-	-	-	-	-	0.367	0.462	0.795

Bank														
KARNATAKA BANK	0.909	1	0.909	0.94	1	0.94	1	1	1	1	1	1	0.989	1	0.989
KARUR VYSYA BANK	0.741	0.819	0.905	0.608	0.733	0.829	0.672	0.728	0.923	0.802	0.88	0.911	0.852	0.918	0.928
KBC BANK	-	-	-	-	-	-	1	1	1	-	-	-	-	-	-
KOTAK MAHINDRA BANK	-	-	-	-	-	-	-	-	-	0.451	0.594	0.76	0.428	0.952	0.45
KRUNG THAI BANK	-	-	-	-	-	-	0.844	1	0.844	1	1	1	1	1	1
LAKSHMI VILAS BANK	0.713	0.741	0.961	0.433	0.496	0.873	0.615	0.633	0.971	0.751	0.763	0.983	0.663	0.665	0.998
LORD KRISHNA BANK	0.678	1	0.678	0.725	0.747	0.971	0.622	0.622	1	0.509	0.514	0.991	-	-	-
MASHREQ BANK	0.94	1	0.94	1	1	1	0.885	0.909	0.973	1	1	1	0.337	0.531	0.635
MIZUHO CORPORATE BANK	-	-	-	-	-	-	-	-	-	0.738	0.781	0.945	0.612	0.614	0.998
MORGAN GUARANTY BANK	-	-	-	-	-	-	0.401	0.417	0.961	-	-	-	-	-	-
NAINITAL BANK	0.99	0.993	0.997	1	1	1	0.87	0.963	0.903	1	1	1	1	1	1
NEDUNGADI BANK	0.772	0.799	0.966	0.63	0.634	0.993	0.614	0.624	0.984	-	-	-	-	-	-
OMAN INTERNATIONAL BANK	1	1	1	0.889	1	0.889	0.474	0.533	0.889	0.872	1	0.872	0.616	0.665	0.926
ORIENTAL BANK OF COMMERCE	0.906	1	0.906	0.9	1	0.9	0.931	1	0.931	0.883	1	0.883	1	1	1
OVERSEA CHINESE BANK	-	-	-	-	-	-	0.745	1	0.745	-	-	-	-	-	-
PUNJAB AND SIND BANK	0.851	0.94	0.906	0.769	0.855	0.9	0.755	0.827	0.913	0.863	0.889	0.971	1	1	1
PUNJAB NATIONAL BANK	0.956	1	0.956	0.746	1	0.746	0.863	1	0.863	0.965	1	0.965	0.927	1	0.927
RATNAKAR BANK	1	1	1	0.719	0.846	0.849	1	1	1	0.816	0.873	0.934	1	1	1
SAKURA BANK	0.773	0.825	0.936	1	1	1	-	-	-	-	-	-	-	-	-
SANGLI BANK	0.831	0.892	0.932	0.758	0.768	0.986	0.975	0.978	0.997	0.818	0.881	0.928	-	-	-
SANWA BANK	-	-	-	0.838	1	0.838	-	-	-	-	-	-	-	-	-
SBI COMM. & INTERNATIONAL BANK	-	-	-	-	-	-	0.609	0.612	0.995	0.852	0.857	0.994	1	1	1
SHINHAN BANK	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1
SIAM COMMERCIAL BANK	-	-	-	-	-	-	0.908	1	0.908	-	-	-	-	-	-
SOCIETE GENERALE	0.924	1	0.924	1	1	1	0.341	0.366	0.933	1	1	1	0.566	0.569	0.995
SONALI BANK	1	1	1	1	1	1	0.514	1	0.514	0.376	1	0.376	0.457	1	0.457
SOUTH INDIAN BANK	0.833	0.936	0.89	0.833	0.835	0.999	1	1	1	0.8	0.807	0.991	0.997	1	0.997
STANDARD CHARTERED BANK	0.737	1	0.737	0.231	1	0.231	0.545	1	0.545	0.745	1	0.745	0.375	0.927	0.405
STATE BANK OF BIKANER & JAIPUR	0.713	0.822	0.867	0.82	0.952	0.862	0.834	0.852	0.979	0.781	0.965	0.809	0.805	0.905	0.889
STATE BANK OF HYDERABAD	0.828	1	0.828	0.743	0.914	0.814	0.903	1	0.903	0.902	1	0.902	1	1	1
STATE BANK OF INDIA	0.783	1	0.783	0.828	1	0.828	0.655	1	0.655	0.984	1	0.984	0.836	1	0.836
STATE BANK OF INDORE	0.669	0.787	0.851	0.607	0.649	0.935	0.701	0.77	0.91	0.754	0.868	0.869	0.926	1	0.926
STATE BANK OF MAURITIUS	-	-	-	1	1	1	1	1	1	1	1	1	1	1	1
STATE BANK OF MYSORE	0.735	0.826	0.889	0.828	0.929	0.891	1	1	1	0.665	0.704	0.944	0.726	0.75	0.968

STATE BANK OF PATIALA	1	1	1	0.948	1	0.948	1	1	1	1	1	1	1	1	1
STATE BANK OF SAURASHTRA	0.747	0.858	0.871	0.91	1	0.91	0.769	0.986	0.78	1	1	1	-	-	-
STATE BANK OF TRAVANCORE	0.808	0.97	0.833	0.793	0.999	0.794	1	1	1	0.956	1	0.956	0.919	1	0.919
SUMITOMO BANK	-	-	-	-	-	-	0.456	0.58	0.785	-	-	-	-	-	-
SYNDICATE BANK	0.775	1	0.775	0.758	0.962	0.788	0.867	1	0.867	0.951	0.957	0.993	0.957	1	0.957
TAMILNAD MERCANTILE BANK	0.656	0.723	0.907	0.568	0.626	0.907	0.878	0.982	0.894	1	1	1	0.821	0.935	0.878
TIMES BANK	-	-	-	0.578	0.618	0.936	-	-	-	-	-	-	-	-	-
TORONTO DOMINION BANK	-	-	-	-	-	-	1	1	1	-	-	-	-	-	-
UBS AG	-	-	-	-	-	-	-	-	-	-	-	-	0.272	0.373	0.729
UCO BANK	0.927	0.984	0.942	0.942	1	0.942	0.987	1	0.987	1	1	1	1	1	1
UNION BANK OF INDIA	0.807	1	0.807	0.671	0.943	0.711	0.832	1	0.832	0.974	1	0.974	0.883	1	0.883
UNITED BANK OF INDIA	0.991	1	0.991	1	1	1	0.999	1	0.999	1	1	1	0.87	0.878	0.991
UNITED WESTERN BANK	1	1	1	0.665	0.807	0.823	1	1	1	0.602	0.604	0.996	-	-	-
UTI BANK	-	-	-	0.892	1	0.892	0.989	1	0.989	-	-	-	-	-	-
VIJAYA BANK	0.612	0.806	0.759	0.635	0.821	0.774	0.71	0.78	0.911	0.887	0.945	0.938	0.94	0.957	0.982
VYSYA BANK	0.754	0.859	0.878	0.805	1	0.805	0.648	0.821	0.788	0.7	0.714	0.981	-	-	-
YES BANK	-	-	-	-	-	-	-	-	-	-	-	-	0.698	0.895	0.78
Mean	**0.85**	**0.94**	**0.9**	**0.73**	**0.89**	**0.82**	**0.77**	**0.87**	**0.88**	**0.83**	**0.91**	**0.92**	**0.79**	**0.88**	**0.89**

*These results refer to Combinations: - inputs: Number of Employees, Establishment Expenditure, Non-establishment Expenditure, Non-interest Expenditure and Fixed Assets; Outputs: Deposits, Advances, Investments, Net Interest Margin and Total Income.

SUMMARY AND CONCLUSIONS

During the 1990s financial sector reforms in India were initiated as a part of structural reforms encompassing trade, industry, investment and external sector. In order to realize the full potential of reforms in the real economy, it was felt that a vibrant and a competitive financial sector was crucial. Consequently, Govt. of India in August 1991, constituted a high-powered committee on the financial system (CFS) under the Chairmanship of Sri M. Narasimham to examine all aspects relating to the structure, organization, functions and procedures of the financial system. The Committee made wide ranging recommendations, which formed the basis of financial sector reforms relating to banks, development financial institutions (DFIs) and the capital market in the years to come.

Some of the important problems that the banking sector faced in the early 1990's were fragile health, low profitability and weak capital base. In order to address these issues several mutually reinforcing measures were initiated, with a view to improving the health of the banking sector. Internationally accepted prudential norms relating to income recognition, asset classification and provisioning, and capital adequacy were introduced in April 1992 in a phased manner. The Indian banking sector over the years had become less competitive as no new bank was allowed to be set up in the private sector after nationalization of 14 banks in 1969. The lack of threat of entry of new players led to inefficiency in the banking sector. Restrictions like regulation of interest rates, the system of financing working capital requirements, opening or closing of branches on the basis of their commercial judgment adversely affected the competitive environment as well as the efficiency of the banking sector. Keeping this in view, several measures such

as permitting entry of private sector banks, liberalized licensing of more branches of foreign banks, and increased operational flexibility to banks to improve their performance.

Research Questions:

Since the initiation of deregulation process of the financial sector in 1992, significant policy changes have been introduced to strengthen the banking sector. These changes are expected to have important implications for operating performance and profitability in the banking system. Therefore, from the point of view of both managerial and policy interests, it is extremely important to know the efficiency levels of banks and their temporal behavior so as to understand how the banking industry has been reacting to the reform measures and the subsequent emerging challenges. It is also of interest to know which banks have performed better than others in the period of transition. Further, it is also of interest to assess the overall performance of Indian commercial banks over the period of time.

Study Objectives:

In the light of the research questions raised above, the present study attempts to evaluate the performance (efficiency) of commercial banks during the period 1991-2009.

The specific objectives of the study are as follows:

6. To present a brief history of commercial banks in India since independence.
7. To examine the banking sector reforms initiated from 1991 onwards.
8. To have a critical insight into the efficiency of Indian commercial banks using accounting measures. (ratio analysis).
9. To estimate the technical efficiency of Indian commercial banks from 1991 to 2009 using the Stochastic Frontier Analysis to look into the possible factors

10. To estimate the relative technical efficiency of banks using the nonparametric DEA.

Hypotheses

In this study the following hypotheses are formulated.

v.   The SBI group is relatively more efficient compared to the other public sector banks.

vi.   The private sector banks are technically more efficient compared to the public sector banks, SBI group included.

vii.   The foreign banks are more efficient compared to the private as well as public sector banks.

viii. Technical efficiency of banks is not time invariant especially in the light of the financial sector reforms.

ix.   Deposits play a significant role in explaining bank outputs such as net interest margin, investment, credit etc.

Methodology

The basic foundation for measurement of efficiency has been the concept of efficiency advanced by Farrell who proposed that efficiency of a firm consists of two components namely, technical efficiency which reflects the ability of a firm to obtain maximal output from a given set of inputs, and allocative efficiency which reflects the ability of a firm to use inputs in optimal proportions given their respective prices. The parametric stochastic frontier analysis (SFA) and the nonparametric data envelopment analysis (DEA) are based on the concept of Farrell efficiency.

The SFA approach is one of the structural approaches to study efficiency. It generates an efficiency frontier for the sample. The efficiency of each bank is then measured as the distance of its output to the frontier. The SFA treats the observed inefficiency of a bank as a combination of the inefficiency specific to the bank and a random error and tries to disentangle the two components by making explicit assumptions about the underlying inefficiency process.

Under the SFA, there are two ways of looking at efficiency namely, the production way and intermediation way. The former considers that banks use capital, labor and other non-financial inputs to provide services for account holders. In the latter, banks are assumed to intermediate funds between savers and investors and incur interest expenses and other operating expenses to provide revenue generating services.

The Data Envelopment Analysis (DEA) is a non-parametric mathematical programming approach to the frontier estimation. DEA computes the efficiency of a bank in transforming inputs into outputs in relation to its peer group. DEA is a linear programming technique that converts multiple inputs and outputs into a scalar measure of efficiency. This conversion is accomplished by comparing the mix and volume of services provided and the resources used by each bank compared with all other banks. Each bank is evaluated against a hypothetical bank with an identical output mix that is constructed as a combination of efficient banks. DEA identifies the most efficient banks in a population and provides a measure of inefficiency for all others. The most efficient banks are rated to have an efficiency score of one, while the less efficient banks score between zero and one. Though DEA does not give a measure of optimal efficiency, it however differentiates the least efficient banks from the set of all banks.

Under the DEA also, there are two ways to measure efficiency namely, one input oriented and two outputs oriented, each being a dual to the other. The technical efficiency may be measured under the assumptions of either constant returns to scale (CRS) or variable returns to scale (VRS). In case of input orientation, output(s) combination is maximized for a given level of inputs, whereas in output orientation, input(s) is minimized to achieve a given output combination.

The CRS assumption is only appropriate when all the banks are operating at an optimal scale. Imperfect competition, constraints on finances, and other limitations may be hinder banks to operate at optimal scale. An extension of the CRS DEA model to account for variable returns to scale has been suggested in the literature. Further, use of CRS specification when all banks are not operating at the optimal, might confound the measure of technical efficiency by scale efficiencies (SE). In this context, use of VRS specification will permit the calculation of TE devoid of these SE effects.

The present study employs these two approaches. These approaches give us the economic measures of efficiency which take into account the behavioral dimension. In addition to the two approaches, the ratio analysis (in the accounting framework) has also been supplemented, as the financial managers frequently resort to the ratio analysis to assess the performances of business units.

Empirical Analysis

The present study covers the post reform period i.e**.** 1991-2009. The data on various inputs and outputs that have been used to calculate efficiency of commercial banks in India have been compiled from the "Statistical Tables Relating to Banks in India" published by RBI. Both parametric (stochastic frontier approach, SFA) and a non parametric (data envelopment analysis, DEA) approaches have been used to estimate

efficiency. In SFA four measures of outputs namely, net interest margin (total interest earned less total interest expended), other income (income from commission, brokerage etc.), credit and investment have been used. The study has also used two broader measures of outputs reflecting the profit earning and the growth and safety of banking sector. The profit earning measure is obtained by adding net interest margin and other income. Another variable reflecting banking growth has been constructed by adding credit and investment. Deposits, borrowings, fixed assets and labor have been used as inputs. The study estimates technical efficiency for different combinations of outputs and inputs. The banks have also been grouped into public sector, private sector and foreign banks etc.

To estimate technical efficiency using DEA, it is necessary to specify the inputs and outputs of banks. Accordingly two alternative combinations of inputs and outputs have been identified. The identification process has been based on an extensive empirical search for appropriate combinations. For the first combination, the inputs considered are number of employees, establishment expenditure, non-establishment expenditure, interest expenditure, non- interest expenditure and fixed assets. The outputs considered are deposits, advances, investments, net interest margin, total income and other income. For the second combination of inputs and outputs, while the inputs remained the same as the first combination, in the outputs the variable 'other income' in the first combination is replaced by the variable 'total income'. The technical efficiency assuming constant returns to scale (CRS), variable returns to scale (VRS), and scale efficiency has been estimated for different groups of banks and the entire banking sector.

Under the ration analysis, the study employs some of the frequently used ratios such as liquidity ratio, return on asset, and return on equity, among others. These ratios are computed from various items in the balance sheet, profit and loss statements or income

and expenditure statement. In the present study, for evaluating the productivity and efficiency of banks, the following rations namely, Operating Costs to Total Assets Ratio, Cost to Income Ratio, Labour Cost per Unit of Earning Assets, Non-Labour Cost, Intermediation Cost, Net Interest Margin (NIM) or Spread, Other Operating Income to Total Income, Business Per Employee, Business per Branch, Return on Assets, Return on Equity, are employed. It may however be noted that the accounting ratios / measures are only relative measures and at best can only partly indicate efficiency of banks. These ratios have a built-in limitation of misleadingly imputing economic significance to accounting numbers. They also suffer from accounting biases namely, that the accounting practices and norms in different economic environments can be significantly different and hence, comparison of the ratios computed from two units operating in different economic environments may not be appropriate for drawing meaningful conclusions.

The data on inputs and outputs of commercial banks in India from 1991 to 2009 have been compiled from the "Statistical tables relating to banks in India" published by RBI. All monetary values have been converted into 2004-05 prices using implicit GDP deflator.

Under SFA, the maximum likelihood estimates of stochastic frontier function of the banks, group-wise as well as all the banks taken together are presented. The estimates refer to the panel frontier for a given output measure and a set of input variable combination. The estimates are generated under two possible error distributions namely half normal and truncated normal. Associated with the panel frontier, along with the input coefficients estimates, four parameter estimates namely, σ^2, γ, μ and η are given. Here σ^2 is variance of composite error term i.e. U_{it} and V_{it}. If it is significant, then one can infer that the difference between actual output and frontier output is because of the factors which are within the control of banks. U_{it} measures the technical effect of the

banks and V_{it} (i.i.d normal with mean 0 and variance σ^2_v) captures the effects of omitted variables/ measurement errors. The parameter γ is the ratio of σ^2_u and σ^2, which measures the extent of the difference between actual output and frontier output, which is due to technical inefficiency. The parameter μ is the mean of the distribution of the U_{it}, assuming that error term follow truncated normal distribution. If μ is not significant then error term will follow half normal distribution. The parameter η shows whether the technical efficiency is time varying or not. If it is significant technical efficiency of the bank will be time varying otherwise it is time invariant. Further, Log likelihood and χ^2 test statistic are computed on the assumption that γ, μ and η are equal to zero.

The technical efficiency measures are given for each of the frontiers, output-wise and bank-group wise over the sample period with a view to comment on the technical efficiency of the banks.

In view of non availability of consistent price data, the present study has been confined to analysis of technical efficiency only as other measures of efficiency such as allocative, cost and profit efficiencies require price data.

Main Findings

From the stochastic frontier analysis (SFA), the following findings emerge:

4. Across the bank groups, the deposit variable as an input emerged as the most significant variable in influencing the bank output. This finding is consistent across all the frontiers that have used alternative output measures. Next to the deposit variable, fixed assets variable has been significant in explaining the bank output. In a few cases 'borrowings' has also been significant in especially in explaining the credit.

5. On the other hand, the labour input has been found to have very little influence on banking output

6. The bank specific effects associated with technical efficiencies are found to be time varying. In other words, the gap between the actual output and the frontier output has largely been due to bank specific technical efficiencies. This phenomenon has varied over time.

7. It turns out that the public sector banks (PSBs) i.e. the nationalized banks (NB) and State Bank of India and its associates (SBI&A) put together, are more efficient compared to domestic private banks and foreign banks. Surprisingly, foreign banks are considerably less efficient compared to PSBs possibly because of their relatively smaller scale. However, the foreign banks have higher efficiency compared to the domestic private banks, due to their specialized activities.

8. The mean technical efficiency (TE) of output for all bank groups has registered a mixed trend. For some outputs it has increased over the period of 1991-2009 and for some others over the same period has decreased. In case of SBI the mean TE of all outputs has shown declining trend trends except in the case of investment and 'other income as output measures. Similarly in case of nationalized and domestic private bank groups, the mean TE has decreased for net interest margin, credit and banking growth while it has increased for investment, other income and for profit goal. Likewise for foreign and private sector bank groups mean TE have shown increasing trend of investment, other income, profit goal and banking growth, but has declining trend for net interest margin and credit. The mean TE of all outputs in case of public sector bank has gone up except for credit and banking

From the DEA, the following conclusions emerge

1. There is no significant difference in the technical efficiencies under constant returns to scale (crste), variable returns to scale (vrste) and scale efficiency (SE), across the input and output combination for the entire bank groups as well as all banks together.

2. The public sector bank groups seem to operate at efficient frontier. There is only a marginal difference in all efficiency measures among individual banks of this bank group, especially in the early years.

3. In case of the private and foreign bank groups, some banks are less efficient compared to the efficient ones among the sample banks. The trend is similar when all the banks are put together, though in case of SBI and its associates, nationalized bank group and public sector bank group, a similar trend is found when the bank groups are taken individually.

4. The differences in efficiency scores of individual banks in the early period of the study got smoothened in the later years. This is particularly so for the public sector group wherein the number of banks in each group remained more or less the same.

5. The DEA scores also reveal that the public sector banks are relatively more efficient when compared to the private banks, though the gap between the groups over time has narrowed down.

6. The foreign banks as a group is no longer more efficient compared to the private domestic and public sector banks.

7. Scale efficiencies are noted in case of public sector banks

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