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BANK OWNERSHIP AND EFFICIENCY IN INDIA: SOME FRESH EVIDENCE

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Abstract: We have assessed the performance of 68 Indian commercial banks from 1998–99 through 2006–07 following a two-stage method. Data Envelopment Analysis (DEA) methodology is used in the first stage to obtain bank-level technical efficiency (TE) while panel data econometric techniques are used in the second stage to explain the obtained TE scores in terms of bank-specific factors. Results show that the relationship between size of a bank and its TE is significant positive and public-sector banks outperform domestic private and foreign banks. Non-performing assets and priority sector advances matter for banks' performance. Indian commercial banks are burdened with excess labor force. Some policy implication of our results is also discussed.

Key words: Data Envelopment Analysis; Panel Data Econometrics; Technical Efficiency; Liberalization; Indian Banking.

JEL Classification Number: C23, C61, G21, G28, L25

1. INTRODUCTION

A recognition of the need of an efficient financial sector to promote overall economic development can be traced all the way back to the early 20th century when Joseph Schumpeter (1911) argued in his *Theory of Economic Development* that scarcity of finance is a serious obstacle to development. Cross-country experience also suggests that the existence of a healthy, efficient and competitive financial sector, which Joseph Stiglitz (1998) termed the "brain" of the economy, is a necessary pre-condition for rapid economic development. This necessity is more pronounced in the case of backward or so-called developing economies because the opportunity cost of capital is more there, coupled with underdeveloped financial markets (Smith, 1998). Further, inefficiency in financial intermediation carries with it the possibility of misallocation of funds, which could result in more non-performing assets (Barman, 2007).

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Financial intermediaries such as banks are major players in any financial market, and their overall performance is therefore an important determinant of the performance of the financial sector concerned, in particular, and that of the overall economy, in general. Over time, the banking systems in many developing economies performed poorly, and researchers diagnosed it as a direct consequence of the excessive regulations that were in place. However, the experience with deregulation in the banking sector has been mixed in nature. Empirical studies in the US show that measured cost productivity actually decreased following deregulation (Bauer, Berger and Humphrey, 1993; Humphrey and Pulley, 1997; Berger and Mester, 2001). On the other hand, a study by Chaffai (1997) analyzed the deregulation experience in Tunisia and found that total factor productivity (TFP) of banks increased following a liberalization program initiated in 1986. However, the rate of technical progress was higher than the rate of productivity growth, implying that the banks, on an average, became less efficient after liberalization.¹ Thus the issue of whether financial deregulation actually helps overall development or sometimes can be so counterproductive as to hinder the process of development may be an interesting subject of debate. The issue becomes more relevant in view of the recent global economic crisis, which originated in the US mortgage lending market and soon spread to others. As noted by analysts, uncontrolled financial innovations introduced by investment agencies and other banks, as well as by some other financial institutions, was one of the major causes of the crisis. The objective of the present paper is to study the performance of major Indian commercial banks in the post-financial deregulation period through a thorough analysis of their efficiency (TE) and to find out some of its major determinants.²

The literature on performance of Indian banking sector is in fact voluminous. However, in this connection, we briefly review few important recent ones of them. Using data envelopment analysis (DEA) to analyze data on 70 Indian commercial banks from 1986 to 1991, Bhattacharyya et al. (1997) found that publicly owned Indian banks are the most efficient among all ownership categories considered in the study, followed by foreign-owned banks and Indian private banks respectively. However, they also found something odd (and almost diametrically opposite) when the inter-temporal behavior of such performance was considered. Evidence of temporal improvement was seen in the performance of foreign-owned banks, virtually no such trend in that of Indian private banks and a temporal decline in that of the publicly owned banks. They explained this pattern in terms of the government's evolving regulatory policies. Now an important question that one may ask is although public sector banks face a temporal decline in their performance while foreign banks improve little bit, what is the absolute scenario now from their performance point of view? In other words, could the private sector and/or foreign banks exceed their public sector counterparts to have relatively higher efficiency level? That is precisely one of our major objectives in this study. A study by

 $^{^1}$ See Casu and Molyneux (2003) for an extensive survey of the relevant literature on performance of banks.

 $^{^2}$ One can alternatively consider cost or profit efficiency or even total factor productivity of Indian commercial banks and its growth over time achieved by them to have an idea about their performance.

Sarkar et al. (1998) (with the motive of evaluating enterprise performance under different ownership patterns) confirmed that in the absence of a well-functioning capital market, there might not be any significant difference in the performance of public- and private-sector banks. Their analysis highlighted the importance of creating an appropriate institutional background before pushing privatization in developing economies. Kumbhakar and Sarkar (2003) analyzed the relationship between deregulation and TFP growth in the Indian banking industry using a generalized shadow cost function approach. Analyzing disaggregated panel data on a population of public and private banks from 1985 to 1996, they found evidence in favor of a significant decline in regulatory distortions and also non-materialization of anticipated TFP growth until 1996. Using DEA, Sathye (2003) measured the productive efficiency of banks in India for the year 1997–98. The efficiency scores, for three groups of banks—publicly owned, privately owned and foreign-were measured. The study showed that the mean efficiency score of Indian banks compared well with the world mean efficiency score and the efficiency of private-sector commercial banks as a group was paradoxically lower than that of public-sector banks and foreign banks in India. The study also recommended that the existing policy of reducing non-performing assets and rationalization of staff and branches might be continued to obtain efficiency gains and make Indian banks internationally more competitive. Chakrabarti and Chawla (2005) used DEA to evaluate the relative efficiency of Indian banks during 1990–2002 and observed that on a "value" basis, foreign banks as a group had been considerably more efficient than all other bank groups, followed by Indian private banks. However, from a "quantity" perspective, the Indian private banks seemed to be doing very well while the foreign banks were the worst off. This, as it can be easily understood, might be a reflection of the general policy of foreign banks to "cherry-pick" more profitable businesses, ignoring the social obligation of offering banking services to a wider section of society. Further, publicsector banks were seen to be lagging behind their private counterparts in performance. Das and Ghosh (2006) investigated the performance of the Indian commercial banking sector during the post-reform period 1992–2002. Using DEA, they applied all the three different approaches—intermediation approach, value-added approach and operating approach—to differentiate how efficiency scores varied with changes in inputs and outputs. The analysis also linked the variation in calculated efficiencies to a set of variables such as bank size, ownership, capital adequacy ratio, non-performing loans, management quality, and so on. Their findings suggested that medium-sized publicsector banks performed reasonably well and were more likely to operate at higher levels of TE. A close relationship was observed between efficiency and soundness as determined by a bank's capital adequacy ratio. Their empirical results also showed some evidence in favor of the expected relationship that technically more efficient banks were

those that had, on average, less non-performing loans. To evaluate the impact of computerization³ on the productivity and profitability of Indian banks, Mittal and Dhingra (2007) applied DEA methodology to Centre for Monitoring Indian Economy (CMIE) data on 27 selected Indian commercial banks over the years 2003-04 and 2004-05. They observed that private-sector banks, which took more information technology (IT) initiatives, were more efficient in terms of the productivity and profitability parameters than their counterparts under public ownership. Das, Ray and Nag (2009)⁴ used DEA to measure the labor-use efficiency of individual branches of a public-sector bank with a large network of branches across India. They found considerable variation in the average levels of efficiency of bank branches across the four metropolitan regions considered in the study. They also introduced the concept of area or "spatial efficiency" for each region relative to the nation as a whole. The results suggested that the policies, procedures, and incentives handed down from the corporate level could not fully neutralize the detrimental influence of local work culture across different regions. Most of the potential reduction in labor cost appeared to be coming from possible downsizing of the clerical and subordinate staff. In a parallel study Bhandari (2012) observed that the nationalized banks in India achieved the best total factor productivity growth among the three broad Indian commercial bank groups, namely those under public, domestic private and foreign ownership.

We thus see that the issues raised earlier can be explored further to a great extent and we have precisely done that using information pertaining to the Indian commercial banking sector during the post-liberalized era. The paper is organized as follows. Section 2 briefly discuss on the institutional background on which financial sector reform, in general and banking sector reform, in particular is introduced in India with some salient features and impacts of it on domestic financial sector. Section 3 briefly reviews the theories proposed in the literature that deal with ownership-performance and sizeperformance nexus. Section 4 states the analytical methodologies we consider here. Section 5 describes the data set we have used and our major findings from analyzing it, and Section 6 concludes. Appendix presents some further information.

2. INSTITUTIONAL BACKGROUND AND BANKING SECTOR REFORMS IN INDIA

It is useful to briefly recall here the nature of the Indian banking system at the time when financial sector reforms were initiated in the early 1990s. This would facilitate a greater clarity of the rationale and basis of reforms. The Indian financial system in the pre-reform period essentially catered for the needs of planned development in a mixed economy where the government sector played a dominant role in economic

⁴ However, this study is a bit different to the others in the sense that while others consider different Indian commercial banks, it deals with different branches of a single public-sector bank.

³ Indian banks are now investing heavily in computerized technologies such as tele-banking, mobile banking, net banking, automated teller machines (ATMs), credit cards, debit cards, smart cards, call centres, customer relationship management (CRM), data warehousing and the like. All these facilities, which are new innovations in banking technologies, help the Indian banking system improve its service quality, particularly by lowering the time cost associated with each transaction, to a huge extent.

activity. The strategy of planned economic development required huge development expenditure, which was met thorough the government ownership of major banks, an automatic monetization of the fiscal deficit and by subjecting the banking sector to large pre-emptions—both in terms of the statutory holding of government securities (statutory liquidity ratio, or SLR) and the administrative direction of credit to preferred sectors. Further, a complex structure of administered interest rates prevailed, guided more by social priorities, necessitating cross-subsidization to sustain the commercial viability of institutions. These not only distorted the interest rate mechanism but also adversely affected development of the financial market (Rangarajan, 2007).

Contrary to this, financial reforms⁵ in India created an enabling environment for banks to overcome external constraints and operate with greater flexibility. Such measures related to dismantling the administered structure of interest rates, and the removal of several pre-emptions to do with reserve requirements and credit allocation to certain sectors. Interest rate deregulation was brought in stages, allowing sufficient resilience to build up in the system. This was an important component of the reform process, which has made resource allocation more efficient. A parallel strengthening of prudential regulation, improved market behavior, gradual financial opening and, above all, underlying improvements in macroeconomic management helped the liberalization process run smooth. Interest rates have now been largely deregulated, except for certain specific classes such as savings deposit accounts, non-resident Indian (NRI) deposits, small loans up to INR 0.2 million, export credit, and the like. Other major objectives of banking sector reforms were enhancing efficiency and productivity through increased competition and, for that, modifying the overall legal environment for smoothly conducting banking business in India. Establishment of new banks was allowed in the private sector and foreign banks were also permitted more liberal entry. Yet another step towards enhancing competition was allowing foreign direct investment in private-sector banks up to 74% from all sources. As for the modification of the legal environment, the Securitization Act was enacted in 2002 to enhance protection of creditor rights. To combat the abuse of the financial system for crime-related activities, the Prevention of Money Laundering Act was also enacted in 2002 to provide the enabling legal framework. The Negotiable Instruments (Amendments and Miscellaneous Provisions) Act 2002 expanded the erstwhile definition of "cheque" by introducing the concept of "electronic money" and "cheque truncation." The Credit Information Companies (Regulation) Act 2005 is expected to enhance the quality of credit decisions and facilitate faster credit delivery. Let us present some highlights of the major areas of banking sector reforms in India. (a) financial repression through statutory pre-emptions has been reduced, while stepping up the prudential regulations at the same time; (b) interest

 $^{^{5}}$ Few unique features of the Indian reform process are as follows. (a) It was undertaken early in the overall reform cycle in India; (b) the banking sector reforms were not driven by any immediate crisis as has often been the case in several emerging economies; (c) the design and detail of the reform were evolved by domestic expertise, while taking on board the international experience in this regard; (d) enough space was created for the growth and healthy competition among public and private sectors as well as foreign and domestic sectors etc. (Rangarajan, 2007).

rates have been progressively deregulated on both the deposit and lending sides; (c) restoration of public sector banks' net worth achieved through recapitalization where needed; (d) increased competition through entry of new private and foreign banks; (e) higher levels and standards of disclosure achieved to enhance market transparency; (f) strengthening of bank regulation and supervision towards international best practice; (g) institution of micro prudential measures; (h) streamlining of supervision process in combination of both on- and off-site surveillance along with external auditing; (i) introduction of risk-based supervision; (j) introduction of structured and discretionary intervention for problem banks through a prompt corrective action mechanism; (k) ownership of public sector banks has been broadened through disinvestment up to 49%; (l) institution of greater regulatory coordination to regulate and supervise financial conglomerates; (m) measures taken to strengthen creditor rights; and so on (see Bhide et al., 2001 for a more detailed discussions).

Now one may ask how useful has been the financial liberalization process in India towards improving the functioning of institutions and markets in all practical sense? This is obviously a legitimate question. To reply, the improvement in the performance of financial system over more than a decade of reforms is also reflected in the improvement in a number of indicators. Capital adequacy of the banking sector recorded a marked improvement and stood at 12.3% at the end-March, 2006. This is a far cry from the situation that prevailed in early 1990s. On the asset quality front, notwithstanding the gradual tightening of prudential norms, non-performing loans (NPL) to total loans of commercial banks which was at a high of 15.7% at the end-March 1997 declined to 3.3 per cent at the end-March 2006. Net NPLs also witnessed a significant decline and stood at 1.2% of net advances at the end-March 2006, driven by the improvements in loan loss provisioning, which comprises over half of the total provisions and contingencies. The proportion of net NPA to net worth of public sector banks has dropped from 57.9% in 1998-99 to 11.7% in 2006-07. Operating expenses of banks in India are also much more aligned to those prevailing internationally, hovering around 2.1% during 2004-05 and 2005-06. These numbers are comparable to those obtained for leading developed countries which were range-bound between 1.4–3.3% in 2005. Bank profitability levels in India have also trended upwards and gross profits stood at 2% during 2005-06 (2.2% during 2004–05) and net profits trending at around 1% of assets. Available information suggests that for developed countries, at the end-2005, gross profit ratios were of the order of 2.1% for the US and 0.6% for France. The extent of penetration of our banking system in our country as measured by the proportion of bank assets to GDP has increased from 50% in the second half of nineties to over 80% a decade later (Rangarajan, 2007).

However, as pointed out by Barman (2007), two distinct phases are discernable in the reform of the Indian banking system. To quote,

"... In terms of imposing regulatory standards, Indian banking system is characterized by two distinct phases. The first phase 1992–98 could be thought of as a period of transition from regulated regime to the gradual adaptation of international standard. A fundamental change during this period was the liberalization of the earlier administered interest rate regime. Besides that, other significant policy measures included reduction in reserve ratio, relaxation of quantitative restrictions on assets/liability composition and removal of some of the major barriers to entry into the financial system. The new policy framework also entailed considerable institutional reforms, including new laws and regulations governing the financial sector, the restructuring and privatization of banks, and the adoption instruments of monetary policy.

In all practical sense, the second phase (post-1998) can be considered as post liberalization period. In the second regime, banks enjoyed almost full freedom in pricing their products. Furthermore, aggressive stance of some new entrant private Indian banks and foreign banks and mergers among some of the existing players ushered significant changes in the structure of the banking sector in India. The new regime, in sharp contrast to the earlier regime that thrived on banking through public sector, could be perceived as more accommodative towards competition. Incidentally, the post-1998 period roughly coincides with the adoption of multiple indicator approach as the monetary policy framework by the RBI, in place of the earlier one of "monetary targeting with feedback."

In other words, unlike the pre-liberalization phase, the post-1998 regime was perceived as more accommodative towards competition. Further, the entry of new private banks and some foreign banks to the industry made a significant change in the structure of the Indian banking sector. For one, there has been increasing competition among banks (as reflected in their share of expenditure on advertising and publicity as a proportion of total operating cost), and the share of publicly owned banks, though still the largest among the major bank groups, has been gradually diminishing over time (Table 1a). These changes necessarily make the individual players more marketoriented and call for them to improve their performance for even mere survival. In addition to that, since banks under private and foreign ownership are relatively more market-oriented than their nationalized counterparts in the sense that they are able to enjoy more freedom in taking their business decisions, these banks are expected to be operating more efficiently (under the overall improved domestic market conditions in the post-liberalization period) in view of the more flexible operating systems. One of our major objectives in this paper is to see whether such anticipation holds well in the Indian banking sector.

In this connection, let us discuss a bit on the ownership-wise Indian banking scenario.⁶ We distinguish among four categories of banking institutions identified by the Reserve Bank of India (RBI) (2005): *Foreign banks* that mostly entered after 1990 and operate local branches, the state-owned *State Bank of India (SBI)* formed in 1955 and its associates; *nationalized banks* that were formerly private large banks and became state-owned in two waves, 1969 and 1980, and *private Indian banks* that were mostly

⁶ One may look at Berger et al. (2008) for a more elaborate discussion on it.

Important Indicators	Year	SBI and	Other Nationalized	Domestic	Foreign
		Associates	Banks	Private Banks	Banks
Share in Total Deposits	1999	30.3	58.0	7.2	4.6
	2000	30.1	57.0	8.6	4.3
	2001	31.2	55.0	9.4	4.5
	2002	30.5	54.1	11.1	4.4
	2003	29.8	52.9	12.4	4.9
	2004	28.4	52.8	13.9	4.9
	2005	28.3	52.1	15.1	4.6
	2006	25.8	51.3	17.7	5.1
	2007	24.1	51.8	18.6	5.5
Share in Total Assets	1999	32.1	54.8	7.0	6.0
	2000	32.2	53.5	8.4	5.9
	2001	32.9	51.6	9.1	6.4
	2002	30.6	48.5	14.8	6.1
	2003	30.1	48.7	14.8	6.5
	2004	28.8	49.0	15.6	6.6
	2005	27.4	50.1	16.2	6.3
	2006	25.6	48.9	18.6	6.9
	2007	24.0	48.6	19.7	7.7
Expenditure on	1999	0.3	0.4	1.5	6.0
Advertisement/Publicity	2000	0.3	0.4	1.6	5.8
as Percentage of	2001	0.3	0.3	2.9	7.0
Operating Expenditure	2002	0.3	0.4	1.9	5.1
	2003	0.4	0.5	2.4	4.5
	2004	0.7	0.8	2.6	5.6
	2005	0.6	0.9	3.1	6.6
	2006	0.8	1.0	3.1	10.9
	2007	0.7	1.2	2.8	9.5

Table 1a. Some Important Indicators of the Major Indian Commercial Bank Groups

created after 1990.7

The RBI was formed in 1945 as the central bank of India and high priority was given to increasing credit to rural areas and small businesses. In 1955, the government took over the largest bank, the *Imperial Bank of India*, to form SBI. The State Bank of India Act in 1959 directed SBI to take over regional banks that were associated with local governments and make them subsidiaries of SBI, which were later named "associates." SBI is now the largest commercial banking organization in the country—and one of the largest in the world.

Given continued pressure to extend bank credit to the agricultural and small business sectors, the Indian government nationalized 14 large banks in 1969 and another 6 banks

⁷ Detailed list of the banks we have considered in our analysis is shown in the Appendix.

in 1980 to redirect credit to "underserved" sectors and populations. Unlike SBI, nationalized banks remained corporate entities and retained most of their management and staff. Although their boards of directors were replaced by the state, appointees included representatives from both the government and private industry (Banerjee et al., 2005).

Private banks are primarily *de novo* entrants that were granted banking licenses during the financial liberalization in the early 1990s. A total of 25 *de novo* private banks began operations between 1994 and 2000. There are also a small number of incumbent private banks that existed before 1990 and some state-owned institutions that have been successfully privatised. An example of the latter is ICICI, which was formed in 1955 as a state-owned institution at the initiative of the Government of India and the World Bank to create a development financial institution for providing medium- and long-term project financing to Indian businesses. During the 1990s, ICICI was privatised and evolved into a private, full-service bank and is now India's second largest bank offering a wide range of services to retail and corporate customers.

Most foreign banks began operating in the 1990s under a license to open branches and are permitted to take deposits and provide credit in accordance with local banking laws and RBI regulations.⁸ Between 1994 and 2000, 21 foreign banks were established. Foreign banks have generally not purchased shares of local Indian banks, since foreign banks were restricted to a ceiling of 10% of voting rights, even though foreign banks could legally own up to 74% of equity. Foreign banks have typically focused their operations in the top 25 cities in the country, likely due in part to restrictions on branch expansion.⁹ The foreign banks are most numerous, but they have relatively few branches and accounts and also have fewer deposits and assets than the other types.

3. THEORIES PROPOSED IN THE LITERATURE

Ownership-Performance Nexus

State ownership gained popularity in the industrialized countries in view of its widely believed role as a remedy for market failures such as externalities and monopoly. In developing nations these justifications were coupled with arguments that state-owned enterprises (SOEs) facilitate economic independence and planned development. However, Alchian (1965) predicted that SOEs will be inherently less efficient than private firms and governments in both industrialized and developing nations also expressed their concern about the SOEs' record of failure and waste since the 1970s. These concerns brought an increasing urgency to the debate on the merits of state ownership. Are the failures of SOEs exaggerated: do they in fact perform worse than private firms? If the failures exist and, therefore, reform is necessary, how should it be accomplished? Can SOEs be reformed from within, or are they intrinsically inefficient? Would changes in

⁸ However, a few foreign banks, such as *Standard Chartered Bank*, have had limited operations in India for decades.

⁹ Foreign banks currently operate only on a branch license basis under which they are required to keep locally \$25 million in capital for the first three branches. Further expansion does not require additional capital, but requires **RBI** approval, which is often difficult to receive.

the operating environment improve SOE performance, or is a wholesale change of ownership necessary? Are SOE inefficiencies a byproduct of government-imposed social objectives, and do the benefits from these social goals outweigh the cost of inefficiency? Are there inevitable flaws in the process of privatization that will produce performance inferior to continued state ownership? Are the circumstances in some countries so inimical to successful privatization that state ownership will always dominate, at least in monopoly markets?

It can be mentioned in this connection that three broad approaches to the performance of state owned enterprises have emerged in the literature.¹⁰ First, one set of theories argues that product market competition, not property rights, is the primary determinant of enterprise performance. Competition in product markets is widely viewed to improve allocative efficiency. In the presence of competing producers, prices will tend towards marginal cost, thus allocating resources to their highest value. Conversely, when competition is absent, prices are raised and production is lowered relative to the competitive equilibrium. There is theoretical evidence that this effect can be extended to public firms - a small group of studies (Beato and Mas-Colell, 1984; De Fraja and Delbono, 1989; Cremer et al., 1989) examines the allocative results of public-private competition in a Stackelberg duopoly framework. These studies suggest that the competitive (price at marginal cost) result will be obtained if the public firm is the Stackelberg follower. Moreover, there is empirical evidence that in absence of competition, SOEs will produce allocatively inefficient results (Peltzman, 1971; Jones, 1985). Although allocative efficiency is clearly important, SOE behavior in this regard follows the well-understood patterns of private firms in various market structures (barring government-imposed rules on SOE pricing and output).

While a strong case can be made that competition enhances internal efficiency, when considering SOEs it must still be determined whether SOEs will perform as well as private firms facing the same market structure, i.e., whether the effects of competition are stronger or weaker than the effects of ownership. In their landmark study Vickers and Yarrow (1989) cite competition's information effect as an important influence on public-sector performance, but do not quantify the effect relative to ownership.

A second set of theories (Shleifer and Vishny, 1994; Boycko et al., 1996a, b) focuses instead on ownership and hypothesizes that states use SOEs for purposes other than to maximize social welfare; in ways they could not if the firms were private, and that this will have an adverse effect on performance in any market structure. Two different sets of assumptions can be used to analyze the behavior of governments. One expects political markets to work efficiently, such that rational governments have incentives to maximize social welfare. The other assumes that political markets are inefficient, and that government actors, such as bureaucrats or legislators, are able to maximize their own utility – in the form of votes, income, or favors – in ways that subvert the common good. In this environment, the concern is that government actors may promote

¹⁰ Interested readers may look at Shirley and Walsh (2001) for a more detailed review of the concerned literature.

distortionary and inefficient SOE practices in order to reap political benefits. In contrast, there is less latitude for such a government to intervene in the operations of private firms.

Judging from the literature on government behavior, even assuming governments act to maximize social welfare, SOEs are the superior solution to market failures only in a relatively rare set of circumstances. Moreover, another body of analysis strongly suggests that government actors do not behave in this way – rather, they behave as rational players who maximize their own welfare. SOEs will thus be used to serve the purposes of politicians in most political markets, at the expense of efficiency. Intervention in private firms will also occur, but will be less effective because of higher costs and greater transparency. If we ignore this body of thought and assume that government actors put their interests aside and demand efficient results from their SOEs, another issue remains. Are governments as capable as private owners of inducing SOEs to produce efficient results, given the problems inherent in the separation of ownership and control?

A third approach (Boardman and Vining, 1992) argues that, regardless of government's goals, private firms will be more successful than SOEs in addressing problems of corporate governance. Public and private firms face a similar problem. In both cases, owners seldom manage the day-to-day operations of the firm. As a result, they face a principal/agent problem with those whom they hire to do the managing. Resolving this principal/agent dilemma is crucial to efficient firm operation. Although both public and private firms face this problem, their responses, and therefore, their performance can differ significantly. This section examines the problems of separation of ownership and control and some of the ways to address these problems, and then considers the different ways that SOEs and private firms respond to these problems and solutions.

The literature just reviewed suggests that competition cannot substitute for private ownership; that politicians in inefficient political markets may distort SOE operations for their own interests; and that even if they don't, the task of motivating managers is even more daunting in the public sector than in the private sector. Based on these analyses, the case for public ownership is limited to a small set of cases (see Hart, Shleifer, and Vishny, 1997 for a discussion of where to draw the line between public and private provision of public goods). These insights are useful for policymakers currently faced with the choice between public and private ownership.

Size-Performance Nexus

So far as the size–performance nexus is concerned, there are two opposite views proposed in the literature. To discuss them briefly here, the size of a firm is supposed to affect its performance for a number of reasons.¹¹ A large firm generally has diverse capabilities and greater ability to exploit economies of scale, thereby performing much better relative to a smaller firm (Penrose, 1959). On the other hand, size is correlated with market power (Shepherd, 1986) which increases possibility of generating

 11 See Majumdar (1997) for some more discussion on the relationship of firm's performance with its size and age.

X-inefficiency in production, leading to relatively inferior performance (Leibenstein, 1976). Theory, therefore, is equivocal on the relationship between size of a firm and its performance. Now, considering the Indian economy one can observe that not only it had an ambivalent attitude towards the role and existence of large firms, the articulation and administration of policy had also been at cross-proposes with each other (Jalan, 1991). However, we wish to examine this size-efficiency relationship prevails among the Indian commercial banks as well.

4. ANALYTICAL METHODOLOGY

We have followed a two-stage procedure to carry out our analyses. In the first stage we follow the DEA methodology to get the TE score of each of the Indian commercial banks we have taken into account and that for each year. In the second and final stage we have explained these bank-level TE scores on a set of bank-specific characteristics supposed to affect the level of its TE using the panel data econometric techniques. We will discuss both the DEA methodology and our regression model followed in the second stage here one after another. Let us, first of all, discuss the concepts of TE of a production unit with the help of the diagram below. Let ATBC (in Figure 1 below) be the production frontier (exhibiting variable returns to scale (VRS) technology with other usual desirable properties). An (output-oriented) measure of TE of firm F, as defined to be the ratio of actually produced amount of output to the frontier level of output for the given level of input used by this firm, is given by $\frac{FX_1}{BX_1}$. In general, it measures the extent to which we can proportionately expand our outputs without expanding the input scale. We can define these concepts for the constant returns to scale (CRS) technological specification as well. For instance, in Figure 1, OD₁TD is the production frontier for the CRS technology and under such technological specification the (output-oriented) TE of firm F is $\frac{FX_1}{DX_1}$. Note that TE is identical (and equal to unity) at all points on the respective frontier for both VRS and CRS technologies.¹²

Data Envelopment Analysis

The first published paper describing this mathematical programming methodology and labeling the approach as DEA was by Charnes, Cooper and Rhodes (1978) in which they assume that the production technology exhibits CRS. The imposition of a CRS structure for the production technology implicitly assumes that producing units operate on optimal scales. Such a presumption may not, however, be always tenable, as different firms operate under different types of market power, financial constraints, and externalities. Subsequently DEA theory advanced considerably relaxing, in particular, the relatively stronger CRS property. In fact, a VRS model was developed by Banker, Charnes and Cooper (1984). Apart from considering a VRS structure the model assumes

 $^{^{12}}$ One can similarly define TE in the input-oriented way also to measure the extent to which input scale can be reduced without reducing the output scale. However, we use the output-oriented measure only throughout this paper.



the following fairly general axioms¹³ for the production technology of firms: (a) all the observed input-output bundles are feasible; (b) the production possibility set is *convex* implying that given a set of N feasible input-output bundles, *any* weighted average of these N input bundles can produce the same weighted average of the corresponding N output bundles and (c) any input or output is *freely disposable*. These assumptions enable one to construct, following the DEA method, a production possibility set and the production frontier on the basis of the observed inputs-output bundles of a given set of producing units. The *frontier*, basically a piece-wise linear surface over the data points, is constructed by the solution of a sequence of linear programming problems—each one for each individual unit in the sample. It then yields, as a by-product, the extent of technical inefficiency of a unit in terms of the distance between the observed data point corresponding to the unit and the frontier so constructed. We briefly describe the method below.

Let the firm *i* be observed to produce Y_i , an *r*-component (column) vector¹⁴ of quantities of outputs, by using the input bundle X_i , a *k*-component (column) vector of quantities of inputs, the *j*th element of X_i (Y_i) is taken to be zero, if the *i*th firm does not use (produce) the *j*th input (*j*th output). The DEA method seeks to construct a frontier on the basis of the observations on inputs and outputs of the *N* firms, by solving a set of *N* linear programs, one for each firm in the industry. The problem for the firm *s* is to

¹³ For economic implications and interpretations of these axioms, see Ray (2004; pp. 27).

¹⁴ In general, we assume that each firm uses k number of inputs to produce r number of outputs. Note that Y_i will be a scalar in case all firms produce a single and the same good.

find a scalar ϕ and an *N*-component vector $\lambda_s = (\lambda_{si})$ which solve the following linear programme:

$$(P_s)$$
 Maximise ϕ

subject to (i) $\sum_{i=1}^{N} Y_i \lambda_{si} \ge \phi Y_s$, (ii) $\sum_{i=1}^{N} X_i \lambda_{si} \le X_s$, (iii) $\sum_{i=1}^{N} \lambda_{si} = 1$ and (iv) $\lambda_s \ge 0$.

Let (P_s) have an optimal solution, say $[\phi_s, \lambda_s = (\lambda_{si})]$. The optimal value, ϕ_s , then indicates the *maximum* possible *proportional increase*¹⁵ in the output vector that could be achieved by the sth firm, with their input quantities being held constant at X_s . This *proportion* is then used to get a measure of (an *output-oriented*) TE of the sth firm relative to the frontier (TE_s) as defined below:

$$TE_s = 1 / \phi_s$$

On the other hand we have to solve the same problem stated above, but without the constraint (iii) to obtain the TE score of this firm if we assume that the production technology follows CRS. Since in this case we are optimizing our objective function with lesser number of constraints, the optimum value in this case will not be smaller than ϕ_s and, therefore, TE of a firm under CRS specification will be, *ceteris paribus*, less than or equal to that under VRS technological specification.

Econometric Model

We have used a two-way error component model of panel data given below to explain the individual bank-wise TE score in terms of some bank-specific characteristics:

$$y_{it} = \sum_{j=1}^{5} \beta_j x_{jit} + \sum_{k=1}^{3} \delta_k D_{kit} + a_i + c_t + u_{it}$$
(1)

where y is the TE score of a bank; x_j (j = 1, ..., 5) is the value of j^{th} characteristic of the bank and D_k (k = 1, 2, 3) is the k^{th} ownership dummy. Subscript *it* stands for the i^{th} bank at t^{th} time point. In addition, a_i and c_t are used to capture the possible fixed effects, if any, of individual-specific and time-specific respectively. Details of the bank-specific characteristics and ownership dummies we have considered in explaining TE score are discussed below:

 x_1 : Total volume of business¹⁶ a bank creates. We have used it as a proxy of the size of a bank.

 x_2 : Ratio of priority sector advances to total advances. RBI has termed certain

¹⁵ Note that a feasible solution to the above problem is given by $\phi = 1$ and $\lambda_s = a$ unit vector (the sth component being unity). Hence, the optimal value, ϕ_s^* , will be greater than or equal to one.

¹⁶ It is the sum of total deposits and advances. Since it is a nominal figure, we adjust this value by the corresponding average of lending and deposit rates for each of the concerned years. We then scale down it by 10^8 . Note that scaling an explanatory variable changes both the parameter estimate and its standard error proportionately without affecting the relevant 'z' or 't' statistic.

sectors of the economy as priority sector like agriculture, small scale industries, small business/service enterprises, micro credits, educational loans, housing loans etc and set a percentage (of adjusted net bank credit or the amount of off-balance sheet exposure) limit at least which a commercial bank has to fulfill by providing advances to these sectors. Since it prohibits a bank to independently decide about the direction of its lending business, its decision making power is, to some extent, constrained by this provision. One, therefore, can expect that this variable may have some negative impact on a bank's performance indicators.

 x_3 : Ratio of secured advances to total advances. Secured advance is that part of advances provided by a bank which is secured by either tangible assets or covered by bank or government guarantees. So, one can expect that it should have a positive impact on bank's performance indicators since nil or negligible risk is associated with it. There may be some counter argument as well. Since banks are forced to invest certain percentage of their investment in approved securities in form of SLR etc, there may be some negative correlation between the volume of secured advances of a bank and its operational flexibility and, therefore, this ratio may have some negative impact on its performance. So, theoretically the impact of the variable we have considered here is equivocal in nature and to be empirically determined.

 x_4 : Ratio of wage bill to total expenses. It is usually argued that for the relatively stronger unions and stringent labor laws, any nationalized entity faces more difficulty in taking *hire & fire* decisions on their employees which they feel sometimes necessary. So, it may result in the problem of excess use of labor which may force the bank to be unable to invest more on modern day technologically upgraded facilities like computerization, availing IT facilities etc. Thus, one can expect that the variable we have considered may have some negative impact on banks' performance.

 x_5 : Ratio of net non performing assets (NPAs) to net advances. Nonperforming assets are those assets of a bank which is lying idle and not generating any income. So, this ratio may have some negative impact on banks performance indicators.

Let us now turn to a brief description of the ownership dummies we have considered. Indian commercial banks (other than the regional rural banks) are usually classified under four broad heads namely State Bank of India (SBI) and its Associates, other nationalized banks, domestic private sector banks and the foreign banks. We have considered these four groups and introduced three ownership dummies accordingly as follows. $D_1 = 1$ if the bank belongs to the other nationalized group, i.e., other than the SBI group and 0, otherwise; $D_2 = 1$ if it belongs to the domestic privately owned banks group and 0, otherwise and $D_3 = 1$ if it is under foreign ownership and 0, otherwise. Since domestic private sector banks and foreign banks enjoy more flexibility while taking their business decisions relative to their nationalized counterparts, one can expect the nature of ownership may have some impact on a bank's performance. For instance, the foreign banks enjoy lower priority sector advances limit to be fulfilled than their domestic counterparts, foreign banks may be expected to be more efficient than the domestic commercial banks. Again, the problem of excess labor/employee we have discussed earlier, if at all, is relatively more severe in case of the nationalized banks and

for that one can expect that the nationalized banks should be relatively less efficient.

5. DATA USED AND EMPIRICAL FINDINGS

We have used Annual Accounts Data of Scheduled Commercial Banks obtained from the RBI's website. A major problem one has to face in empirical banking research is defining the "inputs" and "outputs" of banks. Due to its ambiguous nature of use, an asset/liability may either be considered as an output of a bank or as its input used to produce some other output. For instance, if we view banks as service providers to their customers, as the production approach¹⁷ does, deposits of banks should be taken as an output. On the other hand, it should be included in the set of inputs if we consider a bank to be an intermediating entity between savers and investors whose goal is to earn profit through lending and investing resources collected from customers in the form of deposits. In view of such ambiguity, four approaches have been proposed so far in the literature on banking output-the production approach, the intermediation approach, the operating (income-based) approach and, more recently, the modern approach.¹⁸ We use a variant of the intermediation approach (subject to our data availability constraint) where deposits and other liabilities, together with real resources such as labor, are defined as inputs whereas the output set includes earning assets such as loans and investments (Model I, hereafter).¹⁹ We also use the production approach (Model II, hereafter) to see whether the basic results to the performance-related issues considered in the present study change drastically or not due to merely changes in the approach to defining the inputs and outputs of banks.

We use individual bank-level (yearly) data for 68 major Indian commercial banks for the years 1999²⁰ to 2007. On a totality, we have data on eight SBI and its associates and twenty banks each from the other publicly owned, domestic privately owned and foreign-owned categories.²¹ The input and output variables we have used in our analysis are discussed below. Summary statistics of the major variables is reported in Table 1b.

Model I: Intermediation Approach

¹⁷ Which we shall discuss later in details.

¹⁸ Interested readers may look up Berger et al. (1992), Frexias et al. (1997), Mohan (2005) etc. for detailed discussions on these approaches.

¹⁹ This is also known as the "asset approach".

 20 The year 1999 refers to the financial year beginning in April 1998 and ending in March 1999. Similarly, the year 2007 refers to the financial year April 2006 – March 2007. We adopt this convention throughout the paper.

paper. 21 To clarify about our sample selection, we have taken *all* the Indian commercial banks those have information on all the variables we have considered in our analysis and that for all the sample years. It makes our data set to be a balanced panel as well. Of course, we didn't consider Regional Rural Banks and Co-operative Banks in our study. It is, therefore, incidental that there are twenty banks in each of these three bank groups other than the SBI and its associates.

Bank Group	Variable	Mean	Standard	Coefficient of	Minimum	Maximum
Dunk Group	Variable	Ivicali	Deviation	Variation (%)	Winningin	
	Investment	2399096	4799883	200	188145	19709791
	Advances	2918080	6025903	207	212029	33733649
	Deposits	5061412	5061412 9876912 195		402790	43552109
SBI and	Other Liabilities	816814	1629520	199	66737	6004226
Associates	Fixed Assets	40372	82251	204	2893	281886
	Materials*	44390	87291	197	4747	389094
	Bank Size**	7264013	14013000	0 193 55212		66183516
	No. of Employees	35793	67034	187	6454	237504
	Investment	1612084	966066	60	161706	5067283
	Advances	2247606	1909019	85	107444	9850569
01	Deposits	3860343	2728100	71	275128	14238144
Other Nationalized	Other Liabilities	295706	241678	82	9114	1219479
Panka	Fixed Assets	45789	36823	80	5236	286135
Daliks	Materials*	30193	20292	67	4342	99443
	Bank Size**	5973000	4604664	77	382572	25439965
	No. of Employees	24736	15317	62	419	65705
	Investment	473984	1107528	234	10135	9125783
	Advances	713227	2079346	292	8754	19586560
	Deposits	1028468	2421453	235	33148	23051019
Domestic Private	Other Liabilities	133800	447008	334	947	3822864
Banks	Fixed Assets	24173	72531	300	350	423934
	Materials*	17399	56313	324	298	507381
	Bank Size**	1624756	3818750	235	33465	34220667
	No. of Employees	3213	4130	129	97	33321
	Investment	109218	207101	190	207	1602114
	Advances	183326	441833	241	66	3286110
	Deposits	215848	505040	234	224	3787501
Equipa Doulo	Other Liabilities	37068	108819	294	27	920421
Foreign Banks	Fixed Assets	9528	18432	193	10	89138
	Materials*	11885	22832	192	80	129087
	Bank Size**	629409	1296605	206	493	7066333
	No. of Employees	373	748	200	9	5194
Overall	Investment	1004175	2173037	216	60	19709791
	Advances	1399250	3177821	227	66	33733649
	Deposits	2275705	4747504	209	71	43552109
	Other Liabilities	257496	724731	281	27	6004226
	Fixed Assets	28129	55138	196	10	423934
	Materials*	22716	46931	207	80	507381
	Bank Size**	3274344	6377952	195	493	66183516
	No. of Employees	13403	29457	220	9	237504

Table 1b. Summary Statistics of the Variables Used in our Empirical Analysis

Employee figure is in actual number and all others are in Rs. Lakh.

*Operating expenses less payments to and provision for employees is used as a proxy for Materials.

**Total Volume of Business (i.e., sum of deposits and advances) is used as a proxy for Bank Size.

As we have already mentioned, number of employees, total deposits and other liabilities²² are considered as three inputs whereas investments and advances are considered as two outputs.

Model II: Production Approach

As per the production approach, the total number of deposits created by a bank is considered its output. Since we have no information about these numbers for any of the three types of deposits a bank creates (viz., demand deposits, saving deposits and term deposits), we have taken their values and consider two different outputs—demand deposits and ST deposits (which is the sum of savings deposits and term deposits). Here we have considered the total number of employees, amount of fixed assets and operating expenses less payments to and provision for employees (as a proxy of materials used by the bank) as three inputs. Since we use each cross-section separately for our DEA exercises, we need not adjust the nominal variables to transform them into the values at constant prices. However, we have adjusted the variable "total value of business" created by a bank since we use it in our second stage regression analysis and the adjusting procedure is discussed earlier in footnote #16.

Empirical Findings

We have used the econometric package SHAZAM to solve the various DEA linear programming problems and both SHAZAM and STATA to carry out our regression analvses. The DEA summary results we have obtained are given in Table 2. As discussed earlier, one of the objectives of using two alternative models in the present study is to see whether the basic results regarding the performance-related issues of Indian commercial banks changes by simply changing the sets of their inputs and outputs. This table clearly has negative answer to this query. In other words, the results we obtained about the efficiency of different banks are more or less similar under both the models as well as under two alternative technological specifications. The major findings of our DEA exercises may be summarized as follows. (i) In an overwhelming majority of the cases (i.e., 30 out of total 36) average efficiency of the nationalized banks is more than that for the Indian commercial banking sector as a whole, which means that non-nationalized banks (i.e., domestic private and foreign banks as a group) are lagging behind their nationalized counterparts. Not only non-nationalized banks as a group, each of domestic private and foreign groups separately lagging behind the nationalized banks in these cases also. (ii) All the initial six years where mean efficiency of the nationalized banks is lower than that of non-nationalized ones are under Model I and CRS technological specification. This may be indicative of the fact that initially nationalized banks were unable to enjoy enough flexibility in freely choosing their production scales (for the input and/or output considered under Model I), however, they have gradually

 22 We also have done the same analysis following Model I considering sum of borrowings and other liabilities (instead of taking other liabilities alone) as an input. The results are similar, but we only report the results for the latter in view of higher variability in obtained TE scores among the banks. In doing so, we have to drop two observations from our model since these banks are having *other liabilities* being zero value in some years. So, we have analyzed data on 66 banks under Model I and that on all 68 banks under model II.

Bank Group				Avera	ge TE S	core			
Ballk Oloup	1999	2000	2001	2002	2003	2004	2005	2006	2007
Variable Returns to Scale Under Model I									
SBI and Associates	0.84	0.87	0.90	0.90	0.93	0.93	0.97	0.99	0.96
Other Nationalized	0.96	0.94	0.94	0.94	0.95	0.96	0.96	0.94	0.95
Nationalized	0.93	0.92	0.93	0.93	0.94	0.95	0.96	0.95	0.95
Domestic Private	0.82	0.86	0.88	0.87	0.84	0.88	0.91	0.87	0.86
Foreign	0.95	0.89	0.93	0.93	0.83	0.86	0.89	0.87	0.89
Overall	0.90	0.89	0.91	0.91	0.88	0.91	0.93	0.91	0.91
	Variabl	e Return	is to Sca	le Under	Model	Π			
SBI and Associates	0.89	0.91	0.94	0.95	0.97	0.94	0.94	0.87	0.89
Other Nationalized	0.95	0.91	0.91	0.95	0.91	0.92	0.90	0.93	0.95
Nationalized	0.93	0.91	0.92	0.95	0.93	0.92	0.91	0.91	0.93
Domestic Private	0.82	0.82	0.72	0.73	0.79	0.75	0.76	0.77	0.76
Foreign	0.77	0.78	0.73	0.76	0.74	0.76	0.81	0.90	0.77
Overall	0.85	0.85	0.81	0.83	0.83	0.83	0.84	0.87	0.83
	Constan	nt Return	ns to Sca	ale Unde	r Model	Ι			
SBI and Associates	0.67	0.75	0.65	0.65	0.65	0.74	0.94	0.97	0.95
Other Nationalized	0.64	0.73	0.70	0.74	0.66	0.72	0.85	0.84	0.85
Nationalized	0.64	0.73	0.69	0.71	0.65	0.73	0.88	0.88	0.88
Domestic Private	0.76	0.81	0.78	0.82	0.75	0.82	0.88	0.86	0.85
Foreign	0.89	0.77	0.80	0.86	0.79	0.83	0.83	0.80	0.81
Overall	0.75	0.76	0.74	0.78	0.72	0.78	0.87	0.85	0.85
	Constant Returns to Scale Under Model II								
SBI and Associates	0.84	0.86	0.87	0.91	0.95	0.87	0.91	0.83	0.86
Other Nationalized	0.83	0.82	0.73	0.78	0.80	0.81	0.82	0.84	0.87
Nationalized	0.83	0.83	0.77	0.82	0.84	0.82	0.84	0.84	0.86
Domestic Private	0.76	0.79	0.61	0.63	0.69	0.60	0.66	0.68	0.66
Foreign	0.61	0.68	0.62	0.64	0.67	0.64	0.65	0.64	0.58
Overall	0.75	0.77	0.68	0.71	0.75	0.71	0.73	0.74	0.72

Table 2. Ownership Group-Wise Average Level of TE of Banks

adjusted themselves with the changing domestic economic scenario well to outweigh the non-nationalized banks in the later period. (iii) Within the nationalized group SBI and its associates are performing better than the other nationalized banks in most of the cases. (iv) In almost 50% of the cases foreign banks are performing better and lagging behind the domestic private banks in the remaining cases within the non-nationalized group. (v) On a totality, mean level of efficiency for both the nationalized as well as the overall Indian commercial banking sector have a marginally rising trend over time. However, since the benchmark frontier itself (on the basis of which individual banks are evaluated and their efficiency scores are obtained) is changing from one year to another, this result may be tentative.

Let us turn to our second stage regression analyses. We have estimated our panel data regression models allowing both one-way (separately for individual-specific as well

Table 3a. Diagnostic Test Results for Individual/Time Specific Fixed Effects using DEA TE Score (Obtained under Model I) as Dependent Variable

Assuming One-Way Error Component Model:						
53	3					
$y_{it} = \sum_{j=1}^{n} \beta_j x_{jit} + \sum_{k=1}^{n} \beta_k x_{jit} + \sum_{k=1}$	$\sum_{k=1}^{\infty} \delta_k D_{kit} + a_i + u_{it}$	$(i = 1, \dots, 66; t = 1, \dots, 9)$))			
Null Hypothesis	Calculated F	Tabulated F (at 1% Level)	Decision			
VRS:* H ₀ : $a_i = 0; i = 1,, 65$	8.17 (65, 523)	1.50	Reject H ₀			
CRS: H ₀ : $a_i = 0; i = 1, \dots, 65$	7.15 (65, 523)	1.50	Reject H ₀			
$y_{it} = \sum_{j=1}^{5} \beta_j x_{jit} + \sum_{k=1}^{3} \beta_k x_{jit}$	$\delta_k D_{kit} + c_t + u_{it}$	$(i = 1, \ldots, 66; t = 1, \ldots,$.9)			
VRS: H ₀ : $c_t = 0; t = 1,, 8$	0.18 (65, 520)	1.50	Don't Reject H ₀			
CRS: H ₀ : $c_t = 0; t = 1,, 8$	0.61 (65, 520)	1.50	Don't Reject H ₀			
Assumi	ng Two-Way Error Co	omponent Model:				
$y_{it} = \sum_{j=1}^{5} \beta_j x_{jit} + \sum_{k=1}^{3} \beta_k x_{jit}$	$\delta_k D_{kit} + a_i + c_t + u$	v_{it} (<i>i</i> = 1,, 66; <i>t</i> = 1,	, 9)			
VRS: H ₀ : $a_i = 0; i = 1,, 65$ and $\lambda_t = 0; t = 1,, 8$	7.43 (73, 515)	1.47	Reject H ₀			
CRS: H ₀ : $a_i = 0; i = 1,, 65$ and $\lambda_t = 0; t = 1,, 8$	8.23 (73, 515)	1.47	Reject H ₀			
VRS: H ₀ : $a_i = 0; i = 1,, 65,$ Given that $\lambda_t \neq 0; t = 1,, 8$	7.98 (65, 515)	1.50	Reject H ₀			
CRS: H ₀ : $a_i = 0; i = 1,, 65,$ Given that $\lambda_t \neq 0; t = 1,, 8$	8.04 (65, 515)	1.50	Reject H ₀			
VRS: $H_0: \lambda_t = 0; t = 1,, 8,$ Given that $a_i \neq 0; i = 1,, 65$	1.21 (8, 515)	2.55	Don't Reject H ₀			
CRS: H0: $\lambda_t = 0; t = 1,, 8,$ Given that $a_i \neq 0; i = 1,, 65$	9.46 (8, 515)	2.55	Reject H ₀			

*: VRS/CRS stands for the Technological Specification Assumed to Obtain DEA TE Score in the Earlier Stage.

Figures in Parenthesis is Degrees of Freedom of Chi-Squares in Numerator and Denominator Respectively Variables:

 x_1 : Total volume of business a bank creates, used as a proxy of bank size

 x_2 : Ratio of priority sector advances to total advances

 x_3 : Ratio of secured advances to total advances

 x_4 : Ratio of wage bill to total expenses

 x_5 : Ratio of net non performing assets (NPAs) to net advances

D1: Group dummy used for other nationalized banks-nationalized ones other than SBI and associates

 D_2 : Group dummy used for domestic privately owned banks

D₃: Group dummy used for banks under foreign ownership

as time-specific) fixed effect error component model and two-way fixed effect error component model showing by the equation (1). We have subsequently tested several hypotheses regarding these fixed effects and results of such tests are reported in the Tables 3a and 3b for the results under Model I and Model II respectively. These results clearly show that all of the individual-specific fixed effects cannot be simultaneously statistically significantly different from zero, irrespective of the model specification as

 Table 3b.
 Diagnostic Test Results for Individual/Time Specific Fixed Effects using DEA TE Score (Obtained under Model II) as Dependent Variable

Assuming One-Way Error Component Model:							
5 3							
$y_{it} = \sum_{i=1}^{n} \beta_j x_{jit} + \sum_{k=1}^{n} \delta_k D_{kit} + a_i + u_{it} (i = 1, \dots, 68; t = 1, \dots, 9)$							
Null Hypothesis	Calculated F	Tabulated F (at 1% Level)	Decision				
VRS:* H ₀ : $a_i = 0; i = 1,, 67$	19.7 (67, 539)	1.49	Reject H ₀				
CRS: H ₀ : $a_i = 0; i = 1,, 67$	13.6 (67, 539)	1.49	Reject H ₀				
$y_{it} = \sum_{j=1}^{5} \beta_j x_{jit} + \sum_{k=1}^{3} \beta_k x_{jit}$	$\sum_{i=1}^{n} \delta_k D_{kit} + c_t + u_{it}$	$(i = 1, \dots, 68; t = 1, \dots,$	9)				
VRS: $H_0: c_t = 0; t = 1,, 8$	0.13 (67, 536)	1.49	Don't Reject H ₀				
CRS: H ₀ : $c_t = 0; t = 1,, 8$	0.17 (67, 536)	1.49	Don't Reject H ₀				
Assumir	ng Two-Way Error Co	omponent Model:					
$y_{it} = \sum_{j=1}^{5} \beta_j x_{jit} + \sum_{k=1}^{3} \delta_k$	$D_{kit} + a_i + c_t + u_{it}$	$(i = 1, \dots, 68; t = 1, \dots)$, 9)				
VRS: H ₀ : $a_i = 0; i = 1,, 67$ and $\lambda_t = 0; t = 1,, 8$	18.1 (75, 531)	1.46	Reject H ₀				
CRS: H ₀ : $a_i = 0; i = 1,, 67$ and $\lambda_t = 0; t = 1,, 8$	12.9 (75, 531)	1.46	Reject H ₀				
VRS: H ₀ : $a_i = 0; i = 1,, 67,$ Given that $\lambda_t \neq 0; t = 1,, 8$	19.9 (67, 531)	1.49	Reject H ₀				
CRS: H0: $a_i = 0; i = 1,, 67,$ Given that $\lambda_t \neq 0; t = 1,, 8$	13.9 (67, 531)	1.49	Reject H ₀				
VRS: H ₀ : $\lambda_t = 0$; $t = 1,, 8$, Given that $a_i \neq 0$; $i = 1,, 67$	2.25** (8, 531)	2.54	Don't Reject H ₀				
CRS: H ₀ : $\lambda_t = 0; t = 1,, 8,$ Given that $a_i \neq 0; i = 1,, 67$	3.17 (8, 531)	2.54	Reject H ₀				

*: VRS/CRS stands for the Technological Specification Assumed to Obtain DEA TE Score in the Earlier Stage.

**: Although it is not significant at 1% level, it is significant if we allow 97% level of confidence or less. Figures in Parenthesis is Degrees of Freedom of Chi-Squares in Numerator and Denominator Respectively Variables:

 x_1 : Total volume of business a bank creates, used as a proxy of bank size

 x_2 : Ratio of priority sector advances to total advances

 x_3 : Ratio of secured advances to total advances

 x_4 : Ratio of wage bill to total expenses

x5: Ratio of net non performing assets (NPAs) to net advances

D1: Group dummy used for other nationalized banks-nationalized ones other than SBI and associates

 D_2 : Group dummy used for domestic privately owned banks

 D_3 : Group dummy used for banks under foreign ownership

well as the one-way or two-way error component variation. However, the results cast some doubt on the existence of any significant time-specific fixed effects. To be specific, out of total eight cases the null hypotheses that there are no time-specific fixed effects is rejected in only three cases. Again, these three are out of total four cases under

Following Feasible Generalized Least Squares Method (FGLS)						
	Mode	el I	Model II			
Explanatory Variable	VRS	CRS	VRS	CRS		
<i>x</i> ₁	2.08 (3.14)	2.41 (2.87)	0.318 (3.27)	0.435 (0.41)		
<i>x</i> ₂	-0.0006 (-1.33)	0.0007 (1.37)	0.002 (3.63)	0.003 (4.00)		
x3	0.0001 (0.25)	-0.001 (-1.21)	-0.0004 (-0.72)	0.0005 (0.89)		
<i>x</i> 4	-0.002 (-2.94)	-0.007 (-7.68)	-0.004 (-4.03)	-0.002 (-2.15)		
<i>x</i> 5	-0.007 (-10.41)	-0.007 (-8.55)	-0.007 (-7.27)	-0.006 (-5.41)		
D_1	0.033 (1.91)	-0.029 (-1.33)	0.017 (0.67)	-0.056 (-2.01)		
D_2	-0.046 (-2.47)	0.032 (1.37)	-0.125 (-4.51)	-0.184 (-6.10)		
D_3	0.003 (0.14)	0.050 (1.93)	-0.100 (-3.31)	-0.198 (-6.02)		
Constant	0.983 (23.55)	0.947 (17.92)	0.956 (15.58)	0.797 (11.91)		
Following Parks' (1967) Method						
<i>x</i> ₁	0.633 (2.12)	3.94 (5.25)	0.719 (1.44)	0.766 (1.02)		
<i>x</i> ₂	-0.0002 (-1.12)	0.0008 (2.12)	-0.0001 (-0.47)	0.0006 (1.41)		
<i>x</i> 3	0.0002 (1.23)	-0.0002 (-0.69)	0.00003 (0.22)	0.00005 (0.14)		
<i>x</i> 4	-0.0005 (-1.79)	-0.003 (-3.98)	-0.0007 (-1.59)	0.0004 (0.66)		
<i>x</i> 5	-0.002 (-4.35)	-0.002 (-3.38)	-0.002 (-3.59)	-0.002 (-2.93)		
D_1	0.043 (4.85)	-0.052 (-1.71)	0.0009 (0.04)	-0.092 (-4.94)		
D_2	-0.050 (-3.13)	0.044 (1.34)	-0.173 (-6.95)	-0.204 (-9.34)		
D_3	0.057 (4.10)	0.118 (3.29)	-0.115 (-3.60)	-0.279 (-8.18)		
Constant	0.915 (47.14)	0.815 (17.00)	0.954 (34.02)	0.881 (21.90)		

Table 4. Estimated Results folloing Two Alternative Panel Data Regression Methods

Figure in the Parenthesis is corresponding 'z' (asymptotic 't') statistic in FGLS (Parks') Method. Coefficient highlighted using bold script is statistically significant.

Variables:

 x_1 : Total volume of business a bank creates, used as a proxy of bank size

 x_2 : Ratio of priority sector advances to total advances

 x_3 : Ratio of secured advances to total advances

 x_4 : Ratio of wage bill to total expenses

 x_5 : Ratio of net non performing assets (NPAs) to net advances

 D_1 : Group dummy used for other nationalized banks—nationalized ones other than SBI and associates

 D_2 : Group dummy used for domestic privately owned banks

 D_3 : Group dummy used for banks under foreign ownership

two-way error component model. So, if we allow the possibility of existence of bothway error components, there may be some significant time-specific fixed effects also like the individual-specific one, which may induce the overall error in our model to be autocorrelated and/or heteroscedastic. We, therefore, have estimated our regression equation (1) following both feasible generalized least squares method (without allowing for any autocorrelation or heteroscedasticity) as well as the method allowing crosssectional heroscedasticity and time-wise autocorrelation (*a la* Parks, 1967) and results of such estimations are given in Table 4.

Let us discuss our results (shown in Table 4) on the explanatory variables we have

considered in explaining the efficiency of Indian commercial banks. Among these factors, bank size, ratio of priority sector advances to total advances, ratio of wage bill to total expenses, ratio of net NPA to net advances and ownership category are found to be significant in some or all cases. Out of these, ratio of net NPA to net advances has shown most consistent and robust result. To be specific, it has significant negative impact on efficiency of a bank. Ratio of wage bill to total expenses has significant negative impact on bank efficiency in five out of total eight cases indicating that the Indian commercial banks are probably suffering from the burden of excess labor. There exists significant positive relationship between size of a bank and its TE in five out of total eight cases. In the remaining three cases, although this correlation is not significant, all of them are positive as well. However, although in majority of the cases ratio of priority sector advances to total advances is insignificant, contrary to the common belief, in three out of eight cases it has significant positive impact on bank efficiency. So, it may have some positive influence on the Indian commercial banks to be more efficient. The domestic private sector banks are significantly less efficient than the base group comprising SBI and its associates in most of the cases. Foreign banks are relatively more efficient than this base group under Model I and the opposite under Model II. Since we measure TE in output-oriented way (i.e., considering inputs to be given), foreign banks may be concentrating in more earning business by engaging themselves to invest more and more and providing advances to its customers as much as possible while relatively being more reluctant to serve as much customers as possible by opening deposit account for them. This, while strengthening the results of Chakrabarti and Chawla (2005) mentioned earlier, might be a reflection of the general policy of foreign banks to "cherry-pick" more profitable businesses, ignoring the social obligation of offering banking services to a wider section of the society. Likewise, other nationalized banks are more efficient than the base SBI group under model I and the opposite under Model II, indicating that the SBI group is probably more efficient than the other nationalized banks in drawing large number of customers and collecting relatively larger volume of resources from their savings, but may be lagging behind other nationalized banks in channelizing these resources to more profitable businesses. On a totality, nationalized banks are more efficient than both the domestic private and foreign banks under the ceteris paribus condition.

6. CONCLUDING REMARKS

Assessments of the performance of Indian commercial banks are not new in the literature. We have already discussed a few of them earlier in this paper. As evident from our discussion, some earlier studies have observed that nationalized banks perform relatively better than their more liberalized counterparts under private and foreign ownership, whereas others have got it the other way around. However, considering the Indian commercial banks in the *true* post-liberalized era (in some sense) we have studied performances of the Indian commercial banks once more with an objective to see whether any significant size-efficiency relationship prevails among the Indian commercial banks

and whether ownership pattern at all matters in determining efficiency of a bank. Our results suggest that there do exist significant positive association between size of a bank and its efficiency and public-sector banks are, on average, performing better relative to their counterparts under domestic private and foreign ownerships. Beside the ownership patterns, ratio of net non performing assets to net advances and ratio of wage bill to total expenses have both significant negative impacts on a bank's efficiency. The latter may be indicative of the fact that the Indian commercial banks are subject to the burden of excess labor force. However, contrary to the common belief, there is some evidence that the ratio of priority sector advances to total advances has a significant positive influence in determining the level of efficiency of a bank. One of our objectives in this study was also to see whether our major findings regarding the performance-related issues we have considered for the Indian commercial banking sector got drastically changing due to merely change in the approach of measuring inputs and outputs of the banks. To be specific, we follow both *intermediation approach* and *production approach* to evaluate individual banks' performance and find some evidence that few results indeed change little bit due to change in the approach.

Our results have important policy implications as well. As mentioned earlier, we find that there exists significant positive correlation between size of a bank and its efficiency level. Policy makers should, therefore, encourage the banks to expand their size by expanding their activities to more and more areas, particularly to the rural ones where they can get large number of customers, although majority of whom might be of relatively smaller size. These areas may be of huge business potential for the banks since almost nil or negligible number of formal financial institutions operates in these areas. Banks may expand their size by possible merger and acquisition as well.²³ Secondly, we observed that the nationalized banks perform relatively better than their counterparts under domestic private or foreign ownership. Banks under the latter two ownership groups were widely believed to do better under the new regime, given their relatively more flexible operating systems as well as their better market orientation. This finding clearly has important policy implications for the government's attitude towards overall market orientation of the Indian banking sector. To be specific, the government should more cautiously approach liberalizing its banking sector and not blindly invite more foreign players to it. The lesson becomes particularly more relevant at a time when we are witnessing a severe global crisis which, although began with the bursting of the US housing market bubble, gathered momentum from a series of bankruptcies of the so-called "too big to fail" banks, with Lehman Brothers in the lead.

However, we have used DEA methodology in the first stage of our two-stage analysis, which is based on mathematical programming techniques, without considering the possible error structures that may affect the analysis. Since any methodology has its relative advantages as well as disadvantages over its possible alternatives, our analysis

²³ Recently Indian banking sector witnesses some such mergers also. For instance, Lord Krishna Bank merged with Centurian bank of Punjab Limited in 2006 and subsequently Centurian bank of Punjab Limited merged with HDFC bank with effect from (w.e.f.) May 23, 2008; State bank of Saurashtra merged with State bank of India w.e.f. August 13, 2008 etc.

is not free from its respective limitations. Our results may be subject to one more limitation. It may be noted that results of such second stage regression analysis have some potential bias. As Simar and Wilson (2007) argue, conventional approaches to inference usually employed in such two-stage regression exercises are invalid due to complicated unknown serial correlation among estimated efficiencies. To overcome this limitation, they describe a sensible data-generating process for such models and then propose bootstrap procedure which would permit valid inference. In a recent study, however, Banker and Natarajan (2008) argue that such a two-stage procedure consisting of DEA in the first stage followed by ordinary least squares (OLS) (or alternatively, maximum likelihood estimation (MLE)) in the second stage yields consistent estimators of the impact of contextual variables on efficiency, provided the contextual variables are independent of the input variables used to evaluate DEA-TE scores in the first stage. In fact, they argue that benefits from the two-stage DEA-based methods are more prominent when the contextual variables exhibit low levels of correlation with the input variables. Since one of our contextual variables (i.e., volume of total business of a bank) used in the second stage definitely correlated with one of the inputs used in the first stage (under Model I), our estimates (given in Table 4) may have some potential bias.

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Appendix: List of Banks

State Bank of India and Associates	Domestic Private Banks		
	(Continued)		
State Bank of India	Federal Bank		
State Bank of Bikaner & Jaipur	HDFC Bank		
State Bank of Hyderabad	ICICI Bank		
State Bank of Indore	IndusInd Bank		
State Bank of Mysore	Jammu & Kashmir Bank		
State Bank of Patiala	Karur Vysya Bank		
State Bank of Saurashtra	Lakshmi Vilas Bank		
State Bank of Travancore	Lord Krishna Bank		
Other Nationalized Banks	Nainital Bank		
Allahabad Bank	Ratnakar Bank		
Andhra Bank	Sangli Bank		
Bank of Baroda	SBI Comm. & Intern. Bank		
Bank of India	South Indian Bank		
Bank of Maharashtra	Tamilnad Mercantile Bank		
Canara Bank	Foreign Banks		
Central Bank of India	ABN Amro Bank		
Corporation Bank	Abu Dhabi Commercial Bank		
Dena Bank	American Express Bank		
IDBI Bank/Ltd.	Arab Bangladesh Bank		
Indian Bank	Bank International Indonesia		
Indian Overseas Bank	Bank of America		
Oriental Bank of Commerce	Bank of Bahrain & Kuwait		
Punjab & Sind Bank	Bank of Ceylon		
Punjab National Bank	Bank of Nova Scotia		
Syndicate Bank	Barclays Bank		
UCO Bank	Citibank		
Union Bank of India	DBS Bank		
United Bank of India	Deutsche Bank		
Vijaya Bank	HSBC		
Domestic Private Banks	Krung Thai Bank		
UTI/Axis Bank	Mashreq Bank		
Bank of Rajasthan	Oman International Bank		
Catholic Syrian Bank	Societe Generale		
City Union Bank	Sonali Bank		
Development Credit Bank	Standard Chartered Bank		
Dhanalakshmi Bank			