Bank Financial Performance and its Linkage with Capital: A Dynamic Panel Data Analysis of Public Sector Banks in India

Arindam Bandyopadhyay

Abstract
This article empirically investigates the linkage of capital infusion in the Public Sector Banks (PSBs) in India with the capital adequacy, asset quality, profitability, operational efficiency and the market position of the banks. Utilising a balanced panel data of total 21 PSBs over 9 years (2009 to 2017), we analyse the key determinants of the Indian PSBs’ profitability, net interest margin (NIM), solvency and market efficiency. The study applies a two-step dynamic panel generalised methods of moments. We find empirical evidence that the Capital Infusion programme of the Government during 2008–2009 to 2016–2017 has significant impact on the performance of PSBs in India. We have observed that with frequent infusion of capital by the government, banks were able to meet the regulatory Basel II/III capital adequacy requirements and it has positive influence on their market capitalisation as well as NIM. However, capital infusion has an insignificant impact on improving return on assets (ROA) of banks. Our study suggests that a higher common equity tier 1 capital ratio leads to better market reputation and solvency position of the banks. The results of the study provides insight for bank management, regulators and policymakers for improving bank performance and better utilisation of scarce capital and public money.

JEL Code: G21, G32, G34

Keywords
Capital infusion, credit risk, bank performance

I. Introduction
The banking industry is considered the backbone of most economies and plays a vital role in attaining economic growth and development. A strong and resilient banking system is the foundation for sustainable economic growth, as banks are at the centre of the credit intermediation process between...
depositories and investors. The more efficient a financial system is in resource generation and in its allocation, the greater is its contribution to economic growth (Mohan, 2005). An efficient system of financial intermediation also contributes to the risk mitigation process in the economy. At the cross-country level, many studies have found a positive association between financial development and growth at the industry level (Rajan & Zingales, 1998). Similarly, at the micro level, firms in countries with deeper financial development are able to achieve more external funds and thereby enabled to grow faster (Demigruc-Kunt & Maksimovic, 1998).

The aim of the banking regulations is to increase prudent practices that will reduce the level of risks the banks are exposed to. Capital regulation is very important because it plays an important role in the banks’ health and risk-taking behaviour, and its impact on the competitiveness of banks. The Basel III reforms are the response of the Basel Committee on Banking Supervision (BCBS, 2010) to improve the banking sector’s ability to absorb shocks arising from financial and economic stress thus reducing the risk of spillover from the financial sector to the economy. Basel III regulation emphasises on quality of capital (common equity tier 1 capital) to absorb shocks arising from financial and economic stress and focuses on improved risk management and governance (BCBS, 2010, 2017). The risk management process is aimed at allocation of scarce capital efficiently in order to obtain optimal benefits and reduce the cost of capital.

Capital is crucial to a bank to support the bank’s operations and it acts as a safety belt to absorb unexpected losses and decline in asset values that could otherwise cause a bank to fail. Unanticipated losses may occur mainly due to banks’ exposure to higher credit risk on fund based and non-fund based credit business. Thus, from a regulatory perspective, banks must manage risks to control potential future losses and have sufficient capital funds to absorb large losses before depositor funds are adversely impacted. Capital infusion in any bank is dependent on the rate of growth of credit business, the risk profile of the bank and target risk tolerance (or risk appetite) of the top management. For private sector banks, incremental regulatory capital (equity or non-equity) can be primarily raised from the markets. Such capital is available to them only if they meet shareholder expectations of returns. However, in the case of public sector banks (PSBs), recapitalisation considerations are slightly different. Being the majority stakeholder, government is responsible for both external objection of capital and internal accumulation of capital within the broader objectives of distributional growth and equity in socioeconomic development and commercial operations of PSBs.

The purpose of government capitalisation in commercial PSB is―(a) to ensure these banks can carry on prudent credit business in the long run, such that credit is seamlessly available for economic growth; (b) to meet regulatory capital adequacy norms for safety and soundness; and (c) to generate adequate social and financial returns on the capital invested through performance. At present, PSB in India form the largest segment of the Indian banking system, accounting for over 75% of total lending. Capital of ₹1,187,240 million was infused by the Government of India in PSBs over 2008–2009 to 2016–2017 with the broader objectives of distributional growth and equity in public sector bank operations. The Government of India has been infusing need based capital in the PSBs so that they build up capital adequacy while meeting the credit growth expectations (CAG, 2017). Given their large share in the overall banking sector, the stability and solvency of Indian PSBs is the paramount importance of the government as well as the regulator. It is important for banks to understand the business challenges and inherent risk dynamics to suitably balance its capital, liquidity, risk and return.

Sustained profitability of banks is good for the financial stability and economic growth of the country. The fall in profits of the banks can affect the solvency of the banks adversely. Therefore it is important to explore factors which have bearing on the profits of the banks especially in developing economies like
India where banks are the chief source of finance for business. The Financial Stability Report of the RBI (2013) states that since 2010 there is an increase in the vulnerabilities in the banking sector in terms of almost all risk dimensions captured in the banking stability indicator. This makes a strong case for identifying the factors responsible for the banks’ profitability and market positions in the current scenario.

The objective of the study is to identify and analyse the determinants of the Indian PSBs’ profitability, net interest margin (NIM), solvency and market efficiency in the period 2008–2009 to 2016–2017 using a set of panel regression models. The study also aimed at assessing the impact of capital infusion by Government of India (GoI) during the same period on the profitability, market position and asset quality of the PSBs. A set of Panel regressions has been used to identify and analyse the impact of capital, quality of assets, cost management efficiency, income diversification, liquidity and solvency ratios on bank performance. ROA, NIM, and Market Value of Equity are taken as indicators bank performance and have been considered as dependent variables in various multivariate models. We have deployed panel dynamic panel generalised methods of moments (GMM) since it eliminates the endogeneity issue while using lagged levels and lagged differences of the regressors as instruments.

The rest of the article is structured as follows. In the following section, we present a brief review of literature to frame our hypotheses. Section III explains the methodology, data and variables selected for the study. Section IV is devoted to the empirical analysis and presentation of results. Concluding discussions are gathered in Section V.

**II. Literature Review**

The financial performance analysis of commercial banks has gained lot of interest to academic research since the introduction of Basel norms. Various studies suggest that profitability of a bank is affected by various factors which are specific to the bank and related with broad economic environment as well. Capital adequacy is one of the important determinants of profits of banks as observed from literature. It refers to sufficiency of the capital to absorb any future uncertainty (Kannan et al., 2001; Williams, 2007). The Basel guidelines too, as discussed, ensure that the banks are adequately capitalised to protect the interests of the depositors and general public at large. Although there is a general consensus that statutory capital requirement is a must to reduce moral hazard and to avoid any failure, the debate is about how much capital is sufficient. The impact of the capital adequacy ratio on profits of the banks is found to be mixed. There are empirical studies which report a positive relationship between capital assets ratio and profits of banks (Ben Naceur, 2003; Berger, 1995; Demigruc-Kunt & Huizinga, 1999). Garcia-Herrero et al. (2009) argue that banks which are well capitalised have similar bankruptcy costs and better profitability. Scholars argue that equity is expensive and it is difficult to obtain additional equity while higher requirements restrict the competitiveness of the banks (Koch, 1995).

With regard to expenses, assets and liability management, funding management and control over non-interest cost, the studies have empirical evidences to state that reduced expenses and better cost decisions results in improved performance (Bapat, 2017; Guru et al., 2002; Williams, 2007). Almumani (2013) too in the context of Jordan, reports that profitability is dependent upon the cost to income ratio. The impact of deposits and volume of loan on the profits of the bank has been studied by many researchers. Deposits have a significant positive effect on the profits of commercial banks (Kannan et al., 2001).

Credit risk affects the strength of the bank’s loan portfolio adversely, thus it results in the reduction in profitability of the banks. Credit risk is a reflection of the quality of the assets with a bank (e.g., ratio of
Gross Non Performing Assets to Gross Advances). The review of literature suggest that higher credit risk may lead to lower profitability due to greater likelihood of uncollectible amounts owned by bank clients (Athanasoglou et al., 2005; Miller & Noulas, 1997).

Capital is a key measure of banks' capacity for generating loan assets and is essential for balance sheet expansion. The purpose of fund infusion by the government is to keep all the PSBs financially sound and healthy so as to ensure the growing credit needs of the country is adequately met. Normally, capital infusion by the government in banks is expected to accelerate business growth and augment financial health of the banks. The announcement of large capital infusion by the government may provide positive signal to the market since the funds bolsters the firm’s capital position, give comfort to the regulators and provide a source for pursuing profitable business opportunities. Elyas and Pagano (2014) have found empirical evidence that investors reacted positively to government capital infusion under the Troubled Asset Relief Programme (TARP) in the US as the market viewed the injection as a signal of improvement of bank health.

Paper by Poczter (2016), study the long term effects of bank recapitalisation in Indonesia. His paper examined the long-term impact of a major sector-wide bank recapitalisation program in Indonesia following the Asian financial crisis of 1997 on two central policy variables—lending and bank risk by using bank-level panel data. The findings of this article suggest that recapitalisation increased lending, but also boosted bank risk in the long term.

Nakashima (2016) evaluates empirically Japan’s two large-scale capital injections in 1998 and 1999. By using fixed effect panel regression model, it is found that the public injections significantly reduced the financial risks faced by the capital-injected banks. However, it did not stimulate their lending or profitability. Thus, mainly funds were used to retain higher capital ratio to ensure solvency.

Das (2002) finds empirical evidence on inter linkage between capital, risk and productivity change for Indian banks. His paper shows that inadequately capitalised banks have lower productivity and are subject to higher degree of regulatory pressure than their adequately capitalised counterparts.

In the Indian context, PSBs majorly rely their funding on Government of India as their major stakeholder. It is different from private banks that rely on their funding from capital markets. The Government of India (GoI) has been infusing capital funds in the PSBs on a continuing basis. The government has infused ₹1,187,240 million in PSBs during 2008–2009 to 2016–2017. However, despite these efforts, there is a wide divergence between PSBs in India in terms of capital adequacy and capital utilisation.

In the post Basel II/III era, it has thus become paramount important to study the relationship between risk, non-performing loans, capital, solvency and performance of banks. This article makes an attempt to study the same in the Indian context. We empirically investigate whether capital infusion in the PSBs in India have any influence on capital adequacy, profitability, operational efficiency and the market position of the banks. This way, our work contributes to the existing literature.

### III. Data, Variables, Definitions and Methodology

The main sources of data for this study comprises of Banks’ Balance sheet, Income statements, Annual Reports, CAG Reports, Rating Agencies Reports, RBI’s time series publications and Ace Equity Corporate database. The bank level audited balance sheet data over financial years were collected from Ace Equity Database and were matched with their annual reports. The panel data sample comprises of audited financial data of 21 PSBs over nine year period 2009 to 2017.
For analysing the determinants of efficiency and profitability of banks in India and its relation with capital, a set of bank specific as well market factors have been used that are listed and described below.

**Dependent Variables: Bank’s Key Performance Indicators**

In case of banks, ROA and NIM are the two commonly used indicator of profitability and it finds support from the literature (Evanoff 1988; Kannan et al., 2001; Sinha & Sharma, 2016; Williams, 2007). Market Capitalisation to net-worth capture value of Assets is considered as an important driver of financial performance of an entity (Altman 2000; Crouhy et al., 2000). Though bank performance analysis has extensively done through estimation of efficiency and productivity through Data Envelopment Analysis (DEA) or Stochastic Frontier Analysis, we have applied panel data regressions and dynamic panel data analysis on profitability, NIMs, solvency and market value of banks. The following are the dependent variables used in this study:

1. **CRAR:** Capital is the amount of own funds available to support the bank’s business and act as a buffer in case of adverse situation. Capital Adequacy is the level of minimum capital required by the banks to enable them to absorb the potential losses and protect the bank’s debtors. CRAR is directly proportional to the resilience of the bank to crisis situations. It also measures overall solvency of the bank.

2. **ROA:** Return on Assets measures the ability of the bank management to generate income by utilising company assets at their disposal. A higher ROA shows that the company is more efficient in using its resources.

3. **NIM:** Net Interest Margin measures the gap between the interest income the bank receives on loans and securities and interest cost of its borrowed funds. It reflects the cost of bank intermediation services and the efficiency of the bank. However, a higher interest margin could reflect riskier lending practices associated with substantial loan loss provisions.

4. **MVE/NW:** The variable is the ratio of Market Value of Equity to the Net-worth of the banks. It measures the market performance and position of the banks. This ratio measures the movement of market value of assets for a listed entity. This adds a market dimension which other bank performance studies did not consider.

**Independent Variables: Bank Specific and Market Indicators**

The determinants of Performance of the Commercial Banks of India can be attributed to Bank Specific/Idiosyncratic as well as market specific and External Factors which are enlisted as follows:

1. **Bank Specific Factors:** The independent variables internal to a bank have been identified from empirical studies conducted in the past. These factors are within the scope of the bank to manipulate and differ from bank to bank which is why these are bank specific in nature. Theoretically also these variables affect the performance of the banks to a large extent. This study includes the following bank specific variables:
   (i) **Cost to Income Ratio:** This ratio has been used a proxy for operational efficiency of a bank. Generally, higher amount of costs should have a negative impact on the profitability of banks. Bank’s profitability is significantly determined by the cost control methods. A lower cost to income ratio reflects better management of funds. Thus, higher bank management
quality (or lower CostInc ratio) would be expected to improve bank NIMs and profitability. Many studies have observed that high profit earning banks recorded low operating costs

(ii) CASA: The CASA ratio indicates how much of banks total deposits accounts are in current and savings. It is a ratio of deposits in current and savings account to total deposits. A more stable CASA leads to better capital planning and management of the banks. A higher ratio indicates better liquidity position of a bank. It would be expected that as CASA increases, so the liquidity risk premium in bank interest margins will decline.

(iii) GNPA: Gross NPA ratio has been measured as the percentage of Gross Non-Performing Assets (GNPAs) to the total advances by the banks. This ratio signifies the credit quality of a bank and has been considered as a proxy for asset quality. The higher the GNPAs and NNPAs of the bank, the poorer the asset quality of the bank.

(iv) Credit–Deposit Ratio: The main activity of bank is using the funds (deposits) effectively by the way of lending (financing). It indicates how much a bank’s core funds are utilised through lending. It also captures asset liability management issues.

(v) Bank size: According to McShane and Sharpe (1985), the size of the SCBs are an indication towards the share of the bank and indicates how rapidly the bank lends and invests in assets. The business size (LNBUSS) has influence on Bank performance. It has been used as control variable.

(vi) Fee Income to Total Income: The ratio measures the non-interest income of the banks as a percentage of total income (FeeInc/TI). Fee income is expected to increase the profits of the banks. However, it may also expose the bank to higher credit risk which may lead to losses.

(vii) Interest Income to Working Funds: The ratio measures the interest income earned from the working funds deployed. This is the core portion of income earned by banks through lending. The study by Iannota et al. (2007) tells that this variable (IntInc/WF) positively influences the ROA of banks.

2. Market Factors:

(i) P/E: Price to Earnings ratio is the ratio of banks current share price to the earnings per share and is an important relative market performance indicator.

(ii) Dividend: It is equity dividend expressed as a percentage of current share price (EQDividend) and is also looked upon as a positive market performance indicator of the banks.

3. External/Regulatory Factors:

(i) CAP/NW: Capital Infusion by Government of India to net-worth of the bank has been considered as exogenous factor in determining bank performance. It captures the amount of capital injection done by the Government in PSBs as part the capital infusion policy. Normally, it is expected that capital infusion in banks to accelerate credit growth and augment ROA of the banks. The process of deciding on the capital infusion in PSBs entailed independent assessment by Department of Financial Services (DFS).

The Panel Econometric Methodology

For the purpose of multivariate analysis to test our hypotheses, we use pooled data to combine time series and cross section data. This will ensure sufficient number of observations in each regression analysis. The pooled data models assumes the fact that differences across units can be captured in differences in constant term (termed as fixed effects models) or alternately, individual specific constant terms are randomly distributed across cross sectional units (random effect models).
Hence, the models are specified as:

$$Y_t = \alpha + \beta X_t + \epsilon_t$$

(1)

Where, $Y_t$ is the set of dependent variables that proxy the bank performance for bank $i$ at time $t$ in a panel data structure ($Y_{it}$=$\text{FINPERF}_{it}$). We have considered four set of variables CRAR, ROA, NIM and MVE/NW as dependent variables ($Y_{it}$) in our model specification. The symbol $X_{it}$ is vector of explanatory variables tested in this research work. It captures the effect of several bank specific factors (e.g., GNPA, CASA ratio, Credit/Deposits, CAP/NW, P/E ratio, etc.) used as regressors on the dependent variables. The detailed description of dependent and independent variables has already been provided.

The above panel regression equation has the following error structure:

$$e_{it} = \eta_i + u_{it}$$

(1a)

In the above formulations, $Y_{it}$ and $X_{it}$ are the $i^{th}$ observation for the $i^{th}$ unit at the $t^{th}$ time period and $u_{it}$ is the vector of error term; where $i = 1...21$ is the list of bank observations and $t = 1...9$ are the years over which observations are available for each bank. We have used a balanced panel data structure for our analysis.

The error term $e_{it}$ represent the effects of the omitted variables that are peculiar to both the individual units $\eta_i$ and time period's $u_{it}$ (refer to Equation 1a). Thus, the first term $\eta_i$ of the decomposition of $e_{it}$ is called an individual effect. It is the unknown intercept for each entity ($n$ entity specific intercepts). This unobserved $\eta_i$ay vary across individuals or the cross section units but is constant across time. Then any change in the dependent variable must be due to influences other than these fixed characteristics. The second part $u_{it}$ is the error term varies independently across time and individuals.

The firm performance equation takes the form,

$$\text{FINPERF}_{it} = \alpha_0 + \alpha_1 \text{FINPERF}_{it-1} + \alpha_2 \text{Cap}_t / \text{NW}_{it-1} + \alpha_3 \text{GNPA}_t + \alpha_4 \text{CASA}_t + \alpha_5 \cos \text{tInc}_t + \alpha_6 \text{Credit} / \text{Deposits}_t + \eta_i + u_{it}$$

(2)

A one year lag dependent variable has been used in the bank performance regression to mitigate the simultaneity problem. Symbol $e_{it} = \eta_i + u_{it}$ represents the error term. It consists of the unobserved bank specific effects, $\eta_i$, and the observation specific errors, $u_{it}$.

One major concern is the endogeneity issue regarding capital infusion and bank performance. Accordingly, we have adopted Arellano and Bond (1991) two step difference generalised method of moments (GMM) in dynamic panel regression structure to check the robustness of the results. The bank specific panel fixed effect is removed by the first difference and the first difference lagged dependent variable is also instrumented with its past levels. This way, GMM method solves the endogeneity problem on capital variable. This makes the endogenous variable pre-determined and hence not correlated with the error term. The differenced GMM method also tackles heterogeneity and autocorrelation problems. Further, the panel GMM technique can control the individual and temporal specific effects (Arellano & Bover, 1995; Blundell & Bond, 1998).

### IV. Empirical Results and Discussions

The summary numbers presented in Table 1 provide an insight into the overall CRAR, ROA, NIM, GNPA and many other variables used in the analysis. The average Capital Adequacy of the entire sample of 21 banks from the period of 2009 to 2017 comes out to be 12.28%. The average profitability ratio, that is, ROA and NIM of the entire sample of SCBs comes out as 0.008 and 0.027. The average GNPA ratio stood out to be 4.95% with a standard deviation of 0.43%.
Table 1. Summary Statistics of Variables used in Analysis for PSBs.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Median</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRAR</td>
<td>0.1228</td>
<td>0.1240</td>
<td>0.0124</td>
<td>0.0963</td>
<td>0.1538</td>
</tr>
<tr>
<td>ROA</td>
<td>0.0053</td>
<td>0.0064</td>
<td>0.0059</td>
<td>-0.0137</td>
<td>0.0167</td>
</tr>
<tr>
<td>NIM</td>
<td>0.0251</td>
<td>0.0257</td>
<td>0.0077</td>
<td>0.0000</td>
<td>0.0396</td>
</tr>
<tr>
<td>GNPA</td>
<td>0.0495</td>
<td>0.0316</td>
<td>0.4299</td>
<td>0.0063</td>
<td>0.2239</td>
</tr>
<tr>
<td>MVE/NW</td>
<td>0.7831</td>
<td>0.6615</td>
<td>0.4168</td>
<td>0.0000</td>
<td>2.7046</td>
</tr>
<tr>
<td>CASA</td>
<td>0.3038</td>
<td>0.2942</td>
<td>0.0671</td>
<td>0.1459</td>
<td>0.4942</td>
</tr>
<tr>
<td>Credit/deposits</td>
<td>0.7263</td>
<td>0.7222</td>
<td>0.0615</td>
<td>0.4699</td>
<td>0.9203</td>
</tr>
<tr>
<td>CostInc</td>
<td>0.4801</td>
<td>0.4674</td>
<td>0.0768</td>
<td>0.3305</td>
<td>0.7931</td>
</tr>
<tr>
<td>IntInc/WF</td>
<td>0.0839</td>
<td>0.0844</td>
<td>0.0083</td>
<td>0.0599</td>
<td>0.1003</td>
</tr>
<tr>
<td>FeeInc/TI</td>
<td>0.0353</td>
<td>0.0318</td>
<td>0.0207</td>
<td>0.0071</td>
<td>0.1189</td>
</tr>
<tr>
<td>LNBUSS</td>
<td>12.6624</td>
<td>12.6414</td>
<td>0.7518</td>
<td>10.9902</td>
<td>15.1008</td>
</tr>
<tr>
<td>P/E</td>
<td>6.0778</td>
<td>5.9675</td>
<td>6.6865</td>
<td>-17.4111</td>
<td>33.7665</td>
</tr>
<tr>
<td>EQDividend</td>
<td>0.6036</td>
<td>0.3000</td>
<td>0.7966</td>
<td>0.0000</td>
<td>4.1500</td>
</tr>
<tr>
<td>Cap/NW</td>
<td>0.0502</td>
<td>0.0200</td>
<td>0.0731</td>
<td>0.0000</td>
<td>0.4200</td>
</tr>
<tr>
<td>No. of Obs.</td>
<td>189</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Source:** Author’s own based on Audited Balance Sheet Data of PSBs.

In the next analysis, we have assessed the impact of capital infusion amongst PSBs through univariate analysis (t-test and Wilcoxon Rank-sum tests).

The two sample \( t \) test and Rank-sum tests have been conducted for the PSBs. The sample is divided into categorical variables: Fund category using dummy. The summary of these variables are:

- Fund category-1 (Cumulative Capital Infusion till 2017 <25% of Net worth of the year 2017)
- Fund category-2 (Cumulative Capital Infusion till 2017 >25% of Net worth of the year 2017)

Accordingly, the dummy variable name for the group is given as ‘grp_capnw’ as new variable (=1 for Group 1 set of banks that are in Fund category-1 as specified in the above & = 0 for banks in Fund category-2).


As can be seen from Table 2 results, the difference of the means of the Key Performance Indicators of the PSBs is checked through univariate parametric (\( t \)-test) and non-parametric (Wilcoxon Rank-sum) tests. As depicted by Table 2, the PSBs with relatively lesser capital infusion have higher means as well as medians of Key Performance Indicators like ROA, NIM, market value of equity to net worth (MVE/NW), capital adequacy ratio (CRAR), return on net-worth (RONW), Earnings Per Share (EPS), Fee Income to Total Income Ratio (FeeInc/TI), Price to Book value multiple (P/E). These banks also have lower Cost to Income (Cost/Income) ratios as compared to the banks which received more capital infusion.
Table 2. Comparison of Financial Performance of Public Sector Banks Across Funding Categories.

<table>
<thead>
<tr>
<th>Key Performance Indicators</th>
<th>Fund Category I (Capital&lt;25% of NW)</th>
<th>Fund Category II (Capital&gt;25% of NW)</th>
<th>t-statistic for Mean Difference</th>
<th>Wilcoxon z Statistic for Rank Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>ROA</td>
<td>0.0069828</td>
<td>0.0050794</td>
<td>0.00356</td>
<td>0.0062782</td>
</tr>
<tr>
<td>NIM</td>
<td>0.0254545</td>
<td>0.0096121</td>
<td>0.0247778</td>
<td>0.0064001</td>
</tr>
<tr>
<td>MVE/NW</td>
<td>0.8524941</td>
<td>0.4841467</td>
<td>0.706685</td>
<td>0.3124658</td>
</tr>
<tr>
<td>CRAR</td>
<td>0.1254899</td>
<td>0.021331</td>
<td>0.1200111</td>
<td>0.0122577</td>
</tr>
<tr>
<td>GNPA</td>
<td>0.0423727</td>
<td>0.03328</td>
<td>0.0572711</td>
<td>0.0506623</td>
</tr>
<tr>
<td>CASA</td>
<td>0.3050079</td>
<td>0.0668513</td>
<td>0.3024327</td>
<td>0.0676957</td>
</tr>
<tr>
<td>Cost/income</td>
<td>0.459899</td>
<td>0.0550231</td>
<td>0.5015556</td>
<td>0.090652</td>
</tr>
<tr>
<td>Credit/deposits</td>
<td>0.7346465</td>
<td>0.0471929</td>
<td>0.7172222</td>
<td>0.0732707</td>
</tr>
<tr>
<td>P/E</td>
<td>6.685909</td>
<td>6.438489</td>
<td>5.408833</td>
<td>6.923236</td>
</tr>
<tr>
<td>RONW</td>
<td>0.130101</td>
<td>0.0969904</td>
<td>0.0792222</td>
<td>0.1410732</td>
</tr>
<tr>
<td>IntInc/WF</td>
<td>0.0830263</td>
<td>0.0080836</td>
<td>0.0849067</td>
<td>0.0083934</td>
</tr>
<tr>
<td>FeeInc/TI</td>
<td>0.037392</td>
<td>0.0231945</td>
<td>0.0329856</td>
<td>0.0174439</td>
</tr>
<tr>
<td>EPS</td>
<td>21.51196</td>
<td>20.25352</td>
<td>8.185653</td>
<td>18.07614</td>
</tr>
</tbody>
</table>

Source: Author’s own computations.

Note: This table compares the performance variables between two sets of PSBs in terms of their cumulative fund availability in proportion of their net worth during 2009–2017. The t-statistics test the difference between group means. The Wilcoxon z-statistic denotes the rank sum test for difference between the group distributions. *** denotes statistical significance of 1% or better. ** denotes significance at 1%–5%; * denotes significance at 5%–10%. ESP: Earnings per Share (adjusted annually).

It was noticed that category II banks required frequent infusion of GoI capital to meet the regulatory capital adequacy requirements. Six out of the nine banks in category II had been infused with capital in six or more years out of the nine years.

The banks receiving lesser capital from the Government of India (GoI) are also giving more dividend to their shareholders as can be seen from the Table 2. To add to this, the Gross NPAs of these banks receiving lesser capital infusion from the government are lower as compared to their counterparts receiving more capital infusion from the government. This perhaps is capturing the moral hazard problem pertaining to capital infusion.

Multivariate Results

This section presents the multivariate Dynamic Panel Regression results for PSBs. The regression results are obtained from Arellano-Bond Panel GMM robust estimators using two step difference method. The estimation accounts for endogeneity of factors and dynamic nature of regression by using lag of the dependent variable and lags of exogenous variables as instruments. The Sargan test checks the validity of instrumental variables and is a test involving over identifying restrictions. Our four set of multivariate models capture the relationship between the identified bank specific factors (including capital infusion) and with bank performance indicators as expressed by CRAR, ROA, NIM, MVE/NW. We have also
performed variance inflation (VIF) test to check if there is any multi-collinearity problem. In all our models, there is no multicollinearity issue (results can be produced on request).

The statistical results of different panel regression models are presented in Table 3. Model 1 shows the relationship between dependent variable CRAR and various independent variables. The master circular of RBI defines capital adequacy as the ratio of a bank’s capital to its risk. National regulators track a bank’s CAR to ensure that it can absorb a reasonable amount of loss and complies with statutory Capital requirements. The GNPA ratio has a statistically significant negative impact on the Capital Adequacy ratio of the PSBs. The negative effect indicates that the worsening of asset quality will hit banks profitability and erode capital, thereby curbing their ability to give loans to the borrowers. The credit deposit ratio which helps in assessing banks liquidity is found to have a negative significant relationship

<table>
<thead>
<tr>
<th>Table 3. Arellano-Bond Two Step Dynamic Panel GMM Estimates: Responsiveness of Bank’s Performance Parameters to Government Capital Infusion.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent Variable</strong></td>
</tr>
<tr>
<td>Lagged dependent</td>
</tr>
<tr>
<td>GNPA</td>
</tr>
<tr>
<td>CASA</td>
</tr>
<tr>
<td>Credit/deposits</td>
</tr>
<tr>
<td>Feelnc/TI</td>
</tr>
<tr>
<td>CostInc</td>
</tr>
<tr>
<td>IntInc/WF</td>
</tr>
<tr>
<td>CAP/NW</td>
</tr>
<tr>
<td>LNBUSS</td>
</tr>
<tr>
<td>P/E</td>
</tr>
<tr>
<td>EQDIVIDEND</td>
</tr>
<tr>
<td>Constant</td>
</tr>
<tr>
<td>No. of observations</td>
</tr>
<tr>
<td>Wald Chi2 (d.f., p-value)</td>
</tr>
<tr>
<td>AR1 (p-value)</td>
</tr>
<tr>
<td>AR2 (p-value)</td>
</tr>
<tr>
<td>Sargan J-test Chi2 (d.f., p-value)</td>
</tr>
</tbody>
</table>

**Source:** Author’s own based on panel data analysis of PSBs.

**Note:** The reported GMM results are two step differenced estimates with one period lag of the dependent variable. The z values are given in the parentheses. ***, **, and * denote significance at the 1%, 5% and 10% level respectively. Sargan test is a robust test of over-identifying restrictions for the GMM estimators under the null hypothesis of instruments’ validity. It checks whether model specification is correct and all over-identified instruments are exogenous. The chi-square and p values are reported. AR1 and AR2 are tests for the GMM estimators. Arellano-Bond test that the average autocovariance in residuals of order 1 (AR1) is 0, that is, Null hypothesis (H0): there is no auto correlation. Similarly, Arellano-Bond also test that average autocovariance in residual of order 2 (AR2) is 0, that is, H0, no autocorrelation. The reported z values and p values of AR in first difference refer to the two-step GMM estimators. The Wald Chi2 with a p-value tests the fitness of the model.
with CRAR for PSBs indicating that if the ratio is too high, the banks might not have enough liquidity to cover any unforeseen fund requirements which may further affect the capital adequacy and asset liability mismatch. One of the primary objectives of GoI capital infusion in the PSBs was maintenance of the capital adequacy as per regulatory requirements (Basel norms/ RBI norms). The study indicates that with frequent infusion of GoI capital, the banks were able to meet the regulatory capital adequacy requirements as the variable Capital infused to net-worth has positive statistically significant relationship with the dependent variable CRAR.

In Model 2, we examine various bank specific factors including capital infusion on the bank performance. ROA of a bank is a financial ratio which measures net income as a percentage of average total assets of the bank. It indicates how efficient the management of the bank is, at employing its assets to generate profits.

In line with our expectations, the GNPA has a significant negative effect on the profitability ratio, that is, ROA of PSBs. The loss assets increase the provisioning costs of the banks, which exert pressure on their profits. The results are in line with the results of a study by Sinha and Sharma (2016). Moreover, Table 3 model 2 results further reveal that a one unit change in Gross NPA ratio (e.g., 1 percentage point) significantly reduces the ROA by 12 basis points for PSBs.

We have also assessed economic significance of independent variables of our interest by using the concept of beta weight (beta coefficient = $\beta \times \frac{\sigma x}{\sigma y}$). For GNPA, the beta coefficient is –0.568. It implies that for a 1 standard deviation increase in Gross Non-Performing Assets, the ROA of PSBs on average decreases by 0.568 standard deviation for PSBs.

The variable CASA has a positive and significant relationship with ROA in case of PSBs. We have also found that in terms of economic significance, a one standard deviation increase in CASA ratio can increase ROA of PSBs on average by 0.413 standard deviation. Thus, our results obtained in model 2 regression confirm that that banks having access to low cost CASA deposits and who are able to maintain higher capital adequacy ratio can sustain financial distress without a dent in the profits. We have also found significant impact of cost efficiency on ROA. A lower cost to income ratio (CostInc) significantly improves profitability of banks.

Next, we have examined whether GoI capital infusion results in increase in the profitability of PSBs. As can be seen, the variable Capital infused to Net-worth has an insignificant impact on ROA of PSBs. The model above further indicates that PSBs which received a relatively higher share of GOI capital infusion (category II PSBs) had, in fact, performed worse than Category I PSBs in terms of profits. It was evident in a separate regression. The ROA measures for PSBs which received more capital infusion from the GoI have declined over the period 2008–2009 to 2016–2017. Therefore, Capital infusion has enabled the PSBs to preserve capital (as evident from Model 1) but has not resulted into their profitability.

Model 3 exhibits the relationship between NIM and various independent variables. The NIM for a bank is the difference between interest paid and interest received adjusted relative to the amount of interest generating assets. As can be seen GNPA has negative significant impact on the NIM of all the banks indicating that the problem of NPAs exerts pressure on the interest margins of PSBs as the interest payment is not received in an NPA account.

The CASA variable too has positive significant effect on NIM for all the PSBs. The positive effect is an indication that higher CASA implies access to low cost deposits which in turn leads to lower cost of funds and higher profits for the banks. The credit/deposit ratio has a significant negative effect on the NIM of the PSBs. The result indicates that if the ratio is too high, the bank might not have enough liquidity to cover any unforeseen fund requirements which may create asset liability mismatch and dampen their NIM.
The model also brings out that Fee Income to Total Income ratio has significant positive impact on the interest margins of the PSBs. Thus, income diversification enables the PSBs to retain their NIM.

The variable Cap/NW has positive significant impact on the NIMs of PSBs. Thus, adequately capitalised banks will seek a larger margin to maintain their capital standards. This provides empirical evidence that capital infusion by GoI in PSBs has enabled the PSBs to improve margin. PSBs in India would need to factor such regulatory requirements into account before analysing their spreads.

Measuring the bank’s Market Value of Equity helps banks assess the impact of market capitalisation and the current value of the stock at which it is trading. From our study, the above variables help in explaining the variability in the dependent variable, market value of equity to net worth ratio. Accordingly, Model 4 exhibits the relationship between MVE/NW and various independent variables including capital ratios.

P/E ratio is a reflection of the market’s opinion of the earnings capacity and future business prospects of a company. From the Table 3, model 4 regression results, it can be deduced that in case of PSBs, the market value of equity to net-worth increases positively in response to increase in the P/E ratio. Thus, P/E ratio has significant positive impact on the market value of PSBs.

As investors are also concerned with dividends, the high dividend yields may attract various financial investors and help a better capital infusion through other institutional investors. As per our model, a 1% increase in the equity dividend further increases the market value of equity of PSBs. The effect is statistically positively significant.

Furthermore, the Capital infused to Net-worth (CAP/NW) variable has a significant positive impact on the market value of PSBs. The estimated regression coefficient for CAP/NW is 0.630 and also statistically significant. It suggests that the capital infusion program by the GoI has improved the market perception and market value of the PSBs. This is a new finding that contributes to the existing empirical literature related to capital and performance of banks. The business continuity is ensured through capital infusion which gets reflected on their price behaviour.

V. Concluding Remarks

The impact of various bank-specific variables on solvency, operational efficiency, profitability and market value for PSBs have been identified in this article through a set of panel regression methods. The endogeneity between capital and bank performance has also been addressed through Dynamic panel GMM method. The bank-specific variables are internal and are results of bank policy and management. Therefore, banks have ability to modify and influence them. The study finds that credit to deposit ratio negatively affects the capital adequacy as well as the profitability of PSBs. However, it has positive effect on the NIM. An optimal credit deposit ratio indicates that the banks are fully utilising their resources without much pressure on the resources. The negative impact of the credit deposit ratio on CRAR of PSBs indicates that they need to clear their loan books first and leverage their resources to achieve better capital management.

Banks with access to stable low cost CASA deposits are able to make higher NIMs and banks that are able to maintain higher capital adequacy ratio may sustain financial distress and maintain capital position and profitability which also help banks to retain public and shareholders’ confidence.

The proportion to gross non-performing loans of the banks in their loan book is the most important determinants that are responsible for the draining of the banks’ profits due to increased provisions. Therefore, it is important for the management to ensure healthy asset quality and ensure measures to
control this menace so as to remain profitable. Higher GNPA is demonstrative of poor credit choice making or in other words aggressive lending coupled with poor credit risk management by banks. The economic significance of increase in GNPA on bank profitability (ROA) derived this article through beta regression method would enable the senior management to measure the effect of credit risk on their profitability and develop stress testing scenarios for better capital planning.

The Capital Infusion programme of the Government of India from 2008–2009 to 2016–2017 was not able to increase the profitability (measured in terms of ROA) of the banks. Moreover, we find that the PSBs which received more capital from the Government were actually not able to translate it into profitability. Although the regulatory requirement of maintaining appropriate levels of capital adequacy were achieved, the average CRAR of category II banks is consistently lower than that of category I banks even after relatively higher proportion of GoI capital infusion. This is quite evident in our uni-variate statistical analysis. Our study finding suggests that capital infusion should be based on certain pre-determined robust performance based criteria for its productive utilisation.

Our multivariate analysis reveals that the capital infusion into PSBs has helped them preserve capital and improve market value and NIM, but it is not being translated into profitability. This points to the continued dependence on GoI capital infusion for these banks in the upcoming years as well. It seems that Capital infusion in India virtually financed increased provisioning requirements due to rise in non-performing assets rather than expanding the banking business. Accordingly, to ensure efficient utilisation of scarce capital, the government has recently started signifying memorandum of understanding (MoU) linking capital infusion into banks to operating performance. Such agreements require banks agree to certain business strategic initiatives, reduction in NPAs and generation of adequate ROA. Further, during the period of our study, Reserve Bank of India had introduced asset quality review which led to sharp increase in non-performing assets (NPAs), requiring PSBs to set aside the bulk of their income for provisioning. The repeated capital infusion was needed for banks having more NPAs. This means those banks were not utilising the funds efficiently. This has influence on their ROA and thereby making capital infusion ineffective on improving ROA of PSBs.

Our study suggests that a higher common equity tier 1 capital ratio leads to better market reputation and solvency position of the banks which may be helpful for extending business. However, for effective utilisation of capital, PSBs need to enhance their operating efficiency and improve credit risk and liquidity risk management process. The government need to ensure capital infusion has a direct or indirect impact on real economy including stability and risks in banking services of PSBs. This is possible if post capital infusion, the performance of PSBs are monitored proactively. There is a need for Risk Adjusted Return on Capital (RAROC) based capital allocation to effectively use government capital as a tool to elicit better performance.

Acknowledgements
The helpful comments from Dr Asish Saha, Dr Soumya Kanti Ghosh, Dr Tarashankar Shaw, Dr Tasneem Chherawala, Shri Pawan Kumar Konda are duly acknowledged. All remaining errors are our own.

Declaration of Conflicting Interests
The author declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Funding
The author received no financial support for the research, authorship and/or publication of this article.
ORCID iD
Arindam Bandyopadhyay (ID) https://orcid.org/0000-0002-0771-7907

References


BCBS. (2010). *Basel III: A global regulatory framework for more resilient banks and banking systems*. BIS.


