PERFORMANCE OF PUBLIC SECTOR BANKS IN INDIA DURING THE POST REFORM PERIOD

ABSTRACT
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ABSTRACT

The Indian banking system is characterized by the presence of large number of public sector banks which control a lion share of banking activities in the country. Public sector banks have been contributing significantly over the years to the country’s economic development. They work as catalyst agents of economic growth and prosperity by following the right kind of policies in their working. They occupy a pivotal position in the monetary structure of the country and play an important role in the proper utilisation of national resources through lending, investment and transferring funds throughout the nation. The public sector banks have been working on upliftment of the condition of poor and uneducated farmer by providing them short term financial loan to carry out their farming activities. They also ensure that a proper loan waiver system is followed for those farmers who are not able to repay their debts. The role of the state-controlled banking has allowed the government to draft best policies, which further aided in the growth and development of the economy. Hence, the public sector banks are the prime movers and leaders for the achievement of the socio-economic objectives of our economy.

Banking sector in India was dominated by private banks prior to the two waves of nationalisation of banks (1969, 1980) which completely changed the banking scenario in the country. The sector after nationalisation had continued to be dominated by the public sector banks in terms of number, assets share and total income. The banking sector now comprises of 26 public sectors banks with majority government ownership, 20 private banks and 40 foreign banks. The number of public sector banks has almost remained the same over the last three decades. And in terms of assets share and total income the public sector banks now constitute about 72.8 per cent of the total commercial banking assets and 72 per cent of total income of the scheduled commercial banks. But the point to be noted, the assets share of private sector banks now has gone up to about 20 per cent. On the other hand, even though the number of foreign banks has gone up significantly, their assets share has not increased in that way.

As a group the public sector banks had for long suffered from the image and perception problems. They were perceived as slow in response to market dynamics, competition and customer, poor management, poor loan recovery and high operating
cost, low in technology, poor in innovation and unwieldy in organisation. The nationalisation of banks provided much needed impetus to branch expansion and priority sector lending. But in doing so, the financial health of public sector banks kept on deteriorating. Most of the nationalized banks had weak capital base. Several public sector banks were financially weak and some of them were incurring losses year after year. Owing to this, the performance of public sector banks kept on deteriorating. In the mid-1980s, some efforts were made to liberalise and improve the profitability, health and soundness of the banking sector. But these were small steps considering type and magnitude of the problems. So, Government decided to restructure the banking sector in order to infuse greater competition and efficiency in their working and to increase their profitability. Accordingly, the Government of India set up a committee on financial system in 1991 under the chairmanship of Mr. M. Narasimham. It was asked to examine all aspects relating to structure, organisation, functioning and procedure of the Indian financial system. The Committee 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 depositor's and investor's confidence. Accordingly, financial sector reforms were initiated on the recommendation of the committee as part of overall structural reforms to impart efficiency and dynamism to the financial sector.

The recommendations of the Narasimham Committee are a landmark in the evolution of banking sector in the country, which transformed the Indian banking system from a highly regulated to a more market oriented system. The prudential norms relating to income recognition, asset classification and provisioning introduced early in the reforms phase were a major step towards objective assessment of the profitability and financial health of the banking system. However, in several respects these norms fell short of international best practices. The need, therefore, was felt to strengthen them further and bring them on par with the international best practices. Keeping these developments in mind, the Committee on Banking Sector Reform (Chairman: Shri M. Narasimham) was constituted on December 26, 1997 to review the progress of implementation of financial sector reforms recommended by the Committee on Financial System (CFS, 1991), and to suggest remedial measure for
strengthening banking system, covering areas of banking policy, institutional structure, supervisory system, legislative and technological changes.

Most of the recommendations of the Narasimham Committee have been accepted and implemented by the Government. The administrated interest rate structure has been almost deregulated. Statutory pre emption in the form of CRR and SLR has been reduced significantly. New banks in the private sector are allowed to be set up and entry of foreign banks is liberalised. Simultaneously with deregulation measure, capital adequacy measures and prudential norms relating to income recognition, assets quality and provisioning requirements have also been introduced to strengthen the safety and soundness of the banking system. Banks have also been allowed to diversify into non-traditional activities. Banks are now provided with operational flexibility and functional autonomy in their day-to-day decision making process and fully responsible for their performance. Most of public sector banks have accessed the capital market. This has changed their capital structure. Public sector banks have now become efficiency conscious, focusing on balancing profitability with liquidity and servicing the necessary socio-economic objectives of our development efforts.

The Committee on Technology Upgradation in the Banking Sector, appointed by the Reserve Bank, in its Report submitted in July 1999 provided a medium term road map for absorption of technology by banks and financial institutions. The Induction of information technology and communications networking system has changed the operating environment of banks drastically. Technology has already enabled most of the banks to introduce innovative products to their customers in the form of ATM facility, telebanking, homebanking, 'anytime' and 'anywhere' banking, etc. Technology has helped in automating and networking the branches that has led to timely flow of information and aid decision making process. It has affected and likely to affect more in future, the pricing of deposits, loans and other services provided by banks.

In recent years, foreign direct investment (FDI) in the banking sector was brought under the automatic route. With a view to further liberalising foreign investment in the banking sector, the Government 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 foreign institutional
investor (FIIs), subject to guidelines issued by the Reserve Bank from time to time. In consultation with the Government of India, the Reserve Bank released the roadmap for the presence of foreign banks in India on February 28, 2005. The branch authorisation policy was also liberalised and rationalized in September 2005 in order to give the reasonable freedom to banks and rationalise the policy for opening of new branches in India.

The above mention developments show that a drastic change has taken place in the banking environment of the country since the initiation of reform in 1992-93. The period of little more than two decade witnessed remarkable change in perception, policies and practices of banks. It would be interesting to evaluate the performance of public sector banks in this changed environment.

We have reviewed 32 studies from the developed countries, 25 studies from the developing countries (excluding India) and 50 studies from India. Most of the studies have used Data Envelopment Analysis (DEA) and stochastic frontier approach. Some studies have also used more than one technique. We have observed that different efficiency estimation techniques give different efficiency scores. We have also observed that efficiency scores depend upon the selection of input and output variables. Researchers have generally used capital related operating expenses, labour, deposits, loaned funds, interest expenses, non-interest expenses, total cost, operating expenses, purchased funds and equity, as input variable and advances, investments, interest income, net interest income, net loans, branch number, total deposits, total securities, total off -balance sheet items, earning assets and total revenue as output variable. The deposits have both input and output characteristics. In the literature it has been treated as an input by some authors while other authors treated it as output. Majority of studies reviewed by us have used intermediation approach in order to select input and outputs variables following Berger and Humphrey (1997) according to whom, the intermediation approach is best suited for analysis of bank level efficiency, whereas the production approach is well suited for measuring branch level efficiency.

The majority of the studies are confined to the banking system of the US and other developed countries. Berger and Humphrey (1997) documented a country wise and methodology wise review of the studies on bank efficiency and found that majority of the studies on banking efficiency focused on the banks of the developed
countries (about 95% and most of them in the USA). Therefore, they suggested that more research is needed in developing countries.

Literature on banking efficiency in the developed and developing countries is dominated by the studies assessing the impact of deregulation and liberalization, comparing efficiency on the basis of ownership and comparison of efficiency across the countries. In recent times, many countries have engaged themselves in the process of deregulation and liberalisation of their banking system with avowed objective of improving efficiency and performance of banks. The rationale behind introducing deregulatory and liberalization measures like interest rate deregulation, removal of entry barriers for private and foreign banks, etc. in the banking system is that these measures unleash the competitive forces in the system, which in turn compel the banks to bring the output-input combination to the optimal production frontier and induce them to produce financial services at lower cost. This led to the publication of a large number of research works, which explore the efficiency performance of banks in the wake of financial deregulation and liberalization. Nonetheless, there are mixed findings in the literature about whether deregulation helped the banks to improve efficiency or not. Notable studies which reported a positive impact of deregulation on the efficiency and productivity of banks are Alam (2001) for U.S., Isik and Hassan (2002) for Turkey, Chen, Skully and Brown (2005) for China, Ariss (2008) for Lebanon, etc. In contrast to aforementioned studies, there are studies that reported a negative effect of deregulatory measures on the efficiency and productivity of banks. Some of the studies in this context are Elyasiani and Mehdian (1995), Wheelock and Wilson (1999) for U.S., Harylichek (2006) for Poland, Erdem and Erdem (2008) for Turkey etc. Considerable work is also carried on comparing efficiency of the banks on the basis of ownership are Yildirim (2002) for Turkey, Ariff and Can (2008) for China, Tecles and Tabak (2011) for Brazil etc. have remarkable contribution in this area. Studies that compared efficiency of the banks among different countries are Limam (2001) for Gulf Corporation Council, Masdos and Pastor (2001) (OECD) countries Casu and Molyneux (2003) for European countries, etc.

In India, sincere efforts to examine banking efficiency started from 1997. Literature on banking efficiency in India is dominated by the studies assessing the impact of deregulation and liberalization and the studies comparing efficiency of public, private and foreign banks. There are mixed findings in the literature about

Our survey of literature on the efficiency of public sector banks in India reveals that efficiency of public sector banks have considerably improved during the post-reform period. But the number of such studies is very small. Many studies on the banking efficiency have compared the efficiency of public, private and foreign banks by using a common frontier. Such comparisons are not justified on the ground that public, private and foreign banks follow different technology and banking practices and are operated under different legal and regulatory frameworks. Numbers of Studies on Indian banking have primarily relied on ratio analysis to measure efficiency of financial institution, which suffer from several methodological limitations. To alleviate the methodological limitations associated with ratio analysis, this study uses a different methodology to measure the technical efficiency of banks. To our knowledge, no study has attempted to cover sufficiently (21 years) large time span after initiation of reform. Very few studies have compared the performance of public sector banks before and after financial crisis. Further, very limited number of studies on banking have analysed efficiency by decomposing it into components. In this study, we decompose efficiency into three sources- technical efficiency (CRS), pure technical efficiency (VRS) and scale efficiency. Most studies on the efficiency of public sector banks have followed single stage Data Envelopment Analysis. In our analysis, we have followed the two-stage approach as suggested by Coelli, Prasad and Battese (1998). This approach involves solving a DEA problem in the first stage analysis. In second stage, the efficiency score measures that are derived from the
DEA estimation (first stage) are used as dependent variable and then regressed upon the environmental variables (capital adequacy ratio, non performing assets, return on assets, total assets and ownership). There are very few studies, which have exclusively focused on the efficiency of public sector banks in India.

Keeping in mind the above-mentioned research gaps, we carried out the present study with the objectives (i) to analyse the growth and development of public sector banks; (ii) to examine the efficiency of public sector banks; (iii) to compare the efficiency of public sector banks with that of other bank groups; (vi) to analyse the impact of total assets (bank size), return on assets, capital adequacy, non performing assets and ownership on the banks efficiency. Based on these objectives of our study, we tested the following hypotheses: (i) efficiency of public sector banks has improved during the post-reform period; (ii) among the public sector banks, nationalized banks are relatively more efficient; (iii) efficiency of all public sector banks has improved during the post-reform period; (iv) bulk of inefficiency of public sector banks can be attributed to scale inefficiency; (v) public sector banks are less efficient as compared to private and foreign banks; (vi) size, profitability, capital adequacy ratio, non-performing assets and ownership have significant impact on the efficiency of banks.

There is no agreement in the literature on what represent banks' inputs and outputs. According to Berger and Humphrey (1997), there are two main approaches for selecting the inputs and outputs of a bank: (1) the production approach, also called the service provision or value added approach, and (2) the intermediation approach, also called the asset approach. Both these approaches apply the traditional microeconomic theory of a firm to banking and differ only in the specification of banking activities. The production approach treats banks as the producers of services to customers. The output of a bank under this approach is measured by the number and type of transactions, documents processed or specialized services provided by the bank over a given period of time. While the input includes physical variables (like labour, material, space information systems) or their associated cost. However, if the required information about the transactions is not available, the number of deposits and loan account may be considered as surrogate for the level of services provided by the bank. Under the alternative intermediation or asset approach, a bank is treated as a producer of intermediation services — because it transforms the risk and maturity profile of funds received from depositors, to investment or loan portfolios of a
different risk and maturity profile, by using labour and capital. But banks also
produce services for which specific charges are levied, for example, custodial
services, and safe deposit services for valuables, payment services and others. Thus
according to this approach, money value of loans and non-interest income are taken as
outputs, while inputs are labour and capital. The treatment of the money value of
deposits, however, remains ambiguous. In the literature it has been treated as an input
by some authors while others categorise it as an output (Das et al, 2005). Berger and
Humphrey (1997) pointed out that neither of these two approaches is perfect because
they cannot fully capture the dual role of banks as providers of transactions/document
processing services and being financial intermediaries. Nevertheless, they suggested
that the intermediation approach is best suited for analysing bank level efficiency,
whereas the production approach is well suited for measuring branch level efficiency.
Since our study attempts to analyse the efficiency of individual banks, we have used
intermediation approach to select the inputs and outputs for computing the technical
efficiency scores of individual public sector banks in India over the period 1992-2012.
The selected output variables are (1) interest income (2) non-interest income
(commissions for provision of services and related revenues). The inputs used in the
study are (1) deposits, (2) labour and, (3) capital related operating expenses.

The period of our study is from 1991-92 to 2011-12. Although the main focus
of our study is on the performance of public sector banks in India during the post
reforms period. But, in order to make the study more useful it is pertinent to compare
the performance of public sector banks with that of other banks. Accordingly, our
sample contains the public, private and foreign banks that have operated in India
during 1991-92- 2011-2012. However, it does not include Regional Rural Banks as
these banks have been established to meet some social objectives of providing credit
to a specific target and their inclusion in the study could lead to misleading
conclusions. It is important to mention here that numbers of observations vary across
time due to entry of new private banks in 1995 and merger of banks which leads to an
unbalanced panel data. As a result, the number of reporting banks varies from year to
year. The required data on the input and output variables have been culled out from
the various issues of ‘Statistical Tables Relating to Banks in India’, an annual
publication of the Reserve Bank of India and ‘Performance Highlights of Public
Sector Banks’, an annual publication of the Indian Banks’ Association (IBA).
Though recently a large number of studies, evaluating the performance of public sector banks in the reform have come up, yet certain important dimension of their performance i.e., socio-economic dimensions of their working are altogether ignored. Moreover, in most of these studies, analysis is based upon very limited number of indicators, limited number of years and for a few banks and bank groups. Therefore, against this background, it is thought desirable to take up a comprehensive study evaluating and comparing the performance of different aspects of the public sector banks in India. The performance of public sector banks has been studied by branches and priority sector lending. The branches and priority sector lending are two important wheels on which the whole public sector banks is moving. Considering the national priorities, involvement of banks in rural areas and deployment of credit to different section of the society, it appears to be appropriate to assess the performance of public sector banks in terms of branches and priority sector lending. Other important indicators are deposits, credit, credit-deposit ratio, total income, total expenditure, net profit, total assets, non performing assets and Capital adequacy ratio.

The expansion in branches of public sector banks was much higher in the pre-reform period as compared to the post-reform period. The reason for the rapid increase in number of branches of the public sector banks during the pre-reform period was the expansion of banking facilities in the deficit areas through branch licensing policy and emphasis on the reduction of inter-state and inter-districts disparities in bank branches. However, the same trend could not be maintained by the public sector banks during the post-reform period and they were overtaken by private and foreign banks in the branch expansion. This was largely due to poor financial health of public sector banks.

The priority sector lending, emerged after the nationalisation of banks as major programme of directed credit, aims at extending much needed credit to hitherto neglected key sectors of the economy. With priority sector banks lending becoming one of the most active instruments of policy, banks were able to achieve by 1985 the target of directing 40 per cent of net bank credit to priority sectors. However, banking sector reforms initiated as part of the liberalisation policies, since the beginning of 1990s, have had a negative impact on lending to priority sectors. Various attempts have been made in recent past not only to dilute and broaden the norms of the priority sector lending, but also to loosen monitoring of performance in this regard. As result,
the percentage of credit channelled to priority sectors of the economy declined in the initial years of reforms. It came down from 40.9 per cent in 1991 to 37.8 per cent in 1996. However, it increased thereafter and usually remained above 40 per cent. The higher ratio achieved was possibly the sequence of widening the scope of priority sector lending, which allowed banks to park funds in new areas and even perhaps divert funds from areas originally considered as constituting the priority sector. The areas newly included in the priority sector, it is worth recalling, have among them Rural Infrastructure Development Fund (RIDF) even though it is suffering from gross underutilisation.

The average percentage share of deposits of public sector banks declined in the post-reform period as compared to pre-reform period. Rapid expansion of the branch network in rural areas, special emphasis on deposits mobilisation and rise in income levels propelled the growth of bank deposits of public sector banks during the pre-reform period. But the poor financial health and slow branch expansion drastically reduced the speed of deposit mobilisation by the public sector banks during the post-reform period. The entry of new private banks and foreign banks were also responsible for decline in the share of deposits of public sector banks. Like deposits, average percentage share of credit of public sector banks declined in the post-reform period as compared to pre-reform period. However, compared to public sector banks, private sector banks performed much better in their lending operations during the post-reform period. Owing to deceleration of credit, the credit-deposit ratio of public sector banks declined during the post-reform period. Contrary to that, credit-deposit ratio of private sector banks improved during the post-reform period as compared to pre-reform period. It is to be noted here that average credit-deposit ratio of private sector banks was less than 60 per cent during the pre-reform period. The improvement in their credit-deposit ratio during the post reform period was largely due to the entry of new banks and soundness of their financial health. Unlike private sector banks, public sector banks were more occupied with improving their poor financial health and dealing with their large non-performing assets during the post-reform period. They, therefore, became wary of enlarging their loan portfolio. Their capacity to grant credit was also impaired due to little headroom available in the capital adequacy ratio. They found risk adjusted returns on government securities more attractive. Hence
despite lowering of Statutory Liquidity Ratio (SLR), public sector banks continued to invest in government securities far in excess of the stipulated requirements.

There has been a continuous increase in income of bank groups during both pre and post-reform period. But the total income of private banks increased more rapidly during the post-reform period as compared to that of public sector banks in whose case its speed slowed down during the post-reform period. It was largely due to the entry of new private sector banks during the post reform period. The banking sector reforms have made a decisive positive impact on the expenditure reduction efforts of public sector banks in India. Total expenditure of public sector banks increased much slowly during the post-reform period as compared to private sector banks. Net profits of public sector banks and foreign banks were higher in pre-reform period as compared to post-reform period. Public sector banks suffered losses due to introduction of prudential norms during the initial years of post-reform period. But subsequently they performed well by improving their profits. Similarly, the foreign banks also sustained loss in the year 1993 but thereafter they have improved their profitability. On the other hand, the private banks have not at all sustained any losses during the pre and post-reform period. So again, private banks registered relatively better performance in terms of total assets as compared to other banks group during the post reform. Net- Non Performing Assets (NPAs) to Net Advances of all bank groups improved since 1999. The most significant improvement in assets quality was observed in respect of nationalised banks, followed by old private sector banks and State Bank group. As results, net NPA ratios of all banks groups have converged to around 1-2per cent. The soundness of the Indian banking sectors as well as all bank groups in terms of Capital to Risk Weighted Asset Ratio (CRAR) also improved over the years. There has also been significant improvement in the asset quality of banks, which is close to the global levels.

In response to the reforms, the progress of banking sector in the last twenty one years has been impressive. The banks have been adjusting very well to the new environment and becoming internationally competitive. Hence, the period 1992-2012 may be regarded as the phase of reformation in the evolution of Indian banking system. In general, though the reform process could improve the performance of all banks groups, its impact on private sector banks and foreign banks in India is more pronounced compared to public sector banks.
The debate on differences in measuring and analysing the efficiency of the banking industry is still open and has been the subject of many applied works. The techniques used in estimating the frontier are based on parametric methods (when some hypotheses are introduced on the frontier functional form, based on their properties) and non-parametric methods (when observational criteria based on programming techniques are used to construct the frontier). The parametric method is an econometric model which involves specifying a functional form and error term. The relevant literature has emphasized three main approaches: Stochastic Frontier Approach (SFA), Thick Frontier Approach (TFA), and the Distribution Free Approach (DFA). On the other hand, the nonparametric method is a mathematical model which does not recognize the error term and which usually measures technical efficiency. The literature emphasizes two main approaches: Data Envelopment Analysis (DEA) and Free Disposal Hull (FDH). In this study, we have used nonparametric DEA to estimate bank efficiency of public sector banks in India with the assumption of a variable returns to scale. The reason for choosing DEA is because the parametric SFA requires a large sample size to make reliable estimates (Havrylchyk 2006). On the other hand, DEA works well with a small sample size and does not require knowledge of any functional form of the frontier. In addition, DEA does not require a cost minimizing or profit maximisation condition, and it does not require any data on prices.

In this study, we have employed the two-stage method to analysis the technical efficiency of public sector banks operating in India. In the first stage, we estimated the efficiency level of public sector banks by using the non-parametric DEA approach to investigate whether the technical efficiency of the public sector banks improved between 1992 and 2012, and to compare the efficiency scores of public sector banks with private and foreign banks. In the second stage, we regressed the efficiency level obtained from the first stage on factors that could influence the efficiency of banks by using a Tobit regression model for each year during the period of study. In the study, total assets indicate the size of each bank, the return on assets indicates the profit, capital adequacy ratio of banks indicates soundness of banks and net non-performing assets to net advances indicates the assets quality of banks. Ownership is tested using a dummy variable for public sector and foreign banks. The dummy for private banks is omitted to prevent perfect multicollinearity.
Our analysis shows that the public sector banks in India grew significantly from 1992 to 2012. Output side interest income of public sector banks increased by around fifteen times during the study period from Rs 112938 lakhs in 1992 to Rs1735184 lakhs in 2012. The public sector banks in India achieved a whopping 1436% growth in average interest income during the period 1992-2007. During this period, public sector banks focused extensively on improving their non-interest income, which resulted in a 1325% increase in the average non-interest income from 1992-2012. On the input side, the value of all the inputs of public sector banks (with the exception of labour) increased through time. The number of employees of public sector banks decreased sharply from 31924 lakhs in 1992 to 25550 lakhs in 2008, and then improved to 29668 in 2012. This fall might be related to the merger of some state banks. Another plausible reason the introduction of Voluntary Retirement Scheme for the banks staff with a view to curtail establishment expenditure. On the other hand, capital related operating expenses increased by around twenty four times during the study period from Rs 6091 lakhs in 1992 to Rs 147295 in 2012. The average amount of deposits over the sample period reflected similar growth pattern. The average deposit amount was 19238513 lakhs in 2012 compared to 865752 lakhs at the end of 1992.

The findings of the first stage indicate significant progress in average efficiency scores of public sector banks during the study period. Overall technical efficiency, pure technical efficiency and scale efficiency of public sector banks improved during the post-reform period. Overall and pure technical efficiency of public sector banks improved relatively more in the second phase of reform (2000-2012). Contrary to it, scale efficiency of public sector banks declined in second phase of reform. The bulk of inefficiency of public sector banks is attributed to scale inefficiency. Overall and pure technical efficiency shows high variability in the performance of public sector banks. However, variability was low in case of scale efficiency. Under the overall and pure technical efficiency scores variability in the performance of public sector banks was higher in the first phase of reform as compared to the second phase of reform whereas under scale efficiency scores variation in the performance was higher in second phase of reform as compared to first phase of reform.
The results indicate that under over all technical efficiency if the frontier technology had been imposed then banks in the State Bank and Nationalized Bank groups could produce their output with only 97.4 per cent and 86.3 per cent of their current used level of inputs, respectively. State Bank group was found to be more efficient in the each of the efficiency estimate. If the inputs have been utilized with full potential, the State Bank group could have increased their output by 1.02 (1/0.974) times, while the increase for nationalized banks could have been 1.15 (1/0.863) times than the observed output. This shows the extent of underutilization or wasting of resources by nationalized banks. The average overall and pure technical efficiency of both State Bank Group and Nationalized Banks increased in the second phase of reform as compared to the first phase of reform. In contrary to that their scale efficiency declined in the second phase of reform. Thus, banks affiliated with State Bank groups outperformed the banks belonging to the Nationalized Bank group in terms of efficiency in the resource utilization process.

On the basis of bank wise analysis we found that UCO Bank, United Bank of India and Indian Bank were least efficient banks under the overall technical efficiency during the period of study. These banks were identified weak banks by the Committee on the Banking Sector Reform (1998) and Working Group on the Restructuring of the Weak Public Sector Banks (1999). The most efficient banks were SBI and its associate banks and three nationalized banks viz Oriental Bank of Commerce, Corporation Bank and Andhra Bank. UCO Bank and United Bank of India were also found to be least efficient under the pure technical efficiency while State Bank of India and State Bank of Indore found to be most efficient banks. Under the scale efficiency scores, Punjab and Sind Bank, Bank of Baroda, Canara Bank and Bank of India were found with lowest level of efficiency score and State Bank Patiala and State Bank of Hyderabad were found with highest level of efficiency score. However, the overall efficiency score of public sector banks improved during the post-reform period.

In Assessing efficiency of public sector banks we used annual separate frontier so as to know which bank is efficient within the public sector banks. As mentioned earlier, we also wanted to compare the efficiency of public, private and foreign banks. To facilitate that, we have constructed a common frontier. The mean efficiency measures calculated relative to separate frontiers are always greater than those computed relative to common frontier regardless of the year and group, which implies
that separate frontiers always either coincide with or lie inside of the common frontier. The main advantage of common frontier is that this allows one to compare the banks of each group (public, private and foreign banks) against the same benchmark.

Our results indicate that foreign banks as a group was more efficient users of input quantities to produce a given output as compared to the public sector banks and private sector banks. Average overall technical and pure technical efficiency score was highest for foreign banks followed by public sector banks and private banks. This means that there were inefficiencies in the use of the inputs among the public sector and private sector banks which these banks need to remedy in order to achieve increased efficiency. The public sector and private sector banks have done badly compared to the foreign banks perhaps because of the fact that the latter has adapted best to the new environment compared to the former. The liberalisation policy might have created problems for the Indian banks to reorganise their operation to improve their dynamic efficiency. As a result, the public and private sector banks responded to the liberalisation process very slowly. The possible reasons for the highest level of efficiency of the foreign banks were that they did not carry the heavy burden of lending to the priority sector at the subsidized interest rates. Apart from this, a greater involvement in highly profitable activities like bill discounting, management services, investment in securities, foreign exchange dealings, fee related business, etc. by the foreign banks might have helped them to achieve the higher level of efficiency compared to the domestic banks. Relatively superior quality of officers, clerks and sub-staff of foreign banks might have also contributed to their higher efficiency.

Average variation in the overall technical efficiency score was highest in case of foreign banks and lowest in the case of public sector banks during the study period. Compared to that, average variation in the pure technical efficiency score was highest in the private sector banks and lowest in the public sector banks, whereas scale efficiency score variability across bank groups was almost same during the period of the study. Our analysis shows that most banks displayed decreasing returns to scale. Indeed every Indian bank in every year in the sample period operated in the decreasing returns to scale region of production technology. The banks that were operated in the Increasing Returns to Scale (IRS) and Constant Returns to Scale (CRS) range were mostly the foreign banks. Punjab National Bank was only public
sector bank in the CRS range (2010). The persistence of diseconomies of scale have possibly resulted due to the RBI’s branching policy. Indian banks were required to open branches under the branching policy, but were not allowed to close unprofitable branches. This policy prevented optimization of resources across the branch network because banks have neither control over the location of branches nor ability to close loss-making branches. In sharp contrast, foreign banks exhibited increasing and constant as well as decreasing returns to scale. Foreign banks tend to have smaller branch networks, since they have not yet fully expanded their business and have not been forced by regulator to expand branch networks beyond their optimal size.

In addition to estimating the DEA efficiency scores in stage one; we constructed an econometric regression model in stage two. This regression is based on the efficiency scores as a dependent variable for determining the relationship between efficiency and some of the determinants. Due to the limited nature of our efficiency measure, which ranged from 0 to 1, we estimated our models using Tobit-regression onto a vector of explanatory variables in order to explain the variation in the efficiency scores obtained from stage one.

In this process, we first analysed influence of the difference in total assets on the efficiency scores. The result showed a positive significant relationship between them at 1% significance level for the years 2006, 2007, 2010 and 2012, and at the 5% significance level for the years 2003, 2008 and 2011. This positive relationship between total assets (bank size) and the technical efficiency score was found in several earlier studies also. Yildirim (2002) reported that the size of banks was positively related to the technical and scale inefficiencies. Jerenic and Vujcic (2002) found that large banks appeared to be locally efficient while smaller banks were globally efficient. Altunbas, Liu, Molyneux and Seth (2000) and Mester (1996) also found this positive relationship.

Second, we estimated the relationship with profitability, which we defined as the return on assets (ROA), and technical efficiency scores. Results of the z test suggested that there was a significant positive relationship between them at 1 % significance level for the years 1997, 2003, 2005 and 2006 and at the 5% significance level for years 2007 and 2011. The result is consistent with the finding of Das and Ghosh (2006), Olena Havrylych (2006) and Ariff and Can (2005)
Third, we examined the relationship with the capital adequacy ratios, which we defined as the amount of a bank’s capital in relation to its risk-weighted credit and technical efficiency scores. The results of the z test for the relationship of capital adequacy ratio and technical efficiency score showed that there was a significant positive relationship between them at 1% significance level for the years 1996 and 2012 and at 5% significance level for the years 2005, 2010 and 2011. Increased emphasis on the achievement of benchmark capital adequacy ratio (CAR) necessities changes in the internal functioning of banks, especially in the system of credit evaluation, risk assessment and management, the quality of human resources as well as the quality of internal control and corporate governance. Thus, financial soundness that reduces uncertainties and systematic risk contributes to lowering efficiency, which is well supported by recent empirical finding of Grigorian and Manole(2002) and Das and Ghosh (2006).

Fourth, we analysed relationship between the net non performing assets and technical efficiency scores. The results of the z test suggested that net non-performing assets was negatively related to bank efficiency score at 1% significance level for the years 1996, 1999 and 2001 and at 5% significance level for the years 2000, 2003, 2004, and 2009. It suggests that decline in quality of management (proxied by increase in net non-performing assets loans) reduces the level of technical efficiency. Understandably, as NPAs come down, banks may recycle available resources, including tangible (provisions) and intangible capital (human capital) from monitoring NPAs to more productive uses, thereby raising efficiency levels of banks. This is broadly supportive of bad management hypothesis, which is well supported by recent empirical finding of Reserve Bank of India (RBI) Report on Currency and Finance (2006-2008).

Finally, the dummy variable for public sector banks seeks to detect the influence of government ownership on the efficiency. The value of the z test for the relationship of government ownership and technical efficiency score showed that there was a significant positive relationship between them at 1% significance level for the years 1996, 1997, 1998, 1999, 2000, 2001, 2003, 2004 and 2005 and at 5% significance level for years 2006, 2007, 2008 and 2011. However, the magnitude of the coefficient of dummy variable representing foreign banks has invariably been higher than that of public sector banks. Which indicates that foreign banks have relatively been more efficient as compared to public and private banks.
Thus, in sum, our analysis suggest that efficiency of public sector banks on the whole and of the individual public sector banks has improved significantly during the post-reform period. State Bank group was found to be more efficient in each of the efficiency estimate. In nationalised banks Corporation Bank, Oriental Bank of Commerce and Andhra Bank has been most efficient banks. However, most of the public sector banks in most of the years operated in the decreasing returns to scale region of production technology. The observed technical inefficiency of public sector banks is due to both poor input utilization (i.e., managerial inefficiency) and failure to operate at most productive scale size (i.e., scale inefficiency). Foreign banks as a group were more efficient users of input quantities to produce a given output as compared to the public sector banks and private sector banks. This means that there were inefficiencies in use of inputs in the public sector banks and private sector banks which these banks need to remedy to achieve increased efficiency. The public sector and private sector banks have done badly compared to the foreign banks perhaps because of the fact that the latter has adapted best to the new environment compared to the former. The liberalisation policy might have created problems for the Indian banks to reorganise their operation to improve their dynamic efficiency. As a result, the public and private sector banks responded to the liberalisation process very slowly. The possible reasons for the highest level of efficiency of the foreign banks were that they did not carry the heavy burden of lending to the priority sector at the subsidized interest rates. Apart from this, a greater involvement in highly profitable activities like bill discounting, management services, investment in securities, foreign exchange dealings, fee related business, etc. by the foreign banks might have helped them to achieve the higher level of efficiency compared to the domestic banks. Relatively superior quality of officers, clerks and sub-staff of foreign banks might have also contributed to their higher efficiency. We used Tobit regression model to regress the efficiency level obtained from the stage one on factors that could influence the efficiency score. The result suggest that total assets, return on assets, capital adequacy ratio and ownership had positive effect on the efficiency score, while the impact of non-performing assets was generally negative. On the whole, the study suggest that there is an ample scope for improvement in the performance of inefficient public sector banks by choosing a correct input-output mix and selecting appropriate scale size.