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great by  
deeds, not by  
birth"  
-Chanakya

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**Determinants of allocative, scale and scope  
efficiencies of Indian banks**

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## **Determinants of allocative, scale and scope efficiencies of Indian banks**

This paper analyses the impact of second phase of issuing banking licences, on the determinants of allocative, scope, and cost efficiencies of Indian scheduled commercial banks. The paper follows a two stage estimation process. In the first stage, allocative, scope and cost efficiency scores are estimated following Data Envelopment Analysis. Thereafter, in the second stage, using these scores, determinants of the stated efficiencies are analysed by specifying a regime switching panel regression model. Prior studies, both in the context of Indian and international banks, do not measure and analyse the determinants of scope efficiencies of Banks. The findings reveal that reforms had little impact on the stated measures of efficiency. However, on each of these efficiency parameters, state owned banks perform better than private or even foreign owned banks. Further, the paper finds that profitability, size, ownership and economic growth rate are significant determinants of the stated efficiency measures. As expected, we find that as a result of competition, net interest margins of Indian public and private sector banks have come close to global standards. Reforms have resulted in adoption of global asset classification norms which has resulted in rationalisation of risk across assets. We also find that bigger banks tend to be more efficient although the impact of size on all stated measures of efficiency is diminishing over time. Thus, in order to enhance efficiency, policy measures must encourage banks to reduce their cost to income ratio and enhance their size measured as log of deposits. Accordingly, in order to enhance efficiency, banks need to introduce a number of investment products that are linked to the risk of advances, thus catering to the diversified expectation of depositors. Another way for banks to enhance their efficiency is by offering a wide array of products and services which would result in higher scope efficiency by reducing the cost to income ratio.

JEL classification: G21; G28; D61; L25

Key words: Banks, Financial Reforms, Scope Efficiency, Cost efficiency, Allocative efficiency

## **Introduction**

Over the last two decades, banking sector has been undergoing dramatic changes across the world. Impact of deregulation, financial innovation and increasing use of automation has forced banks to control their costs, minimise risk, as well as maximise welfare and generate higher returns. In this backdrop, analysis of banking efficiency has gained greater attention. While there is a large body of literature analysing the efficiency of banks in US (Berger et.al., 1993; Berger and Humphrey, 1997; Berger, 2007), such studies are of recent origin in the context of emerging economies (Drake et.al. 2006, Sufian 2007, Pasiouras 2008b). Many of these studies find the performance of banks in developing countries to be sub optimal as compared to banks in developed countries (Khumbhakar and Sarkar, 2005). This has been primarily attributed to strict control and regulatory intervention to ensure equitable development. However, over a period of time, both regulators and governments have realized the importance of deregulation in promoting competition led efficiency among banks. Efficiency of banks manifests in the form of better allocation of risks and return (allocative efficiency), wider range of products and services (scope efficiency) and lower operating costs (cost efficiency). These measures of efficiency are interrelated; higher scope efficiency would lead to multiple interactions with clients, thus leading to greater understanding of client risk resulting in higher allocative efficiency. Further, because of greater information and better allocation of risk and return, the cost of gathering and processing information is also lesser, thus, leading to lower operating costs. Any study of banking efficiency is incomplete without measuring scope efficiency.

To the best of our knowledge, most papers do not explicitly measure scope efficiency. This paper aims to fill this gap in literature by measuring allocative, scope and cost efficiency and analysing their determinants in the context of scheduled commercial banks in India. The study measures allocative, scope and cost efficiency following a two stage estimation process. In the first stage, allocative, scope and cost efficiency is measured following DEA. In the second stage, a balanced panel data analysing the determinants of stated efficiency measures is estimated. Since, the regime switching point is known, we analyse the change in determinants of efficiency measure post competition. The findings reveal that reforms had little impact on the stated measures of efficiency. However, on each of these efficiency parameters, state owned banks perform better than private or even foreign owned banks. Further, the paper finds that profitability, size, ownership and economic growth rate are significant determinants of the stated efficiency measures. As expected, we find that as a result of competition, net interest margins of Indian public and private sector banks have come close to global standards. Reforms have resulted in adoption of global asset classification norms which has resulted in rationalisation of risk across assets. We also find that bigger banks tend to be more efficient although the impact of size on all stated measures of efficiency is diminishing over time. Thus, in order to enhance efficiency, policy measures must encourage banks to reduce their cost to income ratio and enhance their size measured as log of deposits. Accordingly, in order to enhance efficiency, banks

need to introduce a number of investment products that are linked to the risk of advances, thus catering to the diversified expectation of depositors. Another way for banks to enhance their efficiency is by offering a wide array of products and services which would result in higher scope efficiency by reducing the cost to income ratio.

The rest of the paper is organized as follows. Section 2 talks about the background to the study. Section 3 details about the study. Section 4 describes the estimation procedure adopted and the hypotheses proposed in this study. Section 5 discusses the data set and the results. Section 6 findings are summarized and concluded.

## **2. Background to the study**

During the last two decades, Reserve Bank of India (RBI) has initiated a series of reform measures aimed at making the banking sector more viable and efficient<sup>3</sup>. The major reform recommendations include (a) lowering of reserve ratios<sup>4</sup>, (b) gradual reduction in interest rates, (c) introduction of prudential asset classification norms, (d) adoption of flexible exchange rates in the current account, and (e) to create a competitive banking environment at par with the international standards. During early 1990's and as a part of overall economic reforms post 1991, along with other sectors, there were a number of reforms in India's banking sector too. The past two decades have witnessed both 'deregulation' and 'reregulation' policy reforms which were guided by two Narsimham Committee reports in 1991 and 1998 respectively. The deregulation period (1992-1997) witnessed introduction of policy reforms targeted at increasing competition<sup>5</sup>. However, the Asian financial crisis forced the regulators to reassess the existing approach<sup>6</sup>. As expected the second Narsimham Committee report proposed "re-regulation" in the banking sector so as to prevent the systemic risk that could negatively affect the financial stability. The main aim is to strengthen regulatory and supervisory framework by following a higher Capital Adequacy Ratio (CAR) and benchmarking critical income recognition and provisioning norms at par with international regulatory standards (RBI, 2001). The above mentioned measures were expected to boost the efficiency of banks, by enhancing their ability to allocate the capital to the highest value use while minimizing the risks and costs involved in their operations, there by achieving both allocative and operational efficiency. One of the important steps in this direction

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<sup>3</sup>Various committees, over the years have been constituted for studying viz. operational efficiency and profitability, operational freedom and competition, the need for evolving a evaluation system and rating of bank's performance, the concept of total factor productivity, how the sector should be organized, role of privatization in restructuring of weak banks etc by Luther Committee (1977), PEP Committee (1977), Sukhmoy Chakravorthy Committee (1985), Pendhekar Working Groups (1982-83), Ahluwalia Committee(1985), Padmanabhan Working Group (1991), Narsimham Committee (1991 and 1998), Verma Committee (1999).

<sup>4</sup> Cash Reserve Ratio (CRR) and Statutory Liquid Ratio (SLR)

<sup>5</sup> Reforms included de-controlled interest rates, reduction in reserve ratios, gradually reducing the government control of banking operations and thus establishing a market regulatory framework (Lawrence and Longjam 2003)

<sup>6</sup> The unprecedented Asian financial crisis during 1997-98, has exposed the shortcomings in the supervisory, regulatory and prudential frameworks.

has been the licensing of new private sector banks in India. As suggested in the second Narsimham Committee report, with the incentive to derive economies of scale and scope, development of Universal banks<sup>7</sup> were promoted. With the emergence of universal banking, the bankers thus have to face multi pronged challenges because of the increased competition and the shrinking margins on their current business portfolios. Till date there have been three rounds<sup>8</sup> of licensing of private banks. While there were pressures to increase the productivity on the one hand, there were also compulsions to serve the nation in a better way through efficient and effective delivery mechanism. In this backdrop, the banking industry has to devise measures so as to reduce reliance on fund based income, enhance and serve savings deficit units and surplus eco-units in a better manner by enhancing allocative, scope and operational efficiencies.

Before embarking on further rounds of licenses, it has become imperative to take stock of the impact that the two rounds of issuance of banking license and the competition built in thereafter has created on efficiency (Allocative, Scope and Cost) of the Indian banking sector. Literature is inconclusive on the effect of competition on efficiency. While some studies (Ataullah *et al.* 2004; Bhattacharyya *et al.* 1997) report a positive relationship others report a negative relationship (De 2004; Kumbhakar and Sarkar 2003). Thus in a nutshell it can be stated that prior studies on competition and its impact on efficiency has been inconclusive.

### 3 The Study

In the light of banking sector reforms, many studies have tried to capture the technical efficiency (Akmal and Saleem, 2008) and/or scale efficiency (Akmal and Saleem, 2008; Quyyam and Khan, 2007; Kraft and Tirtiroglu, 1998; Karvalo and Kasman, 2005) and/or allocative efficiency (Misra 2003), and/or profit and cost efficiency (Karvalo and Kasman, 2005). However, to the best of our knowledge, there are no studies that measure scope efficiency of banking operations and identify its determinants.

The present study aims at filling this gap in literature by measuring efficiency (Allocative, Scope and Cost) of the Indian banks during the pre and post reform period.

As in prior literature (Pasiouras *et al.*, 2007), this paper also follows two stage process to measure efficiency and analyse determinants of different efficiency measures. They have used bank three inputs along with their prices<sup>9</sup> (fixed assets, deposits and number of employees) and two outputs

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<sup>7</sup> This form was banking was also recommended by Khan Committee Report. It gained importance during 2001 and under this form; bank performs different activities like commercial banking, investment banking, insurance, leasing etc under one roof.

<sup>8</sup> In the first round in 1993, ten banks were licensed and during 2004, two more licenses were issued and in 2014 another two more licenses were issued to IDFC Ltd and Bandhan.

<sup>9</sup> The three input prices are (a) depreciation related to fixed assets, (b) interest expense to deposits and (c) personnel expense related to employees.

(loans and liquid assets and investments). Further, in the second stage; they have examined the impact of bank specific factors (Size, Capital, Number of ATMs and branches) as well as local market conditions (GDP per capita, Unemployment rate) on bank efficiency.

As highlighted by Coelli et.al., (1999) and Pastor (2002), there are many advantages by adopting this procedure. These include (a) very easy to implement, (b) this method is simple and transparent, (c) flexibility of taking into consideration many environmental variables simultaneously, (d) it can accommodate both categorical and continuous variables.

Hence first we use a non-parametric technique called Data Envelopment Analysis (DEA) for measuring the efficiency of banks in the sample. Input variables for measuring allocative, scope and cost efficiency are: ( $x_1$ ) Interest expenses, ( $x_2$ ) employee expense, ( $x_3$ ) other operating expense, ( $x_4$ ) provisions. And the output includes ( $y_1$ ) deposits, ( $y_2$ ) loans and advances, ( $y_3$ ) investments. And in the second stage, the efficiency scores are regressed on both internal and external determinants using Tobit analysis. Internal determinants include profitability, risk, size and ownership. And external determinants include concentration in the industry and the macroeconomic trend. A detailed note on the choice of inputs and outputs as well as the expected relationships between explanatory variables and the efficiency estimates are presented in the subsequent section. This study will be of much use to regulators as well as government while framing policies. It will also facilitate management of banks to improve the way in which they allocate resources across the different investment avenues available to them.

#### **4. Estimation procedure**

In this section, concepts on efficiency are discussed first, followed by our choice of input and output variables for this study. Further, the section also describes the choice of variables that determine stated efficiency measures

##### **4.1 Concepts on efficiency**

The two most common approaches to measure efficiency are: (i) parametric approach following Stochastic Frontier analysis (SFA) and (ii) non parametric approach following Data Envelopment Analysis (DEA). While the parametric approach requires the specification of cost functions for each efficiency measure, non parametric approach is data driven and hence does not require the cost function to be specified.

Prior literature recommends use of DEA because: include (a) DEA is equivalent to maximum likelihood estimate (Banker 1993), (b) DEA estimator are faster and converge faster than other estimators from other frontier approaches (Grosskopf, 1996), (c) DEA estimators are also unbiased, if we assume there is no reference technology or underlying models. Even if biased, the bias decreases

with the sample size (Kittelens, 1999), (d) DEA estimation methodology performs better than the parametric procedures (Banker and Natarajan, 2008).

Accordingly, the present paper also follows the non-parametric frontier based Data Envelopment Analysis approach to estimate efficiency scores for different segments of SCBs in India. DEA uses simple linear programming techniques to identify the most efficient firms or decision making units (DMUs) considering multiple performance indicators. Here the most efficient DMUs are assigned a score of 1 and these DMUs form the ‘standards’ and ‘envelope’ other units, thus forming the efficient frontier. The performance of other DMUs (banks) are benchmarked vis a vis the frontier DMUs (banks). In order to estimate the frontier, either input variables are minimised for a given output or output variables are maximised for a given input. Following the recent studies (Pasiouras et.al., 2007), we also have reported the efficiency score on the input oriented approach.

A firm is said to be technically efficient, if it is able produce more with the current level of inputs. This helps to provide information on the wastages in service operations which can be reduced. Further, DEA can be implemented assuming constant returns to scale (CRS) or variable returns to scale (VRS). Under CRS, the importance of scale efficiency does not hold. In other words, if a firm is able to scale up its production, ideally it should result in reduction in average cost per unit which will not be captured when CRS is assumed. Therefore in order to capture the scale efficiency, variable returns to scale are assumed. Technical efficiency is further decomposed into pure technical efficiency (PTE) and scale efficiency (SE)<sup>10</sup>. Pure technical efficiency captures the efficiency relative to the variable returns to scale whereas scale efficiency captures the distance between the variable returns to scale (VRS) as well as constant returns to scale (CRS).

$$TE_{CRS} = PTE_{VRS} * SE \quad (1)$$

Or

$$SE = TE_{CRS} / PTE_{VRS} \quad (2)$$

Thus the ratio of outputs to inputs without prices gives the technical efficiency of each firm and the optimal combination of inputs with prices to outputs gives the allocative efficiency of each firm.

In a nutshell, it can be easily stated that cost efficiency ( $CE_{CRS}$ ) is a product of technical efficiency and allocative efficiency. Or in other words, cost efficiency assuming constant returns to scale ( $CE_{CRS}$ ) is the product of pure technical, allocative and scale efficiencies.

$$CE_{CRS} = TE * AE \quad (3)$$

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<sup>10</sup> Refer equation 1.

$$CE_{CRS} = PTE_{VRS} * AE * SE \quad (4)$$

This helps to measure how close each bank's cost is with that of the best-practise banks cost for producing the same level of output. The cost efficiencies estimated are the product of cost per unit and the total units. The main objective is to minimize the total cost i.e. sum total of interest expenses, employee expense and physical capital expenses. Following the work of Cummins, et.al., (2010), this paper tries to measure the scope efficiency by removing the impact of scale efficiency on cost efficiency computed under constant returns to scale approach. This approach has been used to measure the scope efficiency of insurance firms; however this would be first paper which measures the scope efficiency of scheduled commercial banks. Here scope efficiency is measured as a resultant of pure technical efficiency and allocative efficiency<sup>11</sup>. Here we mean to say, that a bank is said to be scope efficient, if they are able to minimize their total cost by enhancing their scale of operations. Thus the banks will be able to extract higher information through multiple interactions with the same customer through a wide range of products and services.

$$SCE_{CRS} = CE_{CRS} / SE \quad (5)$$

Or

$$SCE_{CRS} = PTE * AE \quad (6)$$

#### 4.2 Choice of inputs and outputs

It is very evident from the existing literatures that choice of variables plays a crucial role while determining the efficiency level of firms. Some researchers view banks as producers of deposits and loan accounts and the output is measured by taking into account the number of transactions or the accounts serviced by the bank. This approach is called as “production approach”. Others view banks as intermediaries, wherein the bank uses deposits together with other inputs to produce different categories of bank assets. This approach is called “intermediation approach”. In the existing studies relating to measurement of efficiency of banks, intermediation approach has been widely adopted when compared to production approach<sup>12</sup>. Following the same logic, intermediation approach has been used in this study too. In this study, banks intermediation approach is viewed as a transformation of three inputs groups namely capital, labor and deposits into outputs namely loans, and other earning assets. A long standing debate still exists on considering, deposits as inputs or

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<sup>11</sup> Refer equation 6.

<sup>12</sup> One of the reason for the same could be that the later one focuses only on the operating expense and not interest expense where as the former one includes both operating and interest expense which might be of better interest while studying the efficiency of banks (Berger, Hanweck and Humphrey, 1987; or Ferrier and Lovell, 1990).

outputs. From one dimension, it is viewed that deposits provide the banks with the raw material of investment funds, but another point of view states that deposits provides liquidity, safe custody and payment services to depositors (Berger and Humphrey, 1997). Another approach indicates that the cost paid on deposits (interest rate) can be considered as an input and the value of the deposits can be considered as an output (Cavallo and Rossi, 2001). Similar approach is adopted in this study. And in order to compute cost efficiency, price information is a must. As suggested by Hao, Hunter and Yang (2001), interest rate could be computed as a ratio of interest expense over total deposits and price on physical capital could be computed as a ratio of total expense on fixed assets over total fixed assets. An argument exists that non-interest expense includes premise expense and therefore computing the ratio of non-interest expense on fixed capital can be used as a proxy for price of physical capital (Zhao 2000). In order to compute price of labour, personnel expense relative to full time employees should be taken. However, paucity on the availability of data regarding the number of employees, here we have computed price of labour as a ratio of employee expense to total assets.

Therefore in this study the proposed outputs are ( $y_1$ ) Total loans, ( $y_2$ ) Total deposits and ( $y_3$ ) Investments. Inputs include ( $x_1$ ) Interest expense, ( $x_2$ ) employee expense and ( $x_3$ ) other operating expense (net of operating expenses and employee expenses), ( $x_4$ ) provisions for loan losses (as a proxy for credit risk). Price of inputs include ( $c_1$ ) Price of Funds (ratio of interest paid on deposits and total deposits), ( $c_2$ ) Price of labor (ratio of employee expense and total assets), ( $c_3$ ) Price of physical capital (ratio of non-interest expense and fixed assets), ( $c_4$ ) Price of risk (ratio of provisions and total loans)

### 4.3 Hypotheses

As stated earlier, in this paper we look at three alternative measures of efficiency viz. Allocative efficiency, scope (of services) efficiency and cost efficiency. Allocative efficiency ensures a pareto optimal allocation of risk and return (Bauer, G.H., 2004). In other words, you can't make a borrower and/depositor better off without making another borrower and/or depositor worse off. Scope efficiency deals with the possibility of higher information arising out of expanding the scope of client relationship across a whole bunch of products and services. Finally, we look at overall cost efficiencies resulting from allocative, scope, scale and technical efficiency<sup>13</sup>. The results are reported in Table -3. Based on prior literature, we analyse the impact of profitability, risk, size and ownership on efficiency. We further analyse external (environmental) determinants of efficiency such as the concentration in the industry and the macroeconomic trend. Finally, we analyse the impact of second round of licensing on each determinant of efficiency.

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<sup>13</sup> Results of scale and technical efficiencies have not been reported in the study. The same can be obtained from the authors on request.

**Profitability and Bank Efficiency:** Based on prior literature (Isik and Hassan, 2002; Hasan and Marton, 2003, Miller and Noulas, 1996, Sufian, 2009), it can be said that profitable banks are found to be more efficient because they are preferred by both, depositors as well as borrowers, alike. In this study, three alternative measures of profitability viz. NIM, RoA and CI are studied.

**NIM:** Based on prior literature a high NIM arising due to lack of competition is expected to be negatively related to banks' allocative and cost efficiency (Kunt and Levine, 1996; Kunt and Huizinga, 2000). As stated earlier, there are no prior studies on scope efficiencies. In the present study we posit a negative relationship between NIM and scope efficiency, which is defined as the product of allocative and pure technical efficiency (Cummins et. al., 2010). A high NIM may be due to enhanced risk perception arising out of moral hazard of lending to a client. The intensity of such risk perception is assuaged when banks enhance their client relationship across products and services (Berger, 1999; Boot, 2000). Thus, a high NIM, we posit, may be indicative of low scope efficiency of a bank.

**RoA:** As compared to NIM, RoA is a more comprehensive measure of profitability as it includes both fund and fee based income. As stated earlier, banks with higher profitability are expected to be more efficient. In the first step, while estimating the efficient frontiers for allocative, scope and cost efficiencies, profitability is an output variable which is to be maximised. Accordingly, in the second step we posit a positive relationship between RoA and the stated three measures of efficiency.

**CI:** Cost to income ratio is a measure of the efficiency with which the bank has managed its operating expenses. A highly efficient bank would tend to have a low CIR and vice versa (Hays et. al.,2009).A reduction in cost is expected to ultimately result in reduction in lending rates and also net interest margins (Bhide, Prasad and Ghosh, 2002). Accordingly, we posit a negative relationship between CI and the three stated measures of efficiency.

**Risk and Bank Efficiency:** As stated earlier, this paper proxies risk as the provisions for loan losses created by the banks. In prior literature, it has been noted that banks with high loan loss provisions tend to have low levels of efficiency (Berger and Humphrey, 1992; Barr and Siems, 1994; Wheelock and Wilson, 1995). Given that the heterogeneity in profile of depositors is much lesser than that of borrowers, we posit that a high risk loan is an indicator of lack of allocative efficiency. Further, as stated earlier, a low risk may also be a result of enhanced client relationship over an array of products and services. Hence we posit a negative relation between risk and scope efficiency. Finally, higher provisions would result in lower income generating advances which leads to a higher cost to income ratio. Hence, we posit that risk is negatively related to cost efficiency of a bank.

**Size and Efficiency:** Prior literature puts forth a positive relationship between size and efficiency to a certain extent. A larger size would give banks a larger bargaining power to raise low cost resources as

well as reduce the fixed cost per unit (Hauner, 2005). In this paper we measure size of a bank by taking a log of its total deposits. However, beyond a certain size, the effect of size could be negative due to bureaucratic and other reasons (Delis and Papanikolaou, 2009). Hence, the relationship between size and efficiency is not linear. To capture this non linearity, in addition, we analyse the relation between square of log of total deposits and the stated three measures of efficiency. A larger size would help the bank enhance allocative efficiency by possibly building greater heterogeneity in depositor base. It would enhance allocative efficiency with greater bargaining power to cross sell products and services and cost efficiency by more efficient allocation of fixed costs. Hence, in this study we posit a quadratic relationship between size and efficiency.

**Ownership and Efficiency:** Licensing of new private banks and enabling foreign banks to operate directly or through a stake in Indian private banks were important reforms aimed at improving efficiency of banking sector through enhanced competition. Participation of foreign banks was expected to enhance efficiency by infusion of fresh capital, better governance and risk management practices (Delis and Papanikolaou, 2009). Since ownership of most foreign owned banks is likely to be concentrated, they are expected to be less prone to agency conflicts. Also, foreign banks were expected to bring best practices internationally to domestic banking thus, increasing operational, scope and cost efficiencies. Accordingly, we posit a positive relationship between foreign ownership and the stated three facets of efficiency. Any study of impact of ownership on efficiency would be incomplete without analysing the role of public sector banks. Thus we also analyse the impact that government ownership has on banking efficiency.

**External determinants of bank efficiency:** In addition to ownership, we also analyse the role played by level of concentration and the rate of economic growth in enhancing efficiency of banking sector. The relationship between concentration and efficiency has been well researched. While the efficient structure hypothesis (Demsetz, 1973) posits a positive relationship between level of concentration and efficiency, the Quiet life hypothesis (Berger and Hannan, 1998) posits a negative relationship between the two. In this paper, we proxy concentration in the industry by computing the herfindahl hirshman index for each bank. A high rate of economic growth is expected to generate higher efficiency (Gregorian and Manole, 2002) since under such circumstances there would be more deposits as well as demand for loans. Accordingly, we posit a positive relation between GDP growth rate and efficiency. Explanation on the determinants as well as expected relationships on efficiency is detailed in Table 1.

**Table 1 Description of explanatory variables used in the study**

Variables	Description	Hypothesized relationship with efficiency	
Bank			

Characteristics			
Return on Assets (RoA)	Ratio of profit after tax and total assets	+	It is used as a proxy for bank profitability. A higher RoA should result in high level of efficiency.
LNDP	Natural logarithm of total deposits	+/-	It is used as a proxy for market share. We do not have a priori expectation for this relationship
LNTA	Natural logarithm of total assets	+	It is used as a proxy for bank size and is used to capture the possible cost advantage arising due to scale economies. We expect a positive relationship with the efficiency.
PLL	Ratio of provision for loan losses and total loans	-	It is used as a proxy for asset quality. A higher provision will result in lower level of efficiency and hence a negative relationship is expected.
CI	Cost to income ratio is the ratio of non- interest (operating) expense to net income; where net income is the difference between total income minus interest paid.	-	It is used as a proxy for measuring the operational efficiency of the banking system. A high CI will reduce the operational efficiency and hence we expect a negative relationship with the efficiency.
OITI	Other income to total income is the ratio of fee based income upon total income (fee based income plus fund based income)	+/-	It is used as a proxy for diversification strategy [used to capture cost advantage arising due to scope economies]. We do not have a priori expectation for this relationship.
Economic Conditions			
LNGDP rate	Real GDP growth rate	+/-	It is used as a proxy for economic conditions. We do not have a priori expectation for this relationship.
Market Concentration			
HHI	Herfindahl-Hirschman Index is computed by squaring the market share of each firm and summing up the resultant values.	+/-	It used as a proxy for market concentration. We do not have a priori expectation for this relationship.
Ownership			
DUMPUB	Dummy variable that takes a value of 1 for Public banks and 0 for others	+/-	It is used to examine the relationship between public banks and efficiency. We do not have a priori expectation for this relationship.

DUMFB	Dummy variable that takes a value of 1 for Foreign banks and 0 for others	+/-	It is used to examine the relationship between foreign banks and efficiency. We do not have a priori expectation for this relationship.
DUMPVT	Dummy variable that takes a value of 1 for Private banks and 0 for others	+/-	It is used to examine the relationship between foreign banks and efficiency. We do not have a priori expectation for this relationship.
Reforms			
PRERF	Dummy variable that takes a value of 1 for Pre-reforms and 0 for post reforms	+/-	It is used to examine the relationship between pre-reforms period and efficiency. We do not have a priori expectation for this relationship.
POSTRF	Dummy variable that takes a value of 1 for Post-reforms and 0 for pre- reforms	+/-	It is used to examine the relationship between pre-reforms period and efficiency. We do not have a priori expectation for this relationship.

## 5 Dataset and Results

A balanced panel of 38 Indian scheduled commercial banks (SCBs) constituted by 19 public sector banks, 14 private sector banks<sup>14</sup> and five foreign sector banks has been taken in the study. In order to study the impact of the second round of reforms on efficiency of banks, the period of study is divided into two phases namely “Pre-Reforms” (1999-2004) and “Post –Reforms” (2007-2013) stages. The year 1999 was chosen as the starting period, because it was during 1994 ten new banking licenses were issued. As prescribed under RBI guidelines, a three year period is given to stabilize their risk return profile. Therefore, the starting period should ideally be from 1997 onwards. However, due to the paucity of data on select variables, viz. provision for loan losses, for all banks, this paper analyses bank performance from 1999 onwards. Similarly during 2004, two new banking licenses, the study analyses data for stated sample from 2007 to 2013. Data for each variable has been drawn from CMIE Prowess database. The descriptive statistics of key variables are presented in table 2. They consist of 494 bank year observations.

**Table 2 Average values of banking inputs, outputs and costs.**

Variables	Mean	SD	Min	Max
<b>Inputs</b>				
Interest expense (INTEX)	43372.69	75320.38	68	753295.8
Other operating expense (OOPEX)	6178.97	12509.51	26.8	95046.4
Employee expense (EMPEX)	9116.38	17825.36	16.5	182809
Provision for loan losses (PLL)	5118.82	11153.77	6.9	125246.7
<b>Price of inputs</b>				
Price of Deposits (PD)	0.062	0.014	0.009	0.118
Price of Physical Capital (PK)	0.458	0.269	0.08	1.76

<sup>14</sup> In this analysis Private banks constitute of both old (9) and new private sector (5) banks.

Price of Labor (PL)	0.012	0.005	0.001	0.032
Price of Risk (PR)	0.013	0.014	0	0.241
<b>Outputs</b>				
Deposits (DEP)	693432.5	1223655	512.5	12027396
Loans (LNS)	498229.8	978218.7	294.7	10456166
Investments (INSVT)	253798.3	416709.4	325.7	3508775
Total Assets	880261	1585531	2193.7	15686992
Total Costs	63786.87	112997.3	151.6	1152325
No. of Observations	494			
Number of banks	38			

Note. All input and output variable are measured in million rupees, price of inputs are ratios

Source: CMIE Database.

## 5.1 Results

The mean efficiency scores (Cost efficiency, Allocative efficiency and Scope efficiency) of the banks have been reported in table 3. It can be seen that among all segments of SCBs, PSBs demonstrate the highest cost, allocative and scope efficiency. In particular their performance in terms of allocative efficiency stands out, as has been observed in other studies (Misra 2003; Sensarma 2005; Ram Mohan and Ray 2004). NIM for foreign banks have been traditionally high which we reason may be due to the scope of products and services that they offer and their abilities to mobilize low cost deposits (Casu et al.2013). High NIM is negatively related to allocative efficiency. The poor allocative efficiency, of foreign banks has a cascading effect on their cost and scope efficiency measures<sup>15</sup>.

While analysing the impact of second round of banking licences on efficiency, we find that, in the case of both, PSBs and PVT banks, all three measures of efficiencies have decreased. The reduction in efficiency is more severe in the case of private banks. As for FBs, reforms seem to have brought a marginal improvement in cost and scope efficiency. However, there is a marginal dip in their allocative efficiency.

**Table 3 Average efficiency estimates on the basis of ownerships**

Ownership #	Average efficiency		
	CE	AE	SCE
<b>Pre-Reforms Period (1999-2004)</b>			
PSB	0.882	0.926	0.904
PVT	0.785	0.845	0.809
FB	0.63	0.685	0.656
<b>Post Reforms Period (2007-2013)</b>			
PSB	0.862	0.912	0.885
PVT	0.634	0.692	0.651
FB	0.661	0.677	0.67

# It consists of 19 public sector banks, 14 private sector banks and 5 foreign banks.

Source: Authors calculations

<sup>15</sup> Refer equations 4 and 5.

In summary, it can be said that greater competition has not led enhanced allocative efficiencies of SCBs in general. Further, except for FBs, the same holds true for cost and scope efficiencies as well. This calls for further competition from both, the private and foreign banks. Next we, analyse the impact of reforms on the determinants of cost, allocative and scope efficiency measures. Since the regime changing point is known (post second round of reforms i.e. 2007-13) we introduce slope and intercept dummies to analyse the impact of reforms on each determinant of efficiency. The results of this analysis are reported in Table 4.

**Table 4: Determinants of Allocative, Scope and Cost Efficiency measures**

Determinants		AE		SCE		CE	
		Pre	Post	Pre	Post	Pre	Post
Profitability	NIM	-0.06128***	-0.0077874	-0.08138***	-0.0187522	-0.07376***	-0.0123325
	RoA	0.0033686	0.0029891	0.0015269	0.0277111	-0.00437	0.0299096
	CI	-0.00367***	-0.00406***	-0.00444***	-0.00371***	-0.00465***	-0.00396***
Risk	PLL	-0.01032*	0.0193	-0.01309*	0.0131101	-0.0147872	0.0040206
Size	LnDep	0.1282	0.4052***	0.1449196	0.3492**	0.1528039	0.3206562
Size 2	LnDep2	-0.0084478	-0.01762***	-0.0089304	-0.01539**	-0.00934*	-0.01475*
Concentration	HHI	0.0000767	0.000222	0.0001188	0.0003017	0.0000745	0.0002319
Macro Economic Trends	GDP	-0.0025322	-0.2182***	0.0005685	-0.01467***	-0.0011922	-0.02145***
Ownership	O1 (FBs)	-0.1476942		-0.0969221		-0.1261186	
	O2 (PSBs)	0.2349***		0.2531322***		0.2592***	
Reforms	R1	-2.0697**		-1.764565**		-1.399725	
Intercept		0.8963255		0.8355595		0.7686432	

Note. \*, \*\*, \*\*\* denotes significance at 10%, 5% and 1% confidence levels.

Source: Authors calculations

As can be seen from the intercept dummy (R1) post reforms AE, SCE and CE has decreased across all SCBs. This is counter intuitive purely because, with licensing and enhanced competition, one would expect a higher mean level of efficiency. Further, it can be seen that among the profitability measures, NIM and CI influence efficiency negatively and significantly, as was hypothesised in the previous section. What is interesting is that while both NIM and CI significantly and negatively influence efficiency, post reforms only CI emerges as a significant determinant. On further analysing the NIM in public and private sector banks, as reported in table 5, it is seen that, post reforms, their

NIM has come down from 3.8% to 3%, which is fairly close to the global average NIM of 2.5 % (Forbes 2014)<sup>16</sup>

	Pre	Post
PSB	3.84	2.97
PVT	3.75	3.20
Average	3.80	3.09

Source: Authors calculations

So far its thumbs up for reforms since post second round of licensing, there seems to be a reduction in NIM as well as CI. As expected, risk is negatively and significantly related to allocative and scope efficiency measures in the pre reforms period. However, post reform, risk becomes insignificant. This, we believe is because of the rationalisation of risk across loan portfolio. During this phase, loan classification standards in India were brought closer to international standards (Packer and Zhu, 2012). Also, it can be seen that risk rationalisation across loan portfolio has actually resulted in a reduction in provision for loan losses from 1.8% pre reforms to 0.75% post reforms.

As stated earlier, size and efficiency are hypothesised to have a quadratic relation. Post reforms, we observe that size is positively related to the three stated forms of efficiency. However, as expected, it can be seen from the coefficient of the quadratic term, the influence is diminishing. As the deposit base increases, the ability of the bank to allocate risk and capital increases. There is economies of scale leading to cost efficiencies. Larger deposit base also helps banks to market a variety of products and services to their clients who also may happen to be their depositors.

Concentration does not affect efficiency, a result which is neither in support of quiet life or the efficient structure hypothesis. This we believe is because Indian banking sector is yet to undergo consolidation. Despite a decade of competition the top ten SCBs still account for about 70% of the assets of SCBs. Indian banking does seem to be concentrated but this concentration has neither been due to crowding out of inefficient units as in the efficient structure hypothesis nor is concentration responsible for complacency and resultant inefficiency. Hence, post consolidation we expect a clearer result on the effect of concentration on efficiency.

Contrary to expectation, macro-economic indicator i.e. GDP growth rate is negatively and significantly related to allocative, cost and scope efficiency only in the post reforms period. As in Keeton (1999) we believe, such negative relation may be because, higher economic growth motivates (pressurizes) banks to expand their loan portfolio at the cost of taking high risk. This in turn will reduce the overall quality of bank assets. In the case of Indian banks, while the economic growth has

<sup>16</sup> Comparison of net interest margin for largest US banks

Refer <http://www.forbes.com/sites/greatspeculations/2014/09/11/a-quick-comparison-of-interest-margins-for-the-largest-u-s-banks/>

increased from 6% pre-reforms to 7.75% post reforms, the loan portfolio for PSBs has increased 400% and for private banks 200%. Such an increase in advance may be a result of high risk advance, which would reduce the efficiency of banks. Finally, foreign banks, were expected to increase the efficiency of banking sector. However, in case of India, they don't seem to have had any effect on efficiency. Rather, the on-set of banks that have positively affected efficiency is the public sector banks. Thus, we believe, that competition is also needed among foreign banks so that the best practices can percolate into banking operations.

## **6 Conclusion**

This paper evaluates the effect of second round of licensing on allocative, scope and cost efficiencies of Indian SCBs. To the best of our knowledge, this is the first paper that develops a measure of scope efficiency and analyses its determinants in the context of banking operations (Dai Mian and Yuan Yuan 2013; Mertens, A. and Urga, G., 2001; Berger et.al.,1987). A bank is said to be scope efficient when they are able to extract higher information through multiple interactions with the same customer by offering a whole bunch of products and services.

As stated earlier, most governments, when they liberalised entry restrictions in the banking sector expected higher competition to enhance the efficiency of the banking sector, as is proposed in the *efficient structure hypothesis*. Comparison of aggregate efficiency figures for each segment across the two time periods reveal that greater competition has not resulted in enhancement of either allocative, scope or cost efficiency. However, there seems to be a marginal improvement in the cost and scope efficiency measure of foreign banks. The reduction in efficiency measures is most severe in the case of private banks. Such a cold response to reforms we believe may be because only two new private sector banks were licensed in this round. Thus, we believe that higher competition and subsequent consolidation may enhance efficiency further. An empirical analysis of determinants of the stated efficiency measures finds that Profitability (NIM and CI), size, economic growth rate and ownership are significant determinants of efficiency. Post reforms, the NIM of PSBs and Private Banks seem to be getting closer to global standards and hence, efforts to enhance allocative, scope and cost efficiency should focus on improving the cost to income ratio. Similarly, size measured as the log of deposits is positively related to the stated efficiency measures during the post reforms period. However, their influence is diminishing. Thus, there must be a drive to mobilise deposits and enhance reach across different segments of depositors in order to enhance efficiency. The study finds risk of portfolio as an insignificant determinant of efficiency which may be an outcome of the tighter loan classification norms adopted by Indian banking sector in line with international banking standards.

Finally, we find that currently, only performance of PSBs are affecting the overall efficiency measures of SCBs, higher competition with a ecosystem that encourages banks to reduce their cost to

income ratios, increase size of deposits across investor segments would go a long way in enhancing the efficiency of banking system.

Additionally, in order to enhance allocative efficiency, banks may introduce larger number of investment products. Currently, most banking products link returns only to tenure of deposit. We propose that in order to cater to heterogeneous expectation, deposit products should also be linked to risk of advances such as infrastructure deposits, personal credit deposit schemes, corporate loans schemes, project finance schemes, working capital deposit schemes etc.

Similarly, to enhance scope efficiency banks would need to come up with more services either on their own or in tie-up with service providers which would reduce their cost to income ratio resulting in a higher scope efficiency measure. On this note, it is surprising that foreign banks have had no significant role in enhancing scope efficiency of the banking sector. Thus, we find that there is a need to introduce competition not only among Indian banks but also among foreign banks so as to enable transfer of best practices which would go a long way in enhancing the efficiency of the banking sector in general.

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<p><i>Abstract:</i> This paper analyses the impact of second phase of issuing banking licences, on the determinants of allocative, scope, and cost efficiencies of Indian scheduled commercial banks. The paper follows a two stage estimation process. In the first stage, allocative, scope and cost efficiency scores are estimated following Data Envelopment Analysis. Thereafter, in the second stage, using these scores, determinants of the stated efficiencies are analysed by specifying a regime switching panel regression model. Prior studies, both in the context of Indian and international banks, do not measure and analyse the determinants of scope efficiencies of Banks. The findings reveal that reforms had little impact on the stated measures of efficiency. However, on each of these efficiency parameters, state owned banks perform better than private or even foreign owned banks. Further, the paper finds that profitability, size, ownership and economic growth rate are significant determinants of the stated efficiency measures. As expected, we find that as a result of competition, net interest margins of Indian public and private sector banks have come close to global standards. Reforms have resulted in adoption of global asset classification norms which has resulted in rationalisation of risk across assets. We also find that bigger banks tend to be more efficient although the impact of size on all stated measures of efficiency is diminishing over time. Thus, in order to enhance efficiency, policy measures must encourage banks to reduce their cost to income ratio and enhance their size measured as log of deposits. Accordingly, in order to enhance efficiency, banks need to introduce a number of investment products that are linked to the risk of advances, thus catering to the diversified expectation of depositors. Another way for banks to enhance their efficiency is by offering a wide array of products and services which would result in higher scope efficiency by reducing the cost to income ratio.</p> <p>JEL classification: G21; G28; D61; L25</p>	
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