An Analysis of Profitability and Marketability Efficiencies of Indian Public and Private Banks

** Thota Nagaraju*

Abstract

The purpose of this study is to analyze the performance of Indian public and private banks by applying the data envelopment analysis (DEA) on a sample of 34 banks by considering the time period from 2006 to 2010. This study reveals that Indian public (nationalized and State Bank group) and private banks underperformed in terms of marketability and profitability efficiency. However, they were performing relatively better in terms of profitability efficiency as compared to the stock market performance (marketability efficiency). Specifically, these inefficiencies are explained by the ownership of the banks, and not by their size. Furthermore, there is little evidence of any impact of the financial crisis on the Indian banking system as evident from the sudden drop of marketability efficiency levels. However, it got recovered by the end of the study period.

Keywords: **banks, profitability, marketability, efficiency, data envelopment analysis (DEA)**
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From the perspective of investors and customers, the performance of the banking industry in terms of efficiency has been a critical issue right from the collapse of Lehman Brothers Holdings in 2008[1]. However, the issue has been of interest for both academicians and various stakeholders since long. Berger and Humphrey (1997) provided a comprehensive review of 130 financial institutions' efficiency studies comprising of more than 116 published research papers touching upon the topic of banking. Due to competition, and especially after financial liberalization in India, banks become more attentive to issues related to efficient performance. Much of the banking efficiency literature focused only on profitability and cost efficiency evaluation, ignoring market efficiency (market value generating) in the banking industry (Luo, 2003), and the same applies in the Indian case as well. There are few published papers that are available on profitability and marketability efficiency (for more details see the Table 1) of the banking sector across the world, and moreover, there are no studies from the developing countries, with an exception to Taiwan, that have focused on this important area . In addition, there is no study focusing on the impact of financial crises on profitability and marketability of the banking sector.

To fill the void that exists in literature and to provide some empirical evidence from India, the current study employs a non-parametric frontier method called data envelopment analysis (DEA) initially introduced by Charnes, Cooper, and Rhodes (1978). This method allows us to measure the relative efficiency of each bank in a sample without any a priori production function based on multiple inputs and multiple output variables (Charnes et al., 1978). As the first study in this area in the Indian scenario, this paper provides evidence on both profitability efficiency and stock market performance of a sample of public and private banks considering the time period from 2006 to 2010.

This paper presents a new variant (with regards to the banking sector) of the DEA profitability approach with regards to input variables and output variables in modeling bank profitability and marketability efficiency in the DEA context. A similar approach was introduced by Ho (2008)[2]. The proposed approach to model the performance of banks in terms

* *Research Associate,* Indian School of Business (ISB), Gachibowli, Hyderabad - 500 032. Email: thotanhcu@gmail.com

[1] However, it doesn't mean that earlier, the investors and customers were not focused on the efficiency of the banks, they did, but before the collapse of Lehman Brothers Holdings in 2008, the investors and customers worried only about system risk, and after the collapse, mounting unsystematic risk frightened them more.

[2] However, that study focused on the information technology (IT) sector.

of profitability and marketability deviates from the 'marketability efficiency' model introduced by Seiford and Zhu (1999) and Luo (2003) only in the usage of the additional inputs and output variables in model specification. The present study makes mainly three contributions into bank-level DEA applications in banking literature. Firstly, it is an improved model over the existing banking marketability efficiency models. Secondly, it is the first - of - its - kind study in the Indian subcontinent which evaluates the profitability and marketability efficiency of public and private sector banks. Finally, it is the only study that particularly focuses on the peak time period of the financial crisis which evaluates the profitability and marketability efficiency levels.

Review of Literature

Producing revenue is not the only goal of the banks, it is very important for banks to have good marketability, since good marketability maximizes the shareholders' wealth. The earnings per share (EPS), market value, and stock price of bank firms commonly receive more attention of the investors in the stock market. Seiford and Zhu (1999) originally proposed a two-stage production process and used the DEA approach to evaluate both profitability and marketability efficiency of top 55 US commercial banks ranked by Fortune magazine in 1996. The study found that large banks performed better in terms of profitability, and the smaller banks performed better in terms of marketability. Thereafter, this approach has been adopted by a number of financial studies. Following the bank production process, Luo (2003) extended the list to more banks in the industry, which contained a sample of 245 large US banks. In his study, he concluded that 34 (14%) banks showed higher level of profitability but lower level of marketability, thus supporting the findings of Seiford and Zhu (1999).

Tsolas (2011) evaluated the performance of a sample of thirteen commercial banks listed on the Athens Exchange by applying a two-step procedure and showed that there is no positive link between profitability efficiency and performance in the stock market. Moreover, this study also supports the existing literature in terms of findings. Lo and Lu (2006) followed Seiford and Zhu's model to measure 14 financial holding companies (FHCs) in Taiwan and showed that big sized FHCs are generally more efficient than small-sized ones both in the profitability and marketability model. They also argued that there should be further mergers and acquisitions in FHCs, since big sized FHCs are relatively technically efficient than the small-sized ones. Ho (2008) evaluated the performance of 69 US listed dot com firms. The study showed that 10 out of the 69 dot com firms were CCR- efficient on profitability, and 23 out of the 69 dot com firms were CCR- efficient on marketability. The study also showed that there is no correlation between profitability and marketability.

Studies on banking efficiency in India (Bhattacharyya, Lovell & Sahay, 1997 ; Chatterjee, 2006 ; Das, 1997; Das &

Table 1.Summary Related Literature Based on Two-stage DEA to Measure Performance

Authors	Samples	Input variables	Intermediate variables	Output variables
Seiford& Zhu (1999)	Top 55 US commercial banks	Assets, Employees, Stockholders' equity	Revenues, Profits	EPS, Market value, Total returns to investors
Luo (2003)	245 US large banks	Assets, Employees, Stockholders' equity	Revenues, Profits	EPS, Market value, Stock price
Ho and Zhu (2004)	41 Taiwan's commercial banks	Assets, Branch employees, Capital stock	Deposits, Sales	Net income, Interest income, Non-Interest income
Lo and Lu (2006)	14 Taiwan's FHCs	Assets, Employees, Stockholders' equity	Revenues, Profits	EPS, Market value, Stock price
Kao and Hwang (2008)	24 Taiwan's non-life insurance	Business and administrative expenses, Commissions and acquisition expenses	Direct premiums written, Reinsurance premiums received	Net underwriting income, investment income
Ho (2008)	69 US listed dot com firms	Assets, Employees, Operating expenses, Equity	Revenues, Profit margins, ROA, ROE	EPS, Market value, P/E ratio, M/B ratio,
Tsolas (2011)	13 Athens Exchange listed commercial banks	Total interest expense, Loan loss provision	Net interest income after loan, loss provision, Burden	Market capitalization

Source: Author's Research

Ghosh, 2006 ; Das, Nag, & Ray, 2005; Ray & Das, 2010 ; Sensarma, 2005 ; Sensarma , 2008) have typically examined the cost, profit, and technical efficiency of banks in the pre and post-liberalization periods by focusing on whether the Indian banks are cost, profit, and technically efficient in the pre - reform period, and has there been any impact of liberalization on the banking sector. Much of the inefficiency in the Indian banking sector is attributed to the government (ownership) control in the pre-reform period. Post-reform period studies have revealed that there has been a positive impact of liberalization on the Indian banking sector.

Methodology

The methodology presented here, known as the 'two-stage performance' (efficiency production process) model, covers two performance dimensions as shown in the Figure 1, and is adopted from the work of Seiford and Zhu (1999) and Ho (2008). The model assesses each bank's performance in terms of both profitability and marketability. The operationalization of the two-stage performance model is depicted in the figure. In the first stage, the model estimates the profitability and in the second stage, it estimates the marketability (i.e. the stock market performance). The causal relationships are operationalized by specifying the outputs of one model (Stage 1) as the inputs to another (Stage 2). The underlying assumption is that the outputs of the profitability efficiency model positively influence stock market performance; hence, they are the inputs for the stock market performance model (Tsolas, 2011). The present study adopts Ho's (2008) production approach in choosing inputs and outputs. However, it is similar to the studies conducted by Seiford and Zhu (1999) and Luo (2003), except for the usage of extra inputs and outputs.

↳ **Specification of Data Envelopment Analysis (DEA):** Charnes, Cooper and Rhodes (1978 and 1981) developed the data envelopment analysis for the efficiency measurement of the decision making units (DMUs) with multiple inputs and multiple outputs in the absence of market prices under the constant returns to scale (Ray 2004). Later, Banker, Charnes, and Cooper (1984, BCC) developed a method in which variable returns to scales are allowed. Formally, DEA is a methodology directed to frontiers rather than central tendencies. Instead of trying to fit a regression plane through the center of the data as in statistical regression, one 'floats' a piecewise linear surface to rest on top of the observations. Due of this perspective, DEA proves to be particularly adept in uncovering relationships that remain hidden from other methodologies. The efficiencies assessed in this context by DEA are intended to reflect the scope for resource conservation at the unit being assessed without being detriment to its outputs, or alternatively, to the scope for output augmentation without additional resources. The efficiencies assessed are comparative because they reflect scope for resource conservation or output augmentation at one unit relative to other comparable benchmark units rather than in some absolute sense. The reason to assess relative rather than the absolute efficiencies is that in most practical contexts, we do not have sufficient information to derive the superior measures of absolute efficiency. Two DEA models are employed in this study, first one is DEA constant returns to scale (CCR) model developed by Charnes et al. (1978) and the second one is variable returns to scale (VRS) model developed by Banker et al. (1984). The DEA input oriented models are chosen in the present study since cost minimization is considered (Golany and Roll, 1989 ; Luo, 2003).

↳ **DEA CRS (CCR) Input-Oriented Model**

$$
\begin{aligned}
& s.t \ \min \Theta \\
& \Sigma_j \lambda_j X_{ij} \quad \Theta X_{i0} \qquad i = 1, 2, ..., m; \\
& \Sigma_j \lambda_j Y_{rj} \quad Y_{r0} \qquad r = 1, 2, ..., s; \\
& \lambda_j \quad 0, j \quad 1, 2, ..., n. \qquad (1)
\end{aligned}
$$

Where x_{ij} and y_{rj} are the amount of the i^{th} input consumed and the amount of the r^{th} output generated by the j^{th} bank, respectively. For the profitability efficiency, the total number of observations (n) is 35 DMUs, m equals to three inputs (employees, assets, and equity), and s equals to two outputs (revenue and profit). For marketability efficiency, n equals to 35 DMUs; m equals to three outputs (market value, earnings per share, and stock price) following X (Luo, 2003). After solving the linear programming problem, we can obtain the efficiency results from the optimum value of the objective Θ for each bank.

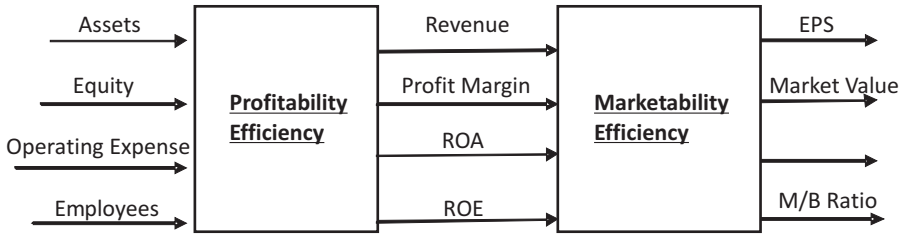
DEA VRS (BCC) Input-Oriented Model

$$
\begin{aligned}
& s.t \ \min \pi \\
& \Sigma_j \lambda_j X_{ij} \quad \pi X_{i0} \qquad i = 1, 2, ..., m; \\
& \Sigma_j \lambda_j Y_{rj} \quad Y_{r0} \qquad r = 1, 2, ..., s; \\
& \Sigma \lambda_j = 1 \\
& \lambda_j \quad 0, j \quad 1, 2, ..., n. \qquad\qquad (2)
\end{aligned}
$$

The essential difference between the VRS model (2) and the CRS model (1) is the addition of a new constraint ($\Sigma \lambda_j = 1$) to the linear programming model (1). With this added constraint, the reference set is changed from the cone in the case of the CRS model to the convex hull in the case of the VRS model. The obvious result from this change is that the tested DMU is compared against a limited number of combinations (Luo, 2003). As such, the efficiency score in the VRS model is greater than that in the CRS model.

The technical efficiency (TE) obtained from model (1) can be divided into pure technical efficiency (PTE) and scale efficiency (SE). Scale efficiency is the optimum value π^* obtained from model (2), which allows for VRS. The value of the PTE of bank i is larger than the TE Θ_i. In addition, the SE of a bank is calculated as the ratio of its TE to its PTE, or Θ_i / π_i. SE can be used to determine how close a bank is to the most productive scale size. Bank scale inefficiency can be due to either increasing returns to scale (IRS) or decreasing returns to scale (DRS). If a bank has no scale efficiency, then it is operating at constant returns to scale. Returns scale classification follows from the pioneering work of Seiford and Zhu (1999). Since their classification was proved to be reliable and robust, there is no cause to worry about the misclassification errors that arise from the optimal solutions of the linear programming model. The following three conditions will explain as to how the returns to scale have been classified. When the TE equals PTE, then that bank exhibits constant returns to scale. Otherwise, increasing returns to scale prevail if and only $\Sigma \lambda_j^* < 1$, if based on optimum values of Model (1), and DRS exists if and only if $\Sigma \lambda_j^* > 1$ (Luo 2003 ; Zhu and Shen, 1995).

Figure 1. Banking Profitability and Marketability Efficiency Model



Source: Adapted from B.C.-T. Ho (2008). "Measuring profitability and marketability in Internet companies." *The Open Management Journal, 1* (14), 12-25.

Sample and Data : This paper examines a sample of 34 Indian public and private banks considering the time period from 2006 to 2010. These 34 banks are listed according to the ownership group to which they belong:

1) Nationalized Banks : Allahabad Bank (ALB), Andhra Bank (AND), Bank of Baroda (BOB), Bank of India (BOI), Bank of Maharashtra (MAH), Canara Bank (CAN), Indian Overseas Bank (IOB), Karur Vysya Bank (KRV), Oriental Bank of Commerce (OBC), Syndicate Bank (SYN), UCO Bank (UCO), Union Bank of India (UNI), Vijaya Bank (VIJ), Punjab National Bank (PNB), and IDBI Bank Ltd (IDB).

2) State Bank Group: State Bank of Bikaner and Jaipur (SBJ), State Bank of India (SBI), State Bank of Mysore (SBM), and State Bank of Travancore (SBT).

3) Private Banks: Axis Corporation Bank (COR), Dena Bank (DEN), Axis Bank (AXI), City Union Bank (CIT), Dhanlaxmi Bank (DHN), Federal Bank (FED), HDFC Bank (HDF), ICICI Bank (ICI), Indus Ind Bank (IND), ING Vysya Bank (ING), Jammu & Kashmir Bank (JKB), Karnataka Bank (KAR), Kotak Mahindra Bank (KOT), South

Indian Bank (SOU), and Yes Bank (YES).

The data in the current study comes from Reserve Bank of India and CMIE Prowess database. Some selection criteria were applied to choose the sample banks in this research study. For inclusion, only those banks that exist currently and for whom the data were available were included in the study. If anyone of the input/output data presented zero or negative value, the banks were excluded. A total of 34 Indian banks that are listed on BSE were considered for analysis. Descriptive statistics of all the input and output variables of these banks from the year 2006 to 2010 are shown in the Table 3. The fiscal year ending for all the banks in the study is March 31. Note that assets, equity, revenue, operating expenses, and market value (MV) are measured in "Lakh rupees," whereas profit margin (PM), ROA, and ROE are presented as percentage, and the P/E and M/B are presented as ratio.

The reasons to choose the period 2006-2010 was to assess the impact of the global financial crisis on the Indian banking sector. Many studies point out that the seeds of the financial crisis were laid in late 2005 and early 2006, but in India, it was a prospering period [3]. However, the real crisis started with Lehman Brothers announcing their bankruptcy in 2008. Hence, the year 2008 is taken as the base year, and for post analysis, the year 2010 is taken as the end period. For a quick understanding of the profitability efficiency and marketability efficiency over the sample period, the summary statistics have been presented in the Table 2.

Table 2. Summary Statistics for Efficiency Score

Var	2006			2008			2010		
	Mean	*S.D.*	Min	Mean	*S.D.*	Min	Mean	*S.D.*	Min
OTE_p	0.940	0.052	0.823	0.955	0.055	0.825	0.961	0.042	0.830
PTE_p	0.969	0.046	0.842	0.977	0.037	0.876	0.986	0.025	0.910
SE_p	0.970	0.035	0.883	0.977	0.038	0.843	0.975	0.033	0.861
OTE_m	0.517	0.311	0.156	0.492	0.318	0.117	0.685	0.233	0.329
PTE_m	0.633	0.267	0.294	0.690	0.236	0.326	0.911	0.106	0.693
SE_m	0.788	0.208	0.280	0.663	0.250	0.298	0.746	0.217	0.371

Source: Author's calculations. Note: OTE_p= overall technical profitability efficiency; PTE_p= pure technical profitability efficiency in stage; SE_p = scale efficiency in profitability stage; OTE_m= overall technical efficiency in marketability stage; PTE_m = pure technical efficiency in marketability stage; SE_m= scale efficiency in marketability stage.

Results and Discussion

Profitability and Marketability : In this paper, the two-stage DEA model was analyzed under an input orientation, which means input minimization. This is chosen because the general consideration is that banks have more control over the inputs rather than on outputs in terms of resource management. The profitability and marketability efficiency results are reported in the Tables 3, 4, and 5 for years 2006, 2008, and 2010 respectively. For bank profitability efficiency, there are three indices of efficiency for each bank, that is, OTE_p (CCRmodel), PTE_p (BCC model), and SE_p. The subscript "*p*" means the profitability efficiency. In the same way, for marketability efficiency, there are three more indices of efficiency for each bank viz. OTE_m, PTE_m, and SE_m. On the whole, there are six different efficiency measures.

The Table 3 reports the results of profitability and marketability efficiency levels of individual banks for the year 2006. Of 34 banks studied under profitability consideration, 17 banks are pure technically efficient (BCC model), 9 banks are technically efficient (CCR model), and 9 banks are scale efficient. On the whole, 20 banks have efficiency levels more than the mean of the technical efficiency, 23 banks had efficiency levels more than the mean efficiency of pure technically, and 20 banks were above the mean efficiency level of scale efficiency. Under marketability efficiency

[3] Stock Markets had shown resilience in November 2005-06, further picking up to exceptionally all-time high levels. Sensex and Nifty increased to 9390 and 2835 points respectively. Both the indices recorded a 5% rise in November against the previous month of 2005-06. Broad Money grew at higher magnitude of 12% in the fiscal year up to December 2005- 06, this was mainly due to higher growth credit to the commercial sector. Government Borrowings reduced further, however, aggregate deposits in Scheduled Commercial banks increased by 14% by December 2005. Lower government borrowings are also reflected in low investments made by SCB, which registered a decline. The total credit of SCBs increased in December 2005-06, ascribed to higher non -food credit (Monthly Economic Analysis, 2006).

consideration, 10 banks are pure technically efficient (BCC model), 9 banks are technically efficient (CCR model), and 9 banks are scale efficient. On the whole, 11 banks have efficiency levels more than the mean of technical efficiency, 13 banks have efficiency levels more than the mean efficiency of pure technical efficiency, and 19 banks are above the mean efficiency level of scale efficiency.

The Table 4 reports the results of profitability and marketability efficiency levels of individual banks for the year 2008. Of the 34 banks studied under profitability consideration, 21 banks are pure technically efficient (BCC model), 11 banks are technically efficient (CCR model), and 11 banks are scale efficient. On the whole, 22 banks have efficiency levels more than the mean of technical efficiency, 25 banks have the efficiency levels more than the mean efficiency of pure technical efficiency, and 24 banks are above the mean efficiency level of scale efficiency. Under marketability efficiency consideration, 8 banks are pure technically efficient (BCC model), 6 banks are technically efficient (CCR model), and 6 banks are scale efficient. On the whole, 12 banks have efficiency levels more than the mean of technical efficiency, 17 banks have the efficiency levels more than the mean efficiency of pure technically, and 19 banks are above the mean efficiency level of scale efficiency.

The Table 5 reports the results of profitability and marketability efficiency levels of individual banks for the year 2010. Out of the 34 banks studied under profitability consideration, 23 banks are pure technically efficient (BCC model), 11 banks are technically efficient (CCR model), and 11 banks are scale efficient. On the whole, 20 banks have efficiency levels more than the mean of technical efficiency, 24 banks have the efficiency levels more than the mean efficiency of pure technically, and 22 banks are above the mean efficiency level of scale efficiency. Under marketability efficiency consideration, 15 banks are pure technically efficient (BCC model), 8 banks are technically efficient (CCR model), and 8 banks are scale efficient. On the whole, 15 banks have efficiency levels more than the mean of technical efficiency, 21 banks have the efficiency levels more than the mean efficiency of pure technically, and 18 banks are above the mean efficiency level of scale efficiency.

↳ **Profitability and Marketability Analysis Using the BCG Matrix :** To further illustrate the difference between profitability and marketability, in this section, the BCG matrix is used, which was developed by the Boston Consulting Group (Luo, 2003 ; Tsolas, 2011). This matrix represents a reference point by which to identify each bank's relative performance. Using the BCC model (OTE) scores of profitability and marketability, the position of each bank was plotted on a two by two matrix, and then the banks were placed into four quadrants - stars, cows, sleepers, and dogs. The Figure 2 shows the distribution of the banks on the profitability and marketability matrix over the study period (from 2006 to 2010). These four segments of the banks are described in the following paragraphs using Figure 2 and Table 6 :

↳ **Stars :** These banks possessed high levels of efficiency in terms of both profitability and marketability performance. There are 8 (23.58%) banks (for the year 2006) in this quadrant: ICI, ING, IND, KOT, SBI, SBM, SBT, and YES bank, and for the 2008, there are 9 (26.47%) banks falling into this quadrant: ICI, CIT, DHN, IND, KOT, SBM, SBT, SBJ, and YES bank. For the year 2010, there are 9 (26.47%) banks falling into this quadrant: AXI, IND, DHN, ICI, KRV, KOT, SBM, SBJ, and SBT. Banks that appear in this quadrant can be considered as the benchmarks (role models) to others banks, since they are technically efficient and operate on the frontier.

↳ **Cows:** Banks that appear in this quadrant possessed a higher level of profitability and technical efficiency, but a lower level of marketability efficiency. There are 12 (35.29%) banks falling (for the year 2006) in this quadrant: FED, VIJ, KAR, IDB, CIT, DHN, UCO, KRV, MAH, DEN, IOB, and OBC. For the year 2008, there are 12 (35.29%) banks falling into this quadrant: KRV, OBC, KAR, IOB, FED, ALB, VIJ, CAN, UCO, UNI, IDB, and SYN. For the year 2010, there are 11 (32.35%) banks falling into this quadrant: DEN, AND, VIJ, UCO, FED, IOB, OBC, YES, IDB, SYN, and BOB. The banks that are in this quadrant should focus more on market value generating activities.

↳ **Sleepers:** Banks that are in this quadrant experienced higher level of marketability efficiency, but a lower level of profitability efficiency. There are 3 (8.82%) banks (for the year 2006) in this quadrant: HDF, SBJ, and AXI. For the year 2008, there are 3 (8.82%) banks falling into this quadrant: AXI, ING, and HDF, and for 2010, there are 6 (17.65%) banks that are falling into this quadrant: BOB, JKB, SBI, HDF, PNB, and BOI. The banks that are in this quadrant should concentrate more on profit generating activities.

Table 3. Profitability and Marketability Efficiency Scores for the Year 2006

Bank_ID	PROFITABILITY06				MARKETABILITY06			
	OTE06	PTE06	SCALE	RTS	OTE06	PTE06	SCALE	RTS
ALB	0.883	1.000	0.883	drs	0.189	0.294	0.643	irs
AND	0.858	0.898	0.956	drs	0.255	0.377	0.677	irs
AXI	0.928	1.000	0.928	drs	0.617	0.673	0.917	irs
BOB	0.823	0.842	0.977	drs	0.373	0.417	0.895	irs
BOI	0.891	0.997	0.894	drs	0.329	0.351	0.937	irs
MAH	0.945	0.948	0.997	drs	0.351	0.511	0.687	irs
CAN	0.902	1.000	0.902	drs	0.379	0.403	0.940	irs
CIT	1.000	1.000	1.000	crs	0.318	0.775	0.411	irs
COR	0.899	0.915	0.982	drs	0.404	0.533	0.758	irs
DEN	0.967	0.968	0.999	drs	0.289	0.489	0.591	irs
DHN	1.000	1.000	1.000	crs	0.507	1.000	0.507	irs
FED	0.948	1.000	0.948	drs	0.195	0.374	0.523	irs
HDF	0.917	0.987	0.929	drs	1.000	1.000	1.000	crs
ICI	0.943	1.000	0.943	drs	1.000	1.000	1.000	crs
IDB	1.000	1.000	1.000	crs	0.304	0.369	0.822	irs
IOB	0.964	1.000	0.964	drs	0.274	0.342	0.802	irs
IND	1.000	1.000	1.000	crs	0.614	0.786	0.780	irs
ING	0.951	0.953	0.999	irs	1.000	1.000	1.000	crs
JKB	0.856	0.868	0.986	drs	0.357	0.584	0.612	irs
KAR	0.960	0.985	0.975	drs	0.156	0.448	0.348	irs
KRV	0.986	1.000	0.986	drs	0.355	0.609	0.582	irs
KOT	1.000	1.000	1.000	crs	1.000	1.000	1.000	crs
OBC	0.946	0.977	0.968	drs	0.354	0.451	0.785	irs
PNB	0.844	0.878	0.962	drs	0.483	0.503	0.960	irs
SOU	0.893	0.894	0.999	irs	0.182	0.650	0.280	irs
SBJ	0.925	0.927	0.998	irs	1.000	1.000	1.000	crs
SBI	1.000	1.000	1.000	crs	1.000	1.000	1.000	crs
SBM	1.000	1.000	1.000	crs	1.000	1.000	1.000	crs
SBT	1.000	1.000	1.000	crs	1.000	1.000	1.000	crs
SYN	0.888	0.956	0.929	drs	0.326	0.379	0.859	irs
UCO	0.965	1.000	0.965	drs	0.259	0.316	0.821	irs
UNI	0.914	0.989	0.924	drs	0.342	0.376	0.908	irs
VIJ	0.970	0.977	0.993	drs	0.368	0.497	0.741	irs
YES	1.000	1.000	1.000	crs	1.000	1.000	1.000	crs
Mean	**0.940**	**0.969**	**0.970**		**0.517**	**0.633**	**0.788**	

Source: Author's calculations. Note: Bank_ID full names are given in sample and data section. OTE=overall technical efficiency; PTE= pure technical efficiency ; SE= Scale efficiency ; RTS = Returns to scale ; drs = decreasing returns to scale ; irs= increasing returns to scale ; and crs= constant returns to scale.

Table 4. Profitability and Marketability Efficiency Scores for the Year 2008

Bank_ID	PROFITABILITY08				MARKETABILITY08			
	OTE08	PTE08	SCALE	RTS	OTE08	PTE08	SCALE	RTS
ALB	0.973	1.000	0.973	drs	0.117	0.326	0.358	irs
AND	0.931	0.944	0.986	drs	0.169	0.426	0.397	irs
AXI	0.833	0.926	0.900	drs	0.753	0.802	0.939	irs
BOB	0.825	0.888	0.929	drs	0.284	0.484	0.588	irs
BOI	0.905	1.000	0.905	drs	0.302	0.406	0.744	irs
MAH	0.925	0.925	1.000	crs	0.250	0.518	0.483	irs
CAN	1.000	1.000	1.000	crs	0.276	0.465	0.594	irs
CIT	1.000	1.000	1.000	crs	0.506	0.772	0.655	irs
COR	0.902	0.933	0.967	drs	0.159	0.419	0.380	irs
DEN	0.904	0.911	0.993	drs	0.160	0.482	0.331	irs
DHN	1.000	1.000	1.000	crs	1.000	1.000	1.000	crs
FED	0.990	1.000	0.990	drs	0.196	0.658	0.298	irs
HDF	0.936	0.989	0.947	drs	1.000	1.000	1.000	crs
ICI	1.000	1.000	1.000	crs	1.000	1.000	1.000	crs
IDB	1.000	1.000	1.000	crs	0.296	0.758	0.391	irs
IOB	0.988	1.000	0.988	drs	0.232	0.354	0.656	irs
IND	1.000	1.000	1.000	crs	1.000	1.000	1.000	crs
ING	0.875	0.876	0.999	drs	0.600	0.831	0.723	irs
JKB	0.953	0.963	0.990	drs	0.301	0.646	0.465	irs
KAR	0.993	1.000	0.993	drs	0.395	0.696	0.567	irs
KRV	0.961	1.000	0.961	drs	0.444	0.784	0.566	irs
KOT	1.000	1.000	1.000	crs	1.000	1.000	1.000	crs
OBC	0.984	0.985	0.999	drs	0.357	1.000	0.357	irs
PNB	0.866	0.958	0.904	drs	0.357	0.457	0.782	irs
SOU	0.927	0.928	0.999	drs	0.305	0.805	0.380	irs
SBJ	0.963	1.000	0.963	drs	0.906	0.984	0.921	irs
SBI	0.843	1.000	0.843	drs	0.483	0.519	0.930	irs
SBM	0.992	0.995	0.998	drs	1.000	1.000	1.000	crs
SBT	1.000	1.000	1.000	crs	0.972	1.000	0.972	irs
SYN	0.997	1.000	0.997	drs	0.233	0.471	0.494	irs
UCO	1.000	1.000	1.000	crs	0.326	0.615	0.530	irs
UNI	0.997	1.000	0.997	drs	0.288	0.443	0.650	irs
VIJ	0.997	1.000	0.997	irs	0.194	0.466	0.417	irs
YES	1.000	1.000	1.000	crs	0.850	0.872	0.975	drs
Mean	**0.955**	**0.977**	**0.977**		**0.491**	**0.690**	**0.663**	

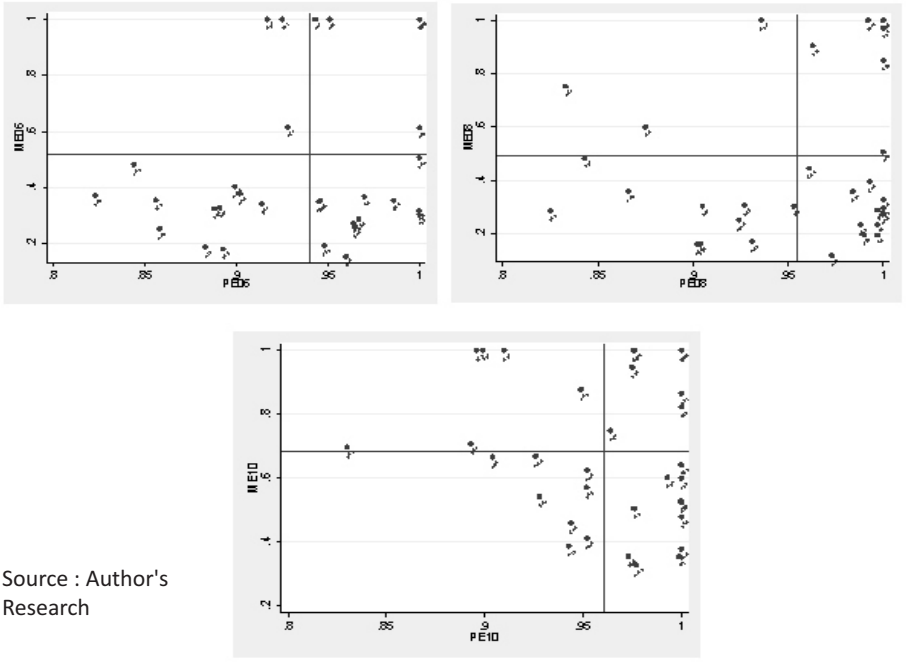
Source: Author's calculations. Note: Bank_ID full names are given in sample and data section. OTE=overall technical efficiency; PTE= pure technical efficiency ; SE= Scale efficiency ; RTS = Returns to scale ; drs = decreasing returns to scale ; irs= increasing returns to scale ; and crs= constant returns to scale.

Table 5. Profitability and Marketability Efficiency Scores for the Year 2010

Bank_ID	PROFITABILITY10				MARKETABILITY10			
	OTE10	PTE10	SCALE	RTS	OTE10	PTE10	SCALE	RTS
ALB	0.943	0.982	0.960	drs	0.388	0.744	0.522	irs
AND	0.977	1.000	0.977	drs	0.329	0.693	0.474	irs
AXI	0.964	1.000	0.964	drs	0.749	0.817	0.917	irs
BOB	0.830	0.964	0.861	drs	0.698	0.757	0.922	irs
BOI	0.893	0.928	0.962	drs	0.708	0.954	0.742	irs
MAH	0.952	0.959	0.993	irs	0.412	0.991	0.415	irs
CAN	0.952	1.000	0.952	drs	0.626	0.730	0.857	irs
CIT	1.000	1.000	1.000	crs	0.524	0.812	0.645	irs
COR	0.926	0.991	0.935	drs	0.669	0.782	0.855	irs
DEN	0.973	0.982	0.991	drs	0.355	0.821	0.432	irs
DHN	1.000	1.000	1.000	crs	1.000	1.000	1.000	crs
FED	1.000	1.000	1.000	crs	0.529	0.970	0.545	irs
HDF	0.910	1.000	0.910	drs	1.000	1.000	1.000	crs
ICI	1.000	1.000	1.000	crs	1.000	1.000	1.000	crs
IDB	1.000	1.000	1.000	crs	0.600	1.000	0.600	irs
IOB	0.976	1.000	0.976	drs	0.505	1.000	0.505	irs
IND	1.000	1.000	1.000	crs	0.823	1.000	0.823	irs
ING	0.904	0.910	0.993	drs	0.666	1.000	0.666	irs
JKB	0.896	0.926	0.967	drs	1.000	1.000	1.000	crs
KAR	0.944	0.972	0.971	drs	0.461	1.000	0.461	irs
KRV	0.976	1.000	0.976	drs	1.000	1.000	1.000	crs
KOT	1.000	1.000	1.000	crs	1.000	1.000	1.000	crs
OBC	0.993	1.000	0.993	drs	0.603	0.863	0.699	irs
PNB	0.949	1.000	0.949	drs	0.878	0.909	0.966	drs
SOU	0.952	0.957	0.994	drs	0.571	0.931	0.613	irs
SBJ	1.000	1.000	1.000	crs	0.865	1.000	0.865	irs
SBI	0.899	1.000	0.899	drs	1.000	1.000	1.000	crs
SBM	0.976	1.000	0.976	drs	1.000	1.000	1.000	crs
SBT	0.975	1.000	0.975	drs	0.948	1.000	0.948	drs
SYN	1.000	1.000	1.000	crs	0.479	0.935	0.512	irs
UCO	1.000	1.000	1.000	crs	0.378	0.812	0.465	irs
UNI	0.928	0.966	0.961	drs	0.542	0.707	0.767	irs
VIJ	0.999	1.000	0.999	drs	0.354	0.953	0.371	irs
YES	1.000	1.000	1.000	crs	0.642	0.809	0.793	irs
Mean	**0.961**	**0.986**	**0.975**		**0.685**	**0.912**	**0.747**	

Source: Author's calculations. Note: Bank_ID full names are given in sample and data section. OTE=overall technical efficiency; PTE= pure technical efficiency ; SE= Scale efficiency ; RTS = Returns to scale ; drs = decreasing returns to scale ; irs= increasing returns to scale ; and crs= constant returns to scale.

Figure 2. BCG-Matrix Representation



Source : Author's Research

Table 6. Profitability and Marketability Efficiency Cross-Tabulation

Profitability Efficiency					
Sleepers			**Stars**		
2006	**2008**	**2010**	**2006**	**2008**	**2010**
N =3 (8.82%)	*N* =3 (8.82%)	*N* =6 (17.65%)	*N* =8 (23.53%)	*N* =9 (26.47%)	*N* =9 (26.47%)
Dogs			**Cows**		
N =11 (32.35%)	*N* =10 (29.41%)	*N* =8 (23.53%)	*N* =12 (35.29%)	*N* =12 (35.29%)	*N* =11 (32.35%)
					Marketability Efficiency

Source: Author's calculations$

Table 7. Non-Parametric Test Results

For the year 2006	**Wilcoxon test**		***T* test**		**Sign test**
	Z	**Significance**	***T***	**Significance**	**Significance**
OTE_pvsOTE_m	4.45	0.00	8.34	0.00	0.00
PTE_pvsPTE_m	4.40	0.00	7.48	0.00	0.00
SE_pvsSE_m	3.87	0.00	4.91	0.00	0.00
For the year 2008					
OTE_pvsOTE_m	4.78	0.00	8.65	0.00	0.00
PTE_pvsPTE_m	4.61	0.00	7.22	0.00	0.00
SE_pvsSE_m	4.42	0.00	7.00	0.00	0.00
For the year 2010					
OTE_pvsOTE_m	4.42	0.00	6.65	0.00	0.00
PTE_pvsPTE_m	3.01	0.00	3.95	0.00	0.01
SE_pvsSE_m	4.03	0.00	5.73	0.00	0.00

Source: Author's calculations. Note: OTE_p=overall technical profitability efficiency; PTE_p=pure technical profitability efficiency in stage; SE_p = scale efficiency in profitability stage; OTE_m=overall technical efficiency in marketability stage; PTE_m=pure technical efficiency in marketability stage; SE_m= scale efficiency in marketability stage.

↳ **Dogs:** Banks that are in this quadrant performed poorly in both activities - profit generating and market value generating activities. There are 11 (32.35%) banks (for the year 2006) in this quadrant: BOB, PNB, JKB, AND, SYN, BOI, COR, CAN, UNI, ALB, and SOU; for the year 2008, there are 10 (29.41%) banks in this quadrant: BOB, SBI, PNB, BOI, SOU, AND, MAH, COR, DEN, and JKB. For the year 2010, there are 8 (23.53%) banks in this quadrant: ING, COR, UNI, SOU, CAN, KAR, ALB, and MAH. The banks that are in this quadrant should focus more on profit generating and market value generating activities.

From the returns to scale point of analysis, this study follows Zhu and Shen's (1995) work on returns to scale classification process, and finds that in terms of profitability efficiency for the year 2006, 9 banks (26.47%) are in the CRS region, most (i.e. 22) of the banks (64.70%) are in the DRS region, and the remaining 3 banks (8.82%) are in the IRS region. On the other hand, in terms of marketability efficiency for the year 2006, only 9 banks (26.47%) are in the CRS region, rest of the (25) banks (73.53%) are in the IRS region, and none of the banks are in the DRS region. For the year 2008, in terms of profitability efficiency, 11 banks (32.35%) are in the CRS region, most (i.e. 22) of the banks (64.70%) are in the DRS region, and only one bank (2.94%) is in the IRS region. On the other hand, in terms of marketability efficiency for the year 2008, only 6 banks (17.65%) are in the CRS region, one bank (2.94%) is in the DRS region, and rest of the (27) banks (79.41%) are in the IRS region. For the year 2010, in terms of profitability efficiency, 11 banks (32.35%) are in the CRS region, most (i.e. 22)of the banks (64.70%) are in the DRS region, and only one bank (2.94%) is in the IRS region. On the other hand, in terms of marketability efficiency for the year 2010, only 8 banks (23.53%) are in the CRS region, most (i.e. 24) of the banks (70.59%) are in the IRS region, and two banks (5.88%) are in the DRS region. As a result, this finding implies that majority of these large banks experienced DRS in terms of profitability and IRS in terms of marketability efficiencies, suggesting that bank size may negatively impact bank profitability and marketability performance.

From the results, it is obvious that size did not matter (in case of the sample banks), but ownership did matter in explaining profitability inefficiency since many of (almost all) the big banks, many of private, and almost all the nationalized banks are in the DRS region throughout the study period. Even in terms of marketability inefficiency, again, size does not matter, but ownership does. Except a few private banks, all the other banks are in the IRS region throughout the study period with an exception of YES bank in 2008 and SBT in 2010. On the whole, it can be said that it is ownership rather than size that helps explaining the efficiency differences throughout the study period consistently. This finding appears to be consistent with and adds further evidence to the profitability efficiency literature. Most previous findings reported that DRS occurs oftentimes among larger banks, but it is a new evidence to the best my knowledge on marketability efficiency that ownership matters and not size of the banks that are operating on the IRS region (e.g., Luo, 2003 ; MacAllister & McManus, 1993; Miller & Noulas, 1996; Seiford and Zhu, 1999). In order to check whether marketability inefficiency is significantly different from profitability inefficiency, three different kinds of tests were run, including paired-difference *t* - test, Wilcoxon test, and Sign test. Table 7 presents the results of these tests. These results provide further evidence that using any of the three index measures, the Indian banks are performing much worse in marketability activities than in operating activities.

Conclusion

Almost all the Indian banking efficiency studies conducted previously evaluated only cost, productivity, and profitability performance (generating more profits), but they did not evaluate the marketability performance (generating more market value) of a bank. It is very important for a bank to have better profitability efficiency, and also, it should have better marketability efficiency, since the real ultimate value of a bank will be defined by the current stock market (Luo, 2003). Hence, this paper presents a model to evaluate both the profitability and marketability efficiency. Profitability efficiency was analyzed using four inputs (assets, equity, operating expenses, and employees) and four outputs (revenue, profit margin, ROA, and ROE). Marketability efficiency was analyzed using four inputs namely, revenue, profit margin, ROA, and ROE and four outputs namely, EPS, market value, P/E ratio, and M/B ratio (Ho, 2008). This is the first study that used four inputs and four outputs for the banking sector's profitability and marketability efficiency analysis, and this model justifies the usage of extra input and output variables by obtaining improved efficiency levels of the banks as compared to the existing literature on the profitability and marketability efficiency model.

Employing a non - parametric frontier method-Data Envelopment Analysis (DEA) with a sample of 34 Indian public and private banks from 2006 to 2010, this study reports that these banks were performing relatively better in terms of generating more profits, but were performing poorly performing in terms of generating more market value. In other words, there is inefficiency in Indian public and private banks due to marketability efficiency rather than due to profitability efficiency. Of the 34 banks that were studied under profitability consideration for the year 2006, 17 banks are pure technically efficient (BCC model), 9 banks are technically efficient (CCR model), and 9 banks are scale efficient. On the whole, 20 banks have efficiency levels more than the mean of technical efficiency, 23 banks have efficiency levels more than the mean efficiency of pure technically, and 20 banks are above the mean efficiency level of scale efficiency. Under marketability efficiency consideration, 10 banks are pure technically efficient (BCC model), 9 banks are technically efficient (CCR model), and 9 banks are scale efficient. On the whole, 11 banks have efficiency levels more than the mean of technical efficiency, 13 banks have efficiency levels more than the mean efficiency of pure technically, and 19 banks are above the mean efficiency level of scale efficiency.

For the year 2008, of the 34 banks studied under profitability consideration, 21 banks are pure technically efficient (BCC model), 11 banks are technically efficient (CCR model), and 11 banks are scale efficient. On the whole, 22 banks have efficiency levels more than the mean of technical efficiency, 25 banks have efficiency levels more than the mean efficiency of pure technically, and 24 banks are above the mean efficiency level of scale efficiency. Under marketability efficiency consideration, 8 banks are pure technically efficient (BCC model), 6 banks are technically efficient, (CCR model), and 6 banks are scale efficient. On the whole, 12 banks have efficiency levels more than the mean of technical efficiency, 17 banks have efficiency levels more than the mean efficiency of pure technically, and 19 banks are above the mean efficiency level of scale efficiency. For the year 2010, of the 34 banks studied under profitability consideration, 23 banks are pure technically efficient (BCC model), 11 banks are technically efficient (CCR model), and 11 banks are scale efficient. On the whole, 20 banks have efficiency levels more than the mean of technical efficiency, 24 banks have efficiency levels more than the mean efficiency of pure technically, and 22 banks are above the mean efficiency level of scale efficiency. Under marketability efficiency consideration, 15 banks are pure technically efficient (BCC model), 8 banks are technically efficient (CCR model), and 8 banks are scale efficient. On the whole, 15 banks have efficiency levels more than the mean of technical efficiency, 21 banks have efficiency levels more than the mean efficiency of pure technically, and 18 banks are above the mean efficiency level of scale efficiency. Thus, these banks should focus more on activities that generate market value.

Managerial Implications

The empirical results of the present study point to a number of managerial implications. Firstly, profitability performance was better than marketability performance over the entire sample period, however, the private banks were relatively better as compared with the government controlled (especially, nationalized) banks in terms of marketability efficiency. It means these nationalized banks are operating well, but the stock market does not reflect this condition. Hence, the management of the Indian public and private banks should focus on improving the marketability efficiency. This can be done in different ways, for example, finding some ways to raise the stock price so that the investors can consider investing money in these banks because their operations are good and there is a growth opportunity in their stock prices. Secondly, banks exhibit relative PTE ; evidence indicates that scale inefficiencies certainly exist in these banks in terms of marketability performance. Finally, if both profitability and marketability of a bank are good, it means the bank is operating well, and the stock market also reflects this and gives a positive evaluation of the bank. Then the management must think how to maintain the profitability and marketability, and the investors will not be too much worried to invest in banks with good profitability and marketability (Ho, 2008). Zaim (1995) suggested that financial reforms have succeeded in stimulating the commercial banks - not only to enhance technical and allocative efficiency, but also to execute necessary scale adjustments, and to achieve optimal scale.

Finally, this study also explored whether the Indian banking sector was impacted by the recent financial crisis. Specifically, the study reports little evidence of the impact of the recent financial crisis on public banks as compared to private banks or the banking system as a whole (eg., SBI's marketability efficiency dropped in 2008 from 1 to 0.483). However, they recovered by the end of the study period.

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