Profit Efficiency and Corporate Governance of Indian Banks*

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Abstract

This paper examines the impact of board structure on the profit efficiency of Indian banks. We employ directional distance function methodology to account for undesirable output in the profit efficiency estimations. Further, we decompose the profit inefficiency into technical and allocative inefficiency to disentangle the source of the inefficiency over ownership pattern. On an average, the performance of state-owned banks has been relatively poor due to their high levels of profit inefficiency emanating primarily from allocative inefficiency. The second stage results suggest that Indian banks with larger boards and those that pay higher sitting fees to the members exhibit better performance. Among the private sector banks, the key corporate governance variables that improves the performance include higher proportion of female board members and relatively larger proportion of independent board members. The results are robust to alternative measures of efficiencies and estimations that address for potential endogeneity concern. Our study contributes to the debate on the role of board structure in bank performance.

Keywords: Corporate Governance, Efficiency, State-ownership, Indian banks

JEL Codes: C14, G21, G32

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1. Introduction

Traditionally banks are highly regulated entities given their systemic impact on the real sector. The Basel regulations, latest being Basel III, provided an overarching framework for the risk management of the banks across countries. In such a regulated environment one might question the relative importance of corporate governance on the performance of banks as compared to non-financial firms, where the board governance play a key role in mitigating agency frictions. However, several studies argue that the board structure of the banks matter to the overall health of the banks (De Haan & Vlahu, 2016; John, De Masi, & Paci, 2016; Srivastav & Hagendorff, 2016). Moreover, the Basel regulatory framework acknowledges the role of board of directors as a complementing and integral part of risk management within banks. In this study, we attempt to empirically examine the association between the board structure and the performance of banks.

Bank boards play an important role in internal monitoring of the bank activities. Specifically, the board has control over executive compensation, is responsible for timely review of management performance, and lays out the risk management framework of the bank (Srivastav & Hagendorff, 2016). However, in markets such as India, there is an asymmetry in the role of bank boards. For instance, in the government-owned banks (PSBs), board committee will have limited scope in making active interventions on executive compensation or take punitive actions as compared to the board committee of the private sector banks (PBs). Badunenko and Kumbhakar (2017) show that the adjustment of banks to regulatory changes in India differs significantly by its ownership type. To this end, the Indian banking system provides an ideal laboratory setting to compare the effectiveness of bank boards in PSBs and PBs.

In order to test our hypothesis on the effectiveness of board structure on the performance, we apply an innovative non-parametric methodology to measure the bank performance using the inefficiency scores to account for undesirable outputs (Barros, Managi, & Matousek, 2012; Fujii, Managi, & Matousek, 2014; Yu, 2020). We employ several variables that capture various dimensions of the board structure such as board size, the proportion of independent board members, female member participation, remuneration, and the member busyness. The key findings of our study are as follows. We find that Indian banks with larger boards and those that pay higher sitting fees to the board members exhibit better performance. Among the state-owned banks, the banks with leaner boards, with a lower proportion of female board members, and with members who serve on other boards have better performance. However, among the private sector banks, the key variables that improve the performance include higher sitting fees for the board members and higher proportion of female board members, possibly as a result of cherry-picking the best candidates with the right incentives for the board membership. The result could also be driven by the collective confidence drawn by the female members on the board as the proportion of female members increase. The results are consistent when we employ a dynamic panel model to control for potential serial correlation in the bank performance and account for endogeneity concerns.

Extant literature on the role of board structure in banks has focused on two outcomes, the bank performance and the bank risk-taking. In our study, we focus on the role of board structure on bank performance, controlling for the undesirable outputs, which is an outcome of the bank risk-taking. While both the regulators and government have acknowledged the gaps in the governance of Indian banks, to our knowledge, no study has considered the composition of bank boards in India with a wide coverage

of both board-level as well as bank-level information. In this study, we attempt to fill this research void by examining the effect of board structure on bank performance with the help of a bank-level data-set that offer significant coverage of both the financial information and board composition. As this is one of the first studies to examine the role of board structure on India banks, we analyze the influence of each of the board characteristic in isolation and consolidate all the characteristics of board structure at a later stage of analysis.

In this study, we analyze the association between various aspects of the board structure and bank performance. First, we examine the role of board size on bank performance. Extant literature extends two conflicting arguments on the relationship between board size and performance (Adams & Mehran, 2012; Jensen, 1993; Milliken & Martins, 1996). Second, we examine the role of board diversity in influencing bank efficiency (Harrison & Klein, 2007; Hutchinson, Mack, & Plastow, 2015; Pathan & Faff, 2013). Third, we estimate the influence of independent board members on bank performance (Duchin, Matsusaka, & Ozbas, 2010; Fama & Jensen, 1983). Fourth, we examine the role of the intensity of board activity on bank performance. Several studies have found corroborating evidence of the inverse relationship between board member busyness and firm performance (Adams & Ferreira, 2008; Falato, Kadyrzhanova, & Lel, 2014; Fich & Shivdasani, 2006; Vafeas, 1999). Another view calls for more frequent participation of board members to improve the monitoring of the firm performance (Conger, Finegold, & Lawler, 1998; Ferris, Jagannathan, & Pritchard, 2003; Lipton & Lorsch, 1992). Finally, we explore the association between board compensation and bank performance.

Our study contributes to existing literature on bank performance in the following ways. First, we decompose the profit efficiency components of bank performance into the technical inefficiency and allocative inefficiency components that help us explain the source of the asymmetry in bank performance. Our study contributes methodologically to the literature on non-parametric performance estimations using directional distance functions (Fukuyama & Matousek, 2018). Second, we contribute to the bank governance literature by examining whether the board structure affects bank performance and its various components in an economy that offers an interesting setting based on the ownership structure of the banks.

The paper is organised as follows. Section 2 gives a brief overview of the Indian banking system in the last decade. It is followed by a description of the methodology and data employed in the study in Section 3. The subsequent section presents a second stage regression analysis of bank performance on board characteristics and discusses the results. In the final section, we conclude with some implications for the policy.

2. Indian context

The scheduled commercial banks (SCB) in India can be categorized as public sector banks (PSBs), which are state-controlled with a majority ownership (greater than 51% shareholding), and the private sector banks (PBs), which also include the foreign banks as per the Reserve Bank of India (RBI) classification of SCBs. Currently, there are 19 PSBs and 21 PBs (excluding the foreign banks and its subsidiaries operating in India).[1] Majority of the banking assets in India, which is close to 70% of the total banking assets, are with the PSBs. However, the PBs continue to increase their market share in recent years as shown in Table A1. The PBs have increased their overall share of assets from 23.8% in 2008 to 29.8%

[1]The share of foreign banks in the overall banking assets is less than 5%.

in 2018. Interestingly, the proportion of total credit of the PBs as compared to the PSBs has increased from 22.5% to 31.6% in the last decade (see % share in Table A1).

The period under consideration, 2008-18, witnessed a huge fiscal spending by the government. This was more so immediately after the 2008 global financial crisis. Also Indian banks gradually moved to Basel-II and further to Basel-III regulatory standards. The massive credit fuelled private investments during the post crisis years contributed to the current levels of stressed assets, predominantly in the PSBs. They account for about 90% of all the non-performing assets in Indian banking. We have shown the summary statistics for two sub-periods, the period between 2008-2013 characterized by fiscal spending and 2013-18, characterized by the increasing scrutiny of the banking system by the regulators. The asset quality review and the revision of the recognition norms forced banks to classify many restructured deals (ever-green loans) as non-performing. The change in the recognition norms led to a steep increase in the NPA in the Indian banks starting 2014-15 (see Figure 1).

While the divergence in the balance sheet risk of the PSBs and PBs were minimal in the pre-2013 period, the post-2013 period witnessed a significant increase in the NPAs of the PSBs as compared to the PBs. In January 2014, The RBI constituted a review committee under the Chairmanship of P. J. Nayak to study the governance issues in the PSBs. The report submitted in the second quarter of 2014 brought forth the key problem areas and suggested improvements to the governance structure of Indian banks. The committee identified three specific externally imposed constraints that led to the poor governance standards of the PSBs (a) dual reporting of the PSBs to both the RBI as well as to the Ministry of Finance (b) the disparity in the compensation of the employees in PSBs and PBs and (c) the lack of external vigilance enforcement. Our attempt in this paper is to understand how the internal composition of the board affects the performance and thereby complement the review committee report on the governance shortfalls of the banks in India.

3. Methodology and Data

3.1. Methodology

3.1.1. Profit efficiency and its decomposition: a nonparametric methodology

Due its very nature of intermediation, banks are inherently exposed to adverse selection and moral hazard. A part of their lending portfolio becomes non-performing as borrowers either do not pay pack interest on time or default on its loan obligations. In a production model, these are usually considered as undesirable outputs. There are few recent papers on handling undesirable outputs using the by-production approach (Aparicio, Kapelko, & Zofío, 2020; Dakpo, Jeanneaux, & Latruffe, 2016; Førsund, 2018; Murty & Russell, 2018; Murty, Russell, & Levkoff, 2012). These authors criticized the directional distance function (DDF) approach for measuring efficiency in the context of bad outputs. However, we argue that the undesirable output of a bank is distinctly different from the notion of undesirable or bad outputs considered in environmental studies of efficiency measurement. Firstly, the non-performing loan is an outcome of the risk-return trade off of a bank. Secondly, the incidence of high non-performing loan affects the internal organisation far more adversely than creating external negative repercussions. Finally, it has direct impact on the profitability and sustainability of banks. In this direction, this paper estimates profit efficiency and its decomposition using DDF based on (Yu, 2020). [2]

[2]Note that (Aparicio et al., 2020) also used a DDF to decompose Nerlovian profit inefficiency, similar to that of (Yu, 2020).

Unlike econometric applications, nonparametric data envelopment analysis (DEA) based methodology of efficiency measurement is grounded on a number of common assumptions about the benchmark technology. These include feasibility of input-output bundle, convexity of the production possibility set, and free disposability of both inputs and outputs. Suppose there are K banks. Consider a bank producing M outputs $\mathbf{y} = (y_1, ..., y_M)^{'} \in \mathbf{R}_+^M$ from N inputs $\mathbf{x} = (x_1, ..., x_N)^{'} \in \mathbf{R}_+^N$

The production possibility set is given by:

$$T = \{(x, y) : x \in \mathbf{R}_+^N \text{can produce } \mathbf{y} \in \mathbf{R}_+^M\} \tag{1}$$

Under the above mentioned assumptions, an empirical estimate of the production possibility set is denoted as

$$S = (x, y) : x \geq \sum_{j=1}^{K} \lambda_j x^j; y \leq \sum_{j=1}^{K} \lambda_j y^j; \sum_{j=1}^{K} \lambda_j = 1; \lambda_j \geq 0, \ (j = 1, \ldots, K) \tag{2}$$

Let $\mathbf{w} = (w_1, ..., w_N) \in \mathbf{R}_+^N$ denote the vector of input prices and $\mathbf{p} = (p_1, ..., p_M) \in \mathbf{R}_+^M$ denote the vector of output prices of a bank. For given $(\mathbf{w},\mathbf{p}) \in \mathbf{R}_+^{M+N}$, observed profit of the bank is defined as:

$$(\mathbf{p}'\mathbf{y}\text{-}\mathbf{w}'\mathbf{x}) = \sum_{m=1}^{M} p_m y_m - \sum_{n=1}^{N} w_n x_n \tag{3}$$

Based on the production technology T, given a positive input-output price vector, $(\mathbf{w},\mathbf{p}) \in \mathbf{R}_+^{M+N}$,the profit maximization problem of a competitive bank is:

$$\pi(\mathbf{w},\mathbf{p}) = \underset{x,y}{max}\{\mathbf{p}'\mathbf{y} - \mathbf{w}'\mathbf{x} : (x, y) \in T\} \tag{4}$$

Therefore, the profit maximization problem in Equation 4 translates into the following DEA problem:

$$max \sum_{m=1}^{M} p_m y_m - \sum_{n=1}^{N} w_n x_n$$

$$Subject\ to$$

$$\sum_{j=1}^{K} \lambda_j y_{mj} \geq y_m, \ (m = 1, \ldots, M);$$

$$\sum_{j=1}^{K} \lambda_j x_{nj} \leq x_n, \ (n = 1, \ldots, N);$$

$$\sum_{j=1}^{K} \lambda_j = 1;$$

$$\lambda_j \geq 0, \ (j = 1, \ldots, K)$$

This can be written as:

$$\pi(\mathbf{w},\mathbf{p}) \geq \mathbf{p}\mathbf{y} - \mathbf{w}\mathbf{x}, \forall(\mathbf{x},\mathbf{y}) \in T \tag{5}$$

3.1.2. Nerlovian profit inefficiency

The decomposition of profit efficiency using the directional distance function as presented here is based on Yu (2020). The directional distance function, introduced by Chambers, Chung, and Färe (1996), provides a measure of technical efficiency from the potential for maximum contraction in inputs and the

maximum expansion in outputs simultaneously. This give us

Given a directional vector $\mathbf{g} = (-\mathbf{g}_x, \mathbf{g}_y) \in \mathbf{R}_+^{M+N} : \mathbf{g} \neq 0$, the directional distance function is defined as:

$$\vec{D}_T(\mathbf{x},\mathbf{y};\mathbf{g}_x,\mathbf{g}_y) = \underset{\beta}{max}\{\beta : (\mathbf{x} - \beta\mathbf{g}_x, \mathbf{y} + \beta\mathbf{g}_y) \in T\} \tag{6}$$

$$(\mathbf{y} + \vec{D}_T(\mathbf{x},\mathbf{y};\mathbf{g}_x,\mathbf{g}_y)\mathbf{g}_y, \mathbf{x} - \vec{D}_T(\mathbf{x},\mathbf{y};\mathbf{g}_x,\mathbf{g}_y)\mathbf{g}_x) \in T \tag{7}$$

Using the inequality in Equation 5, we obtain

$$\begin{aligned}\pi(\mathbf{w},\mathbf{p}) &\geq \mathbf{p}(\mathbf{y} + \vec{D}_T(\mathbf{x},\mathbf{y};\mathbf{g}_x,\mathbf{g}_y)\mathbf{g}_y - \mathbf{w}(\mathbf{x} - \vec{D}_T(\mathbf{x},\mathbf{y};\mathbf{g}_x,\mathbf{g}_y)\mathbf{g}_x) \\ &\geq (\mathbf{py} - \mathbf{wx}) + \vec{D}_T(\mathbf{x},\mathbf{y};\mathbf{g}_x,\mathbf{g}_y)(\mathbf{pg}_y + \mathbf{wg}_x),\end{aligned} \tag{8}$$

if $\mathbf{pg}_y + \mathbf{wg}_x \neq 0$, then

$$\frac{\pi(\mathbf{w},\mathbf{p}) - (\mathbf{py} - \mathbf{wx})}{(\mathbf{pg}_y + \mathbf{wg}_x)} \geq \vec{D}_T(\mathbf{x},\mathbf{y};\mathbf{g}_x,\mathbf{g}_y) \tag{9}$$

Left hand side of the above inequality is the deviation between maximal profit and the observed profit normalized by $(\mathbf{pg}_y + \mathbf{wg}_x)$, which is called the Nerlovian profit inefficiency. As profit inefficiency emanates from both technical and alternative inefficiency. Equation 9 can be written as

$$\frac{\pi(\mathbf{w},\mathbf{p}) - (\mathbf{py} - \mathbf{wx})}{(\mathbf{pg}_y + \mathbf{wg}_x)} = \vec{D}_T(\mathbf{x},\mathbf{y};\mathbf{g}_x,\mathbf{g}_y) + AI \tag{10}$$

$\vec{D}_T(\mathbf{x},\mathbf{y};\mathbf{g}_x,\mathbf{g}_y)$ is the technical inefficiency component derived from the directional vectors and the residual is the allocative inefficiency component.

Given a directional vector $\mathbf{g} = (-\mathbf{g}_x, \mathbf{g}_y)$, the directional distance function defined in Equation 6 assumes simultaneous contraction of inputs and expansion of outputs by the same fraction β. This can be further generalized as

$$\vec{D}_T(\mathbf{x},\mathbf{y};\mathbf{g}_x,\mathbf{g}_y) = \underset{\beta^x,\beta^y}{max}\{(\beta^x + \beta^y) : (\mathbf{x} - \beta^x\mathbf{g}_x, \mathbf{y} + \beta^y\mathbf{g}_y) \in T\} \tag{11}$$

Implementation of Equation 11 in the standard DEA framework for the reference bank with input-output bundle (x_0,y_0) translates into

$$max(\beta^x + \beta^y)$$

$$Subject\ to$$

$$\sum_{j=1}^{K} \lambda_j y^j \geq y_{m0} + \beta^y g_{ym},\ (m = 1,\ldots,M);$$

$$\sum_{j=1}^{K} \lambda_j x^j \leq x_{n0} - \beta^x g_{xn},\ (n = 1,\ldots,N);$$

$$\sum_{j=1}^{K} \lambda_j = 1;$$

$$\lambda_j \geq 0,\ (j = 1,\ldots,K)$$

This framework is further extended to include three directional vectors identifying inputs, desirable outputs, and undesirable outputs.

A general form DEA can be written as

$$max(\beta^x + \beta_d^y + \beta_{ud}^y)$$

$Subject\ to$

$$\sum_{j=1}^{K} \lambda_j y^j \geq y_{m0}^d + \beta_d^y g_{ym}^d, \text{for the desirable outputs, } (m = 1, \ldots, M);$$

$$\sum_{j=1}^{K} \lambda_j y^j \geq y_{m0}^{ud} - \beta_{ud}^y g_{ym}^{ud}, \text{for the undesirable outputs, } (m = 1, \ldots, M);$$

$$\sum_{j=1}^{K} \lambda_j x^j \leq x_{n0} - \beta^x g_{xn}, \ (n = 1, \ldots, N);$$

$$\sum_{j=1}^{K} \lambda_j = 1;$$

$$\lambda_j \geq 0, \ (j = 1, \ldots, K)$$

In the literature, there is no agreement about the choice of the directional vectors. Following Leleu and Briec (2009) and Aparicio, Pastor, and Ray (2013), we use mean values of the inputs and outputs as the directions. In order to check the robustness of the estimated inefficiency values, we also use

$$g_{xn} = \underset{j}{max}\{x_{nj}\} - \underset{j}{min}\{x_{nj}\}, (n = 1, \ldots, N)$$

$$g_{ym} = \underset{j}{max}\{y_{mj}\} - \underset{j}{min}\{y_{mj}\}, (m = 1, \ldots, M)$$

3.1.3. Impact of corporate governance on profit efficiency

In order to estimate the impact of corporate governance on profit efficiency of banks, we employ a panel data fixed effects model as follows:

$$\textit{Inefficiency}_{it} = \alpha + \beta \times CG_{i,t-1} + \gamma \times X_{i,t-1} + \mu_i + \tau_t + \epsilon_{i,t} \tag{12}$$

where $\textit{Inefficiency}_{it}$ refers to the inefficiency measure computed based on equations detailed in the earlier subsection for bank i in the year t. TI, NPI, and AI are the three *Inefficiency* measures employed in this study. CG refers to corporate governance indicators such as $Board\_size$, Fem_prop, $Indep\_prop$, Avg_fees, and $Other\_board$. X refers to a set of bank-level control variables such as capital to risk-weighted assets ratio ($CRAR$) and Log_assets, a proxy for the size of the bank. All independent variables are lagged by one year to address biases arising out of possible reverse causality. μ_i captures the bank fixed effects and τ_t represents the year dummies to capture any year-specific exogenous shocks affecting all banks in the sample. A detailed description of all the variables employed in this study is shown in Table 1.

We also acknowledge the possibility of a lagged relationship of inefficiency. In alternative estimations, we employ a dynamic panel system generalized method of moments (SGMM) approach advanced by Blundell and Bond (1998). These estimations include a lagged dependent variable and controls for potential endogeneity in the estimation by using the lagged explanatory variables as instruments. In all the estimations, the standard errors are clustered at the bank level and are corrected for heteroskedasticity.

3.2. Data

What comprises inputs and outputs of banks within a standard production function framework is debatable. There is no consensus in literature. Broadly two approaches, namely, the *production approach*, and the *intermediation approach* are primarily used to identify the inputs and outputs of banks. While both the approaches are grounded on microeconomic theory, they treat banking activities quite differently. The use of production approach is challenging in practice, as it requires detailed transaction level data on services. As a proxy to the transaction level services rendered by a bank, the number and various types of transactions, and documents processed are used as outputs. On the other hand, the intermediation approach considers a bank as a typical financial intermediary whose job is to accept deposits and lend it to the borrowers. That is, banks use its deposits and other liabilities to produce loans and investments. However, there is ambiguity if deposits can be treated as only inputs. This has resulted in three variants of intermediation approach namely *asset*, *user cost* and *value-added approach*. Das and Kumbhakar (2012) provides a brief account of this debate and present benefits and shortcomings of these approaches. In this paper, we emphasize the banks role as a financial intermediary and define the inputs and outputs based on the *asset approach*. This approach also helps us to isolate the undesirable output in a straightforward manner. Further, we do recognize the increasing role of fee based activities in banking.

Accordingly, deposits together with real resources like labor and capital are considered as inputs. Capital is measured by fixed assets, which is the book value of all fixed assets and premises, net of depreciation. Outputs include interest earning bank assets such as loans, investments, and other income emanating from fee based activities. In particular, inputs used are: 'deposits' (x_1), 'total number of employee' (x_2), and 'fixed assets' (x_3). As outputs, we have used 3 variables: 'total investments' (y_1),'total performing loans' (y_2) and 'other income' (y_3). As a measure of undesirable outputs, total net non-performing loans (y_4) is used. Input prices corresponding to x_1, x_2 and x_3 are: interest paid on deposits divided by deposits (w_1, or cost of deposits), salaries and other provisions to employees divided by the number of employees (w_2, or average staff cost), and expenses towards fixed assets divided by fixed assets (w_3, non-labor operational cost for managing fixed asset).[3] Output prices corresponding y_1 and y_2 are return on investments (p_1) and return on performing loans (p_2). Pricing of fee based income are fairly standard and do not vary much across banks. Therefore, we assume unit price for other income (p_3). A detailed descriptive statistics of the input and output variables employed in the non-parametric estimations are shown in Table A2.

In order to explain the estimated profit efficiency measures as defined in Equation 10, we use several control variables besides corporate governance indicators. These include ownership (state-owned or private), size (as measured by logarithm of total assets) and capital to risk-weighted assets ratio (CRAR). As corporate governance measures, we use several indicators like board size, proportion of female or independent board members, average number of other board memberships held by the board members, average sitting fees of the members in a year, etc.

All relevant inputs and outputs which are in monetary terms are measured in Indian rupees lakh (1 lakh = 100,000). Bank-wise data on inputs, outputs, selected ratios and other variables were collected

[3]Expenses towards fixed assets include: rent, taxes and lighting; depreciation on bank's property; repairs and maintenance; and insurance to bank property.

from the annual publication called the Statistical Tables Relating to Banks in India, Reserve Bank of India. Corporate governance indicators of banks are obtained from PRIME database. Sample includes annual data of all Indian (state-owned and private) commercial banks operating in India during 2008 to 2018. While consolidation has been an ongoing process among Indian banks since deregulation introduced in 1991-92, it gained momentum post 2008. As a result, the number of banks varies from year to year. Hence, we have an unbalanced panel of banks. Further, Indian banking system is dominated by a few large banks. For example, 90^{th} percentile of 'deposits' was over 22 times larger than its 10^{th} percentile value. However, the size differential has been declining post deregulation due to increased competition from new private banks.

4. Results and findings

4.1. Summary statistics

Although we have bank-level data starting from the 1990s, the board-level information is available only from 2008. Hence, we restricted our analysis for the period from 2008 to 2018. The sample has information on 38 unique banks for this period. The total sample size in the study is 355 bank-year observations. Some of the board level variables such as the proportion of Independent board members ($Indep.\_prop$) and membership in other boards ($Other\_board$) is available only since 2013. Consequently, the sample size gets reduced when these variables enter the model.

The descriptive statistics of the key corporate governance variables are shown in Table 2. While the board size of the average bank in the sample is 10.47, the board size of the average private sector bank and public sector bank is 10.19 and 10.67 respectively. Average sitting fees of the board members in our sample is INR 2.28 lakhs, with private sector banks' fees about 5 times as large as the public sector counterparts. The proportion of independent directors in private sector banks are 2.5 times as many as in the case of public sector banks. Board members of private sector banks are on average more busy in terms of other board memberships (4.2 other boards as compared to 0.9 in the case of PSBs). PSBs have on an average more female board participation (8%) as compared to the PBs (6%). PSBs have conducted more meetings per annum as compared to the PBs.

4.2. Trends in inefficiency estimates

Trends in inefficiency measures show a contrasting picture of performance of Indian banks. On an average, the profit inefficiency of state-owned banks has been large and increasing over time. A substantial part of their inefficiency is allocative in nature. This is contrary to the findings of Yu (2020). That is, the state-owned banks are less efficient due to their misallocation of productive resources (see Table 3) against their competing demand. The results show that the deployment of operational resources of state-owned banks into good quality loans and investments is far from satisfactory. Note that, as the owner or majority shareholder, the government exercises significant control over the business operations of state-owned banks. Time and again, state-owned banking system is used for political mileage. The so called 'phone banking', a sarcastic phrase referring to the telephone calls of the politicians to banks for credit disbursement, is a reality. Government's influence in credit allocation has effectively resulted in ballooning of non-performing loans. Also, as part of banking regulation, these banks support government's large borrowing programme by investing in government securities. Government's overarching influence is also witnessed in the corporate governance outcome, as discussed earlier. Finally, the effect

of fiscal dominance shows up in the performance of Indian state-owned banks.

On the other hand, private banks are losing very little profits due to misallocation of resources. However, these banks have shown increasing trends in technical inefficiency result from their inability to choose a set of optimum inputs and outputs. That is given the set of inputs, private banks can produce higher outputs; or they can reduce inputs to produce the given level of outputs. Note that these inefficiency estimates are derived in presence of undesirable outputs using a directional distance function approach. Hence, the results are broadly in line with the effective performance of PSBs vis-à-vis PBs.

4.3. Impact of bank governance on profit inefficiency - regression results

The baseline results of Equation 12 for the inefficiency estimates obtained using the Nerlovian profit inefficiency (NPI) methodology is shown in Table 4. The results in columns (1)-(5) represent effect of individual corporate governance indicator on profit inefficiency. The findings suggest that banks with larger board size and higher average sitting fees are closer to the efficiency frontier. Further, we split the banks by its ownership type, the PSB variable takes the value of 1 for all banks that are state-owned and 0 for all the banks that belong to the private-sector. The analysis of the corporate governance variables interacted with the ownership type ($CG \times PSB$) in columns (6)-(10) provides some valuable insights.

While proportion of female board members do not seem to affect the inefficiency estimate on an average for all the banks, the results in column (7) suggests that the private-sector banks with higher $Fem.\_prop$ have a lower inefficiency estimate. Whereas, in the case of PSBs, there is a significant and positive impact of the female board participation on inefficiency, in fact the effect is adverse if we consider the sign and magnitude of the coefficient of $PSB \times Fem.\_prop$. The finding is interesting in the context of mandatory female board participation. On one hand, we find that PBs are able to attract female board members who seem to affect the overall performance of the bank. On the other hand, we find that PSBs are probably filling up the numbers to meet the criteria rather than seeking quality members to improve the performance of the bank. Prior literature suggest that the diversity in the board composition affects the firm performance. In our study, we examine the role of gender diversity captured by the proportion of women directors on the board (Milliken & Martins, 1996). Gender diversity is one of the components of board diversity that can provide separation, disparity, as well as variety to the board composition (Harrison & Klein, 2007). Hutchinson et al. (2015) find that gender diversity negatively influences firm risk-taking and positively affects firm performance in Australia. Pathan and Faff (2013) find a similar positive association between higher female representation in the board and bank performance in the United States, however, the effect is lower after improvements in the overall governance improvements through the Sarbanes-Oxley Act.

Similarly, we estimate the influence of independent board members on bank performance. Interestingly, we do not find any association for the proportion of independent board members on the performance of the banks at an overall levels. However, the results in column (8) suggests that the proportion of independent members have a positive effect on the performance of PBs rather than PSBs. It is argued that independent directors do a better job at monitoring firm performance to maintain their reputation in the directorship market (Fama & Jensen, 1983). However, Fama and Jensen argue that firms with higher information asymmetry might benefit from having more insiders in the board given the opaque operations. Duchin et al. (2010) find that the presence of outside directors negatively (positively) affects firms with higher (lower) information asymmetry. To this end, the asymmetric nature of the banks in India provides an opportunity to test the importance of independent directors on bank boards. Results show

that presence of independent directors helps PBs to improve performance as they have lower information asymmetry.

When it comes to remuneration in terms of average sitting fees of the board members, we do find a statistically significant negative association. The overall results shown in column (4) and (9) suggests that higher the average sitting fees, the lower the inefficiency of the bank irrespective of the ownership type. Note that the evidence in the literature about the relationship between board members' remuneration and performance is not congruous. A recent study on Indian firms suggests a positive relation - the firms that pay higher to the board members are also high on performance (Raithatha & Komera, 2016). Our results broadly supports this view. At the same time, there are other studies which found either a weak or no relationship (Chen, Ezzamel, & Cai, 2011; Conyon & He, 2011).

Finally, on average there is no effect of board member busyness on the bank efficiency estimates (see column (5)), the interaction effects shown in column (10) also suggests no significant impact. There are conflicting theories on the benefits and costs of higher board activity. Jensen (1993) proposes the board to remain inactive unless there is a pertinent problem that needs board intervention. Consistent with this argument, Vafeas (1999) finds that enhanced board activity is associated with poor firm performance. Vafeas argues that the inverse relationship between the frequency of board meetings and the firm performance could be a result of firm response to poor results. Several studies have found corroborating evidence of the inverse relationship between board member busyness and firm performance (Adams & Ferreira, 2008; Falato et al., 2014; Fich & Shivdasani, 2006). Whereas, another view calls for more frequent participation of board members to improve the monitoring of the firm performance (Conger et al., 1998; Ferris et al., 2003; Lipton & Lorsch, 1992). The literature on board interlocks also complements the beneficial view of higher board activity, in which higher board interlocks provide access to value-enhancing resources for the firms. In our study, we employ three measures that influence board activity that include other board membership undertaken by the bank board members, the number of meetings held, and the attendance of the board members.

4.4. Impact of bank governance on various decomposition of inefficiency

In this section, we evaluate the association between the decomposed parts of the NPI measure into the technical inefficiency component based on directional distance function TI and the allocative inefficiency estimate AI.

First, we discuss the results of the TI estimates. The results shown in Table 5 corroborates the results in Table 4 to a large extent. The effect of board size and average sitting fees is in line with results obtained for profit efficiency. Larger the board size (sitting fees), lower the inefficiency (see columns (1) and (4)). However, when we split the banks by their ownership type, we do not find any significant difference between the PSBs and PBs. The closest we get is with regards to the effect of female members in the board (see column (7)), where the magnitude and sign suggest the asymmetric nature of the effect for PSBs and PBs.

Next, we discuss the result of the AI estimations shown in Table 6. Most of the effects documented in the earlier section is not present in the regressions with AI. The only effect is on the resourcefulness of the directors. PBs with board members who sit on other boards, those members with higher degree of network, have a positive impact on the performance of the banks (see column (10)). Possibly, such board members do bring in knowledge on the table that help the bank take better decisions so far as the allocation of resources against their competing demand is concerned. We find no significant difference

between the PSBs and PBs here.

In order to examine if the results vary with alternative estimates of inefficiency, we use max-min specifications of the directional vectors as explained in subsubsection 3.1.1. Estimated results are presented in Table 7. Overall, the results are consistent with the baseline estimations shown in Table 5 and the implications remain the same.

4.5. Dynamic Panel estimations

In this section, we re-estimate Equation 12 with a system GMM (SGMM) dynamic panel model proposed by Blundell and Bond (1998). SGMM allows to control for serial correlation in the dependent variables as well as allows to control for potentially endogenous regressors. The endogenous regressors are instrumented with the lag values of the regressors in a GMM setup.

The results of the SGMM estimations are shown in two tables Table 8 and Table 9. In Table 8, we estimate Equation 12 with a lagged dependent variable for all three measures of inefficiencies. The results that larger board size, higher female member presence and higher sitting fees positively affect bank performance is largely in line with our baseline findings. Further, in Table 9, we estimate the effects of corporate governance factors on bank performance after controlling for other board aspects. The key takeaways from the regressions is the asymmetric effect of board size on bank performance. On one hand we find that larger board size improves the performance of the PBs. On the other hand, we find that the larger board size have a negative impact on performance of the PSBs.

5. Conclusion

Even after deregulation of Indian financial sector initiated during 1991-92, state-ownership continues to dominate the banking sector. Dual control of regulatory structure of PSBs has been one of the biggest bottlenecks to streamline their corporate governance structure. Performance of PSBs has been a cause of concern of Indian policy makers. For an emerging market country with a bank based financing structure, higher inefficiency of banks potentially hinders the growth potential. A sizeable part of the inefficiency is allocative in nature, implying the effect of misallocation of resources into productive business opportunities. This has resulted in higher non-performing loans of PSBs. In this context, the role of corporate governance is critical.

Based on a panel data of Indian banks from 2008 to 2018, this study examines the effect of corporate governance on profit (in)efficiency of Indian banks. First, we estimate the profit inefficiency that explicitly incorporates the role of undesirable outputs and decompose it into technical and allocative inefficiency. Methodologically, it is quite advanced. Then as a second stage analysis we explain the role of corporate governance on performance under a standard panel regression framework.

Empirical results suggest that board size matters, providing yet another support of agency and resource dependency theory of corporate finance. That is more board members do exert pressure for bank performance by better monitoring and control. At the same time, they bring wide variety of expertise which are performance enhancing. We also find that better performance is associated with higher compensation. High-powered incentives might motivate the board members to actively contribute in the monitoring and advisory roles. Our findings on the influence of independent board members on bank performance suggest that the private banks benefit from a higher proportion of such members. Finally, we find a weak association between diversity and bank performance. Private sector banks tend to benefit from the presence of female board members and board members with high network potential.

A healthy banking system is essential for a country to facilitate an efficient allocation of credit to the real sector. In a country with a high proportion of government owned banks, it is imperative for the policy makers to provide a conducive environment for the efficient functioning of the bank boards. Empowering the boards can lead to a stronger governance structure that will facilitate better risk management and an efficient allocation of resources.

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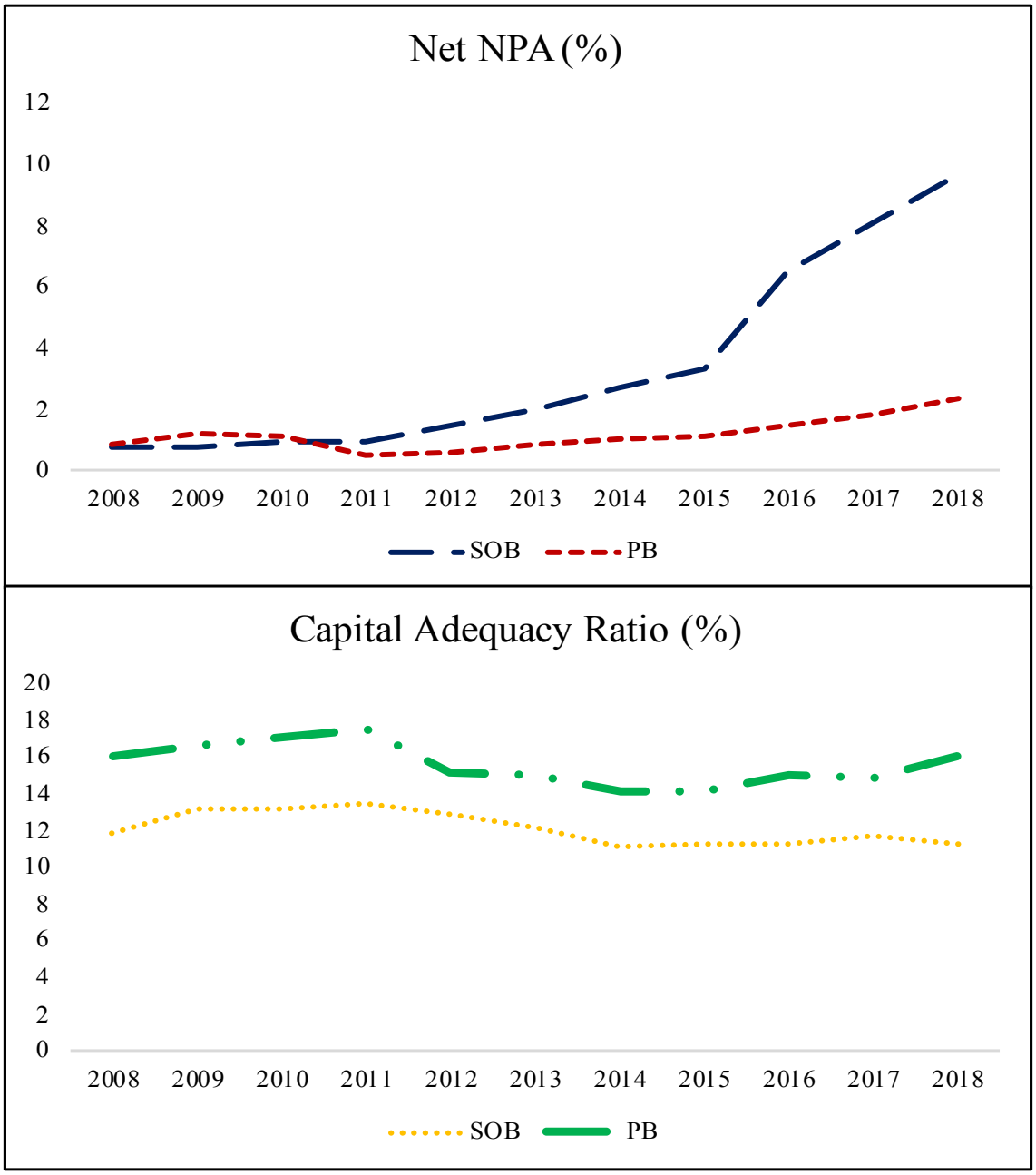
Figure 1: Trends in Net NPA and Capital adequacy ratio of Indian banks



Top panel shows the trends in the mean Net non performing assets (NPA) of the state owned banks (SOB) and private banks (PB). Bottom panel shows the trends in the capital to risk weighted assets ratio for the SOB and PB.

Table 1: Definition of variables

Variable	Definition	Source
TI	Technical inefficiency measure computed based on the directional distance function	Reserve Bank of India database and Authors' calculation
NPI	Nerlovian profit inefficiency measure computed based on the equations shown in section	Reserve Bank of India database and Authors' calculation
AI	Captures the Allocative inefficiency. Measured as the yearly difference between NPI and TI measures.	Reserve Bank of India database and Authors' calculation
Board_size	Count of board members in a bank in a year.	Indian Boards database
Fem_prop	Proportion of female board members in the board of directors of a bank in a year.	Indian Boards database
Indep_prop	Proportion of the independent committee members in the board of directors of a bank in a year.	Indian Boards database
Avg._fees	The average sitting fees in INR lakhs (1 lakh = 100,000) drawn by the board members of a bank in a year.	Indian Boards database
Other_board	Average of the number of other board memberships held by the committee members of the board of directors of a bank in a year. A measure of director busyness.	Indian Boards database
CRAR	Capital to risk-weighted assets ratio.	Reserve Bank of India database
Log_assets	Logarithm of the total assets of the bank.	Reserve Bank of India database
PSB	A dummy variable that takes the value of 1 if the bank is state-owned and 0 otherwise	Reserve Bank of India database

Table 2: Summary statistics

The table shows the summary statistics of the variables employed in the study. The definition of variables are shown in table Table 1. P(x) is the xth percentile value in the distribution.

Bank Type	Variable	Obs.	Mean	Std. Dev	Median	Min.	Max.	P10	P90
Private sector banks	TI	150	0.07	0.09	0.03	0.00	0.41	0.00	0.18
	NPI	150	1.58	0.41	1.58	0.15	3.00	1.12	2.02
	AI	150	1.52	0.40	1.55	0.15	3.00	1.03	1.91
	$Board\_size$	150	10.19	2.39	10.00	3.00	18.00	7.50	13.50
	$Fem.\_prop$	150	0.06	0.07	0.07	0.00	0.25	0.00	0.14
	$Indep.\_prop$	75	0.59	0.16	0.58	0.20	0.92	0.40	0.80
	$Avg.\_fees$	120	4.20	3.17	3.02	0.00	13.96	1.36	9.38
	$Other\_board$	75	0.85	0.83	0.50	0.00	2.64	0.00	2.25
	Avg_attend	45	0.86	0.10	0.88	0.62	0.99	0.74	0.96
	$Meetings$	45	10.78	4.76	10.00	4.00	26.00	6.00	16.00
	$CRAR$	150	14.52	2.61	14.06	7.51	22.46	11.82	18.33
	Log_assets	150	15.46	1.22	15.41	12.91	18.27	13.99	17.43
Public sector banks	TI	205	0.85	0.79	0.73	0.00	3.90	0.00	1.84
	NPI	205	1.35	0.44	1.41	0.00	2.43	0.96	1.81
	AI	205	0.63	0.55	0.62	0.00	2.08	0.00	1.41
	$Board\_size$	205	10.67	2.17	11.00	5.00	17.00	8.00	13.00
	$Fem.\_prop$	205	0.08	0.07	0.08	0.00	0.29	0.00	0.18
	$Indep.\_prop$	105	0.24	0.22	0.20	0.00	0.78	0.00	0.55
	$Avg.\_fees$	166	0.90	0.71	0.76	0.00	3.30	0.00	1.84
	$Other\_board$	105	0.32	0.28	0.25	0.00	1.20	0.06	0.67
	Avg_attend	62	0.88	0.08	0.89	0.58	0.99	0.80	0.95
	$Meetings$	62	13.31	2.84	13.00	8.00	20.00	9.00	17.00
	$CRAR$	205	12.22	1.22	12.23	9.39	15.38	10.63	13.86
	Log_assets	205	16.84	0.77	16.80	15.17	19.42	15.93	17.88
Overall	TI	355	0.52	0.72	0.14	0.00	3.90	0.00	1.55
	NPI	355	1.45	0.44	1.47	0.00	3.00	0.99	1.90
	AI	355	1.01	0.66	1.09	0.00	3.00	0.00	1.78
	$Board\_size$	355	10.47	2.28	10.00	3.00	18.00	8.00	13.00
	$Fem.\_prop$	355	0.07	0.07	0.08	0.00	0.29	0.00	0.17
	$Indep.\_prop$	180	0.39	0.26	0.43	0.00	0.92	0.00	0.72
	$Avg.\_fees$	286	2.28	2.68	1.43	0.00	13.96	0.00	5.78
	$Other\_board$	180	0.54	0.63	0.29	0.00	2.64	0.00	1.55
	Avg_attend	107	0.87	0.09	0.89	0.58	0.99	0.75	0.96
	$Meetings$	107	12.24	3.95	12.00	4.00	26.00	7.00	17.00
	$CRAR$	355	13.19	2.24	12.83	7.51	22.46	10.80	16.07
	Log_assets	355	16.26	1.20	16.39	12.91	19.42	14.53	17.71

Table 3: Summary statistics - Inefficiency variables

The table shows the time series means of the inefficiency variables (dependent variables) employed in the study. The definition of variables are shown in table Table 1. P(x) is the xth percentile value in the distribution.

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Private sector banks										
AI	0.97	0.98	0.75	0.47	0.48	0.52	0.39	0.59	0.58	0.70
TI	0.43	0.57	0.64	0.84	0.76	0.72	0.98	1.08	1.19	1.26
NPI	1.35	1.49	1.36	1.08	1.07	1.13	1.15	1.44	1.61	1.83
Public sector banks										
AI	1.42	1.66	1.58	1.23	1.34	1.44	1.37	1.59	1.65	1.84
TI	0.07	0.07	0.05	0.06	0.06	0.05	0.07	0.08	0.08	0.07
NPI	1.49	1.73	1.63	1.29	1.40	1.49	1.44	1.67	1.72	1.90
Overall										
AI	1.16	1.28	1.10	0.79	0.84	0.91	0.80	1.00	1.04	1.21
TI	0.27	0.35	0.39	0.52	0.47	0.44	0.60	0.66	0.71	0.73
NPI	1.41	1.59	1.48	1.17	1.21	1.28	1.27	1.53	1.66	1.86

Table 4: Nerlovian profit inefficiency and corporate governance

The dependent variable in all the estimations is the Nerlovian profit inefficiency estimated as shown in Equation 10. The variable definitions are as indicated in Table 1.

$Dep.\_var: NPI$	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$Board\_size_{t-1}$	-0.014**					-0.016				
	(0.007)					(0.011)				
$Fem.\_prop_{t-1}$		-0.368					-1.309*			
		(0.310)					(0.673)			
$Indep.\_prop_{t-1}$			-0.04					-0.299*		
			(0.119)					(0.149)		
$Avg.\_fees_{t-1}$				-0.025*					-0.025*	
				(0.013)					(0.013)	
$Other\_board_{t-1}$					-0.095					-0.086
					(0.087)					(0.105)
$PSB \times Board\_size_{t-1}$						0.005				
						(0.012)				
$PSB \times Fem.\_prop_{t-1}$							1.339*			
							(0.721)			
$PSB \times Indep.\_prop_{t-1}$								0.357*		
								(0.182)		
$PSB \times Avg.\_fees_{t-1}$									0.028	
									(0.040)	
$PSB \times Other\_board_{t-1}$										-0.028
										(0.181)
$CRAR_{t-1}$	0.041**	0.039**	0.048*	0.019	0.050*	0.041**	0.039***	0.050*	0.019	0.050*
	(0.015)	(0.015)	(0.027)	(0.018)	(0.027)	(0.015)	(0.013)	(0.027)	(0.018)	(0.027)
Log_assets_{t-1}	-0.516***	-0.523***	-0.912***	-0.560***	-0.900***	-0.514***	-0.483***	-0.897***	-0.539***	-0.900***
	(0.148)	(0.142)	(0.193)	(0.162)	(0.199)	(0.148)	(0.130)	(0.195)	(0.172)	(0.197)
$Constant$	9.033***	9.047***	15.616***	10.108***	15.440***	8.991***	8.431***	15.378***	9.776***	15.435***
	(2.316)	(2.246)	(3.057)	(2.586)	(3.153)	(2.316)	(2.056)	(3.101)	(2.750)	(3.135)
Bank-year obs.	355	355	180	286	180	355	355	180	286	180
Banks	38	38	38	38	38	38	38	38	38	38
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj._R^2	0.587	0.586	0.672	0.657	0.675	0.586	0.6	0.676	0.657	0.673

Robust standard errors, clustered at bank level are presented in the parenthesis. '***', '**' and '*' indicate significance at the 1%, 5% and 10% respectively.

Table 5: Technical inefficiency and corporate governance

The dependent variable in all the columns is the technical inefficiency estimated using a directional distance function as indicated in Equation 6. The variable definitions are as indicated in Table 1.

$Dep.\_var: TI.$	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$Board\_size_{t-1}$	-0.034**					-0.040***				
	(0.013)					(0.014)				
$Fem.\_prop_{t-1}$		-0.404					-1.850**			
		(0.529)					(0.745)			
$Indep.\_prop_{t-1}$			0.009					-0.238		
			(0.246)					(0.191)		
$Avg.\_fees_{t-1}$				-0.057***					-0.057***	
				(0.019)					(0.019)	
$Other\_board_{t-1}$					-0.081					0.075
					(0.126)					(0.069)
$PSB \times Board\_size_{t-1}$						0.010				
						(0.016)				
$PSB \times Fem.\_prop_{t-1}$							2.057			
							(1.282)			
$PSB \times Indep.\_prop_{t-1}$								0.340		
								(0.328)		
$PSB \times Avg.\_fees_{t-1}$									-0.007	
									(0.061)	
$PSB \times Other\_board_{t-1}$										-0.517
										(0.322)
$CRAR_{t-1}$	-0.038	-0.041*	0.021	-0.027	0.023	-0.037	-0.042*	0.023	-0.027	0.022
	(0.023)	(0.023)	(0.040)	(0.022)	(0.038)	(0.023)	(0.021)	(0.040)	(0.023)	(0.038)
Log_assets_{t-1}	-0.108	-0.143	-0.07	0.222	-0.049	-0.103	-0.082	-0.056	0.217	-0.04
	(0.123)	(0.124)	(0.215)	(0.188)	(0.218)	(0.127)	(0.122)	(0.214)	(0.193)	(0.213)
$Constant$	2.765	3.037	1.307	-2.701	0.974	2.675	2.091	1.081	-2.618	0.876
	(1.930)	(1.938)	(3.680)	(2.932)	(3.674)	(2.002)	(1.856)	(3.661)	(3.010)	(3.581)
Bank-year obs.	355	355	180	286	180	355	355	180	286	180
$Banks$	38	38	38	38	38	38	38	38	38	38
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$Adj.\_R^2$	0.141	0.128	0.073	0.134	0.075	0.139	0.142	0.071	0.131	0.086

Robust standard errors, clustered at bank level are presented in the parenthesis. '***', '**' and '*' indicate significance at the 1%, 5% and 10% respectively.

Table 6: Allocative inefficiency and corporate governance

The dependent variable in all the estimations is the Allocative inefficiency estimated as shown in Equation 10. The variable definitions are as indicated in Table 1.

$Dep.\_var: AI$	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$Board\_size_{t-1}$	0.011					0.016				
	(0.012)					(0.018)				
$Fem.\_prop_{t-1}$		0.158					0.242			
		(0.428)					(0.708)			
$Indep.\_prop_{t-1}$			-0.081					-0.215		
			(0.182)					(0.218)		
$Avg.\_fees_{t-1}$				0.025					0.025	
				(0.019)					(0.019)	
$Other\_board_{t-1}$					-0.017					-0.172*
					(0.122)					(0.095)
$PSB \times Board\_size_{t-1}$						-0.009				
						(0.019)				
$PSB \times Fem.\_prop_{t-1}$							-0.12			
							(0.854)			
$PSB \times Indep.\_prop_{t-1}$								0.184		
								(0.264)		
$PSB \times Avg.\_fees_{t-1}$									0.031	
									(0.063)	
$PSB \times Other\_board_{t-1}$										0.513
										(0.345)
$CRAR_{t-1}$	0.067***	0.068***	0.028	0.039*	0.027	0.066***	0.068***	0.029	0.039	0.029
	(0.017)	(0.017)	(0.042)	(0.023)	(0.041)	(0.018)	(0.017)	(0.042)	(0.023)	(0.041)
Log_assets_{t-1}	-0.354*	-0.344*	-0.595**	-0.627**	-0.612**	-0.359*	-0.348*	-0.587**	-0.604**	-0.621**
	(0.198)	(0.193)	(0.282)	(0.273)	(0.267)	(0.201)	(0.193)	(0.286)	(0.284)	(0.266)
$Constant$	5.694*	5.626*	10.329**	10.479**	10.608**	5.781*	5.681*	10.206**	10.110**	10.705**
	(3.083)	(3.031)	(4.646)	(4.322)	(4.388)	(3.141)	(3.024)	(4.724)	(4.474)	(4.373)
Bank-year obs.	355	355	180	286	180	355	355	180	286	180
$Banks$	38	38	38	38	38	38	38	38	38	38
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$Adj.\_R^2$	0.214	0.213	0.138	0.177	0.136	0.212	0.21	0.134	0.176	0.151

Robust standard errors, clustered at bank level are presented in the parenthesis. '***', '**' and '*' indicate significance at the 1%, 5% and 10% respectively.

Table 7: Technical inefficiency and corporate governance - alternative directional vector

The dependent variable in all the columns is the technical inefficiency estimated using a directional distance function as indicated in Equation 6. However the directional vectors used in the estimations are the difference between maximum and minimum input and outputs. The variable definitions are as indicated in Table 1.

$Dep.\_var: TI\_alt$	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$Board\_size_{t-1}$	-0.005**					-0.007***				
	(0.002)					(0.002)				
$Fem.\_prop_{t-1}$		-0.090					-0.336***			
		(0.072)					(0.113)			
$Indep.\_prop_{t-1}$			-0.009					-0.047		
			(0.034)					(0.034)		
$Avg.\_fees_{t-1}$				-0.009***					-0.009***	
				(0.003)					(0.003)	
$Other\_board_{t-1}$					-0.010					0.012
					(0.020)					(0.012)
$PSB \times Board\_size_{t-1}$						0.004*				
						(0.002)				
$PSB \times Fem.\_prop_{t-1}$							0.350*			
							(0.175)			
$PSB \times Indep.\_prop_{t-1}$								0.053		
								(0.051)		
$PSB \times Avg.\_fees_{t-1}$									0.003	
									(0.009)	
$PSB \times Other\_board_{t-1}$										-0.074
										(0.048)
$CRAR_{t-1}$	-0.006	-0.006*	0.000	-0.006	0.001	-0.006	-0.006**	0.001	-0.006	0.000
	(0.003)	(0.003)	(0.005)	(0.003)	(0.005)	(0.004)	(0.003)	(0.005)	(0.003)	(0.005)
Log_assets_{t-1}	-0.037*	-0.040**	0.001	0.012	0.001	-0.035*	-0.030*	0.003	0.014	0.002
	(0.018)	(0.018)	(0.027)	(0.029)	(0.027)	(0.019)	(0.017)	(0.027)	(0.029)	(0.027)
$Constant$	0.706**	0.726**	0.029	-0.066	0.03	0.669**	0.565**	-0.006	-0.101	0.017
	(0.293)	(0.291)	(0.461)	(0.463)	(0.460)	(0.300)	(0.264)	(0.460)	(0.463)	(0.460)
Bank-year obs.	355	355	180	286	180	355	355	180	286	180
$Banks$	38	38	38	38	38	38	38	38	38	38
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$Adj.\_R^2$	0.27	0.262	0.133	0.26	0.134	0.271	0.284	0.132	0.258	0.144

Robust standard errors, clustered at bank level are presented in the parenthesis. '***', '**' and '*' indicate significance at the 1%, 5% and 10% respectively.

Table 8: Inefficiency and corporate governance - Dynamic panel estimations

The table shows the estimation results for the dynamic panel using system GMM methodology that controls for potential auto correlation in the inefficiency values with potential endogeneity controls. The dependent variable in columns (1) - (5) is the technical inefficiency estimated using a directional distance function as indicated in Equation 6, in columns (6) - (10) is the Nerlovian profit inefficiency (NPI), and in columns (11) - (15) is the Allocative inefficiency (AI). The variable definitions are as indicated in Table 1.

	TI					NPI					AI				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
$Lag.DD\_eff$	0.641***	0.497**	0.582***	0.369***	0.432*										
	(0.137)	(0.195)	(0.166)	(0.135)	(0.228)										
$Lag.NPI$						0.550***	0.566***	0.683**	0.719***	0.820***					
						(0.195)	(0.152)	(0.336)	(0.161)	(0.256)					
$Lag.AI$											0.525**	0.368***	0.651***	0.592***	0.345*
											(0.230)	(0.142)	(0.217)	(0.179)	(0.187)
$Board\_size_{t-1}$	-0.038*					-0.056***					-0.02				
	(0.021)					(0.020)					(0.032)				
$Fem.\_prop_{t-1}$		-1.306**					-0.475					-0.886			
		(0.621)					(0.696)					(0.736)			
$Indep.\_prop_{t-1}$			-0.021					-0.601***					-0.598**		
			(0.164)					(0.221)					(0.295)		
$Avg.\_fees_{t-1}$				-0.053***					-0.015**					0.009	
				(0.015)					(0.008)					(0.021)	
$Other\_board_{t-1}$					0.072					-0.179**					-0.18
					(0.776)					(0.091)					(0.295)
$CRAR_{t-1}$	-0.046***	-0.057***	-0.068**	-0.049***	-0.093	0.005	0.005	0.01	-0.012	0.01	0.056***	0.064***	0.073**	0.044**	0.117**
	(0.014)	(0.019)	(0.029)	(0.013)	(0.141)	(0.011)	(0.009)	(0.018)	(0.010)	(0.020)	(0.022)	(0.014)	(0.034)	(0.020)	(0.059)
Log_assets_{t-1}	0.130**	0.142**	0.147*	0.132	0.168	-0.057	-0.081*	-0.144	-0.067	-0.014	-0.160*	-0.188***	-0.219**	-0.165**	-0.243***
	(0.052)	(0.055)	(0.081)	(0.082)	(0.114)	(0.051)	(0.048)	(0.088)	(0.041)	(0.055)	(0.086)	(0.056)	(0.086)	(0.068)	(0.059)
Bank-year obs.	355	355	180	286	180	355	355	180	286	180	355	355	180	286	180
No. of instruments	20	19	30	20	14	30	40	22	44	21	39	57	21	33	30
$Hansen\_Stat$	2.846	3.89	21.033	5.594	5	19.983	26.353	8.318	27.903	7.933	28.482	23.142	10.77	24.319	20.425
$Hansen\_pvalue$	0.584	0.274	0.101	0.232	-	0.131	0.335	0.216	0.47	0.16	0.198	0.989	0.056	0.111	0.117
$AR2\_stat$	1.034	1.06	1.347	0.652	1.305	2.014	1.406	1.644	1.373	0.819	1.069	0.762	1.653	1.1	1.516
$AR2\_pvalue$	0.301	0.289	0.178	0.515	0.192	0.044	0.16	0.1	0.17	0.413	0.285	0.446	0.098	0.271	0.13
Chi^2	761.522	1381.995	224.202	201.119	91.791	964.812	873.019	619.604	594.369	342.144	2994.525	2749.523	196.546	2512.201	1090.43

Robust standard errors, clustered at bank level are presented in the parenthesis. '***', '**' and '*' indicate significance at the 1%, 5% and 10% respectively.

Table 9: Inefficiency and corporate governance - Dynamic panel estimations

The table shows the estimation results for the dynamic panel using system GMM methodology that controls for potential auto correlation in the inefficiency values with potential endogeneity controls. The dependent variable in columns (1) - (7) is the technical inefficiency estimated using a directional distance function as indicated in Equation 6 and in columns (8) - (14) is the Nerlovian profit inefficiency (NPI). The variable definitions are as indicated in Table 1.

	DD_eff		NPI	
	(1)	(2)	(3)	(4)
$Lag.DD\_eff$	0.663***	0.655**		
	(0.148)	(0.290)		
$Lag.NPI$			0.457**	0.764**
			(0.224)	(0.379)
$Board\_size_{t-1}$	0.011	-0.091	-0.038**	0.007
	(0.032)	(0.077)	(0.017)	(0.072)
$Fem.\_prop_{t-1}$	-2.072***	-3.716	-1.058	-2.374*
	(0.737)	(2.731)	(0.949)	(1.391)
$Indep.\_prop_{t-1}$	0.187	0.382	-0.119	-1.093*
	(0.223)	(0.457)	(0.208)	(0.593)
$Avg.\_fees_{t-1}$	-0.036	-0.021	-0.012	0.013
	(0.023)	(0.038)	(0.012)	(0.014)
$Other\_board_{t-1}$	0.215	0.383	-0.027	-0.046
	(0.168)	(0.566)	(0.159)	(0.248)
$CRAR_{t-1}$	-0.066***	-0.063	0.007	-0.025
	(0.023)	(0.045)	(0.028)	(0.038)
Log_assets_{t-1}	0.131*	0.116	-0.088**	0.038
	(0.067)	(0.162)	(0.045)	(0.091)
PSB		-1.388		-0.699
		(1.128)		(0.818)
$PSB \times Board\_size_{t-1}$		0.161**		-0.024
		(0.069)		(0.087)
$PSB \times Fem.\_prop_{t-1}$		0.954		2.207
		(3.298)		(1.525)
$PSB \times Indep.\_prop_{t-1}$		-0.171		0.915**
		(0.436)		(0.444)
$PSB \times Avg.\_fees_{t-1}$		-0.007		0.116
		(0.144)		(0.090)
$PSB \times Other\_board_{t-1}$		-0.381		-0.182
		(0.557)		(0.302)
Bank-year obs.	180	180	180	180
No. of instruments	46	65	39	63
$Hansen\_Stat$	24.525	17.619	24.514	20.709
$Hansen\_pvalue$	0.546	0.987	0.177	0.919
$AR2\_stat$	1.416	1.396	2.331	1.642
$AR2\_pvalue$	0.157	0.163	0.02	0.101
Chi^2	676.093	1090.896	400.34	48534.62

Robust standard errors, clustered at bank level are presented in the parenthesis. '***', '**' and '*' indicate significance at the 1%, 5% and 10% respectively.

A. Appendix

Table A1: Summary of Banks in India

The table shows the mean values of some of the key performance variables for both public sector banks (PSBs) and private sector banks (PBs) for year 2008, 2013, and 2018. The proportion is shown in the bottom panel under % share. The proportion of profits of PSBs and PBs are not shown as the average profits in the year 2008 was negative.

	2008		2013		2018	
Amount	PSB	PB	PSB	PB	PSB	PB
Deposits (INR billion)	22,200	6,040	53,300	13,200	82,600	29,600
Investments (INR billion)	7,260	2,560	16,400	5,980	27,900	9,960
Credit (INR billion)	16,200	4,700	41,400	10,800	57,000	26,300
Assets (INR billion)	27,300	8,540	64,600	18,900	100,000	42,400
Profit (INR billion)	243.2	89.3	469.0	278.6	-853.7	416.1
% Share						
Deposits	78.6	21.4	80.2	19.8	73.6	26.4
Investments	73.9	26.1	73.3	26.7	73.7	26.3
Credit	77.5	22.5	79.3	20.7	68.4	31.6
Assets	76.2	23.8	77.4	22.6	70.2	29.8
Profit	73.1	26.9	62.7	37.3	-	-

Table A2: Summary statistics of input and output variable for efficiency computation

The table shows the summary statistics of the input and output variables used to compute the inefficiency scores for each bank. P(x) is the x^{th} percentile value in the distribution.

Variable	Obs.	Mean	Std. Dev	Median	Min.	Max.	P10	P90
Private sector banks								
Cost of deposit	153	0.06	0.01	0.06	0.03	0.09	0.05	0.08
Expense per employee	153	6.71	2.07	6.41	2.68	14.69	4.40	9.24
Price of fixed assets	153	0.55	0.24	0.51	0.11	1.20	0.27	0.92
Returns from investment	153	0.07	0.01	0.07	0.05	0.09	0.06	0.08
Returns from loans	153	0.10	0.01	0.10	0.07	0.15	0.09	0.12
Deposits (INR billion)	153	1010.00	1380.00	459.39	46.47	7890.00	112.94	2930.00
No. of employees	153	17,282.69	22,055.54	7,627.00	1,402.00	88,253.00	2,628.00	56,617.00
Fixed assets (INR billion)	153	10.41	14.99	4.19	0.41	79.04	1.36	32.13
Investments (INR billion)	153	381.50	511.98	152.27	15.67	2420.00	37.92	1210.00
Advances (INR billion)	153	862.75	1250.00	361.09	31.96	6580.00	77.77	2540.00
Other income (INR billion)	153	23.40	37.79	5.43	0.73	195.04	1.24	76.04
Net NPA (INR billion)	153	11.93	35.05	3.02	0.05	278.23	0.48	21.63
Public sector banks								
Cost of deposit	205	0.06	0.01	0.06	0.04	0.08	0.05	0.07
Expense per employee	205	8.14	2.15	8.06	3.88	13.93	4.99	10.84
Price of fixed assets	205	0.29	0.17	0.24	0.08	1.04	0.14	0.54
Returns from investment	205	0.07	0.01	0.07	0.04	0.09	0.06	0.08
Returns from loans	205	0.09	0.01	0.09	0.07	0.12	0.08	0.10
Deposits (INR billion)	205	2720.00	3200.00	1900.00	430.51	27100.00	849.72	5250.00
No. of employees	205	35,968.28	44,109.13	23,264.00	8,041.00	264,041.00	12,822.00	54,915.00
Fixed assets (INR billion)	205	28.42	43.40	18.47	2.93	429.19	4.93	58.86
Investments (INR billion)	205	839.00	1090.00	583.06	124.73	10600.00	276.45	1370.00
Advances (INR billion)	205	2010.00	2500.00	1370.00	288.78	19300.00	583.35	3810.00
Other income (INR billion)	205	32.05	51.35	17.81	3.94	446.01	6.79	57.34
Net NPA (INR billion)	205	77.79	119.17	40.09	0.79	1110.00	4.73	196.50
Overall								
Cost of deposit	358	0.06	0.01	0.06	0.03	0.09	0.05	0.07
Expense per employee	358	7.53	2.23	7.52	2.68	14.69	4.66	10.61
Price of fixed assets	358	0.40	0.24	0.31	0.08	1.20	0.16	0.79
Returns from investment	358	0.07	0.01	0.07	0.04	0.09	0.06	0.08
Returns from loans	358	0.10	0.01	0.10	0.07	0.15	0.08	0.11
Deposits (INR billion)	358	1990.00	2710.00	1270.00	46.47	27100.00	203.33	4510.00
No. of employees	358	27,982.54	37,477.73	17,108.50	1,402.00	264,041.00	4,043.00	55,752.00
Fixed assets (INR billion)	358	20.72	35.37	12.53	0.41	429.19	1.99	44.13
Investments (INR billion)	358	643.48	915.43	432.46	15.67	10600.00	62.19	1300.00
Advances (INR billion)	358	1520.00	2140.00	940.87	31.96	19300.00	157.71	3420.00
Other income (INR billion)	358	28.35	46.19	13.29	0.73	446.01	2.64	68.53
Net NPA (INR billion)	358	49.64	98.50	11.87	0.05	1110.00	0.93	140.79