Determinants of banks' debt: dynamic panel evidence from Indian public sector banks

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Abstract: This study aims at examining the major determinants of debt financing of Indian public sector banks. To achieve the study objective, we form a balanced panel by extracting data of 26 public sector banks (PSBs) of India over 12 years from 2005 to 2016. The study employs the pooled OLS, and both the static and the dynamic panel data techniques, such as the random-effects model and system GMM model for the empirical analysis. The analysis reveals that the bank's debt financing is significantly determined by bank size, tangibility, liquidity, and financial strength. It shows that bank size, liquidity, and tangibility are positively related to banks' debt, whereas financial strength and economic growth are negatively related to the banks' debt level. It is also found that the debt level is consistent over time; however, the speed of adjustment is around 92% per annum. This implies that the PSBs adjust their actual debt level towards their optimal debt level at a faster rate.

Keywords: debt financing; dynamic panel data; system GMM; public sector banks; PSBs; India.

Reference to this paper should be made as follows: Naik, P.K. (2020) 'Determinants of banks' debt: dynamic panel evidence from Indian public sector banks', *Int. J. Accounting and Finance*, Vol. 10, No. 1, pp.24–39.

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This paper is a revised and expanded version of a paper entitled 'Determinants of bank's leverage decision: dynamic panel evidence from public sector banks in India' presented at the 3rd International Conference on Financial Markets and Corporate Finance (ICFMCF 2018), IIT Kanpur, 12–14 July 2018.

1 Introduction

A strategic choice between firms' debt and equity financing decisions plays a vital role in selecting various investment projects. While both the sources of financing are desirable, a firm always looks for an optimal level in its capital structure. Debt financing is attractive as it has low costs due to the tax shield on interest payment. Moreover, it is predictable and flexible. Thus, firms usually set a targeted debt to equity ratio (also known as financial leverage ratio). The targeted leverage ratio can help to reduce the possible financial distress and bankruptcy (Eriotis et al., 2007; Ebrahim et al., 2014). This issue of the capital structure decision of a firm is well debated in the corporate finance literature. The well-known Modigliani and Miller (1958) capital structure irrelevance proposition has attracted several controversies, and subsequently, several theories of capital structure have emerged to provide the solution. Most prominent among them are the trade-off theory, the pecking-order theory, and the agency cost theory (see Kraus and Litzenberger, 1973; Jensen and Meckling, 1976; Myers, 1984; Myers and Majluf, 1984; Bradley et al., 1984, Harris and Raviv, 1991). Also, some researchers tried to provide the empirical validation of these theories, but the issue remained unsettled (Titman and Wessels, 1988; Rajan and Zingales, 1995). Besides, most studies primarily motivated towards non-financial and non-banking firms.

Having a crucial connection with economic growth and development, the banking sector mobilises the resource transformation and finances most business firms of a country. To perform this function, banks must maintain a well-balanced capital structure. A balanced capital structure also determines the deposit-taking capacity and the lending activities of banks. Thus, research on examining banks' capital structure is equally important. It is argued that the capital structure of the banks significantly differs from non-banking firms since the banks are highly regulated and that a minimum capital requirement is imposed. Besides, as most researchers argue, the usual corporate finance doctrine may not fit well with the banking sector, because banks are believed to be reluctant in issuing equity capital relative to non-financial firms and thus rely on debt financing (Rajan and Zingales, 1995; Diamond and Rajan, 2000; Berger et al., 1995; Octavia and Brown, 2010). Moreover, the experiences from the financial crisis (which uncovers banks' financial solvency issue) and the subsequent introduction of Basel III (that focused heavily on bank leverage, liquidity, and capital adequacy) motivate research on bank's leverage decision.

Albeit growing, only a handful of studies were devoted to examine banks' capital structure using different proxy variables for capital structure (e.g. Yu, 2000; Amidu, 2007; Brewer et al., 2008; Gropp and Heider, 2010; Octavia and Brown, 2010; Caglayan and Sak, 2010; Gocmen and Sahin, 2014; Sheikh and Qureshi, 2017; Laux and Rauter, 2017). Most of them have considered financial leverage as a proxy for capital structure decisions. Yet, it is an under-explored area in the banking literature on developing countries. Specifically, in the Indian context, limited research has been conducted to examine the leverage decision of commercial banks (e.g., Ghosh and Chatterjee, 2015).

The present study, thus, extends the literature on bank capital structure decisions by examining the determinants of debt financing of the Indian banking sector. Specifically, this study tries to examine the bank-specific determinants of debt financing of public sector banks (PSBs) in India by employing more sophisticated statistical tools, namely,

system GMM methods developed by Arellano and Bover (1995) and Blundell and Bond (1998).

The banking sector of India constitutes 27 public sector banks including state banks and its associated, 26 private banks, 46 foreign banks, and 56 regional rural banks[1]. The total deposits grew at a CAGR of 12.03% during the financial year 2006-2017. As Mohan and Ray (2017) noted the PSBs continued to dominate the entire banking industry in the country accounting for more than 70% of banking sector assets. Moreover, the financial landscapes are still bank-based to a large extent with the existence of minimal role of the capital market. It is believed that by examining the capital structure decision of PSBs in India this study would contribute both academically as well as from the policy perspective.

The rest of the paper is organised as follows. Section 2 discusses the theoretical underpinning of the firms' capital structure and extends it with a review of some of the previous empirical works, especially on the bank capital structure. Section 3 deals with the data sources and the econometric methods applied for the analysis. In Section 4, we present the findings and discussion. Finally, Section 5 concludes the study.

2 Literature review

The study of firms' capital structure is an intriguing issue in the area of corporate finance. The most influential work of Modigliani and Miller (1958, 1963) provided the base for the capital structure debate, and became the milestone of the empirical literature on corporate finance. Subsequently, several theories have emerged, such as the agency theory, the trade-off theory, the pecking-order theory, and the signalling theory. According to the agency theory, agency costs (a cost due to the conflict of interest between principal and agent) increase the cost of equity and thus reduce the firm value. It suggested that debt financing can solve the problem since the monitoring of the firm increases with the increasing debt relative to equity (Jensen and Meckling, 1976). Myers (1977) argued that the increasing debt level of the firm may lead to an underinvestment problem. This implies a negative relationship between leverage and growth opportunities of the firm.

The trade-off theory advocated that the optimal capital structure decision of a firm is achieved when the marginal costs and benefits of leverage are equal (see Modigliani and Miller, 1963; Kraus and Litzenberger, 1973; Jensen and Meckling, 1976; Myers, 1984). According to this theory, firms prefer debt financing over equity financing to take advantage of tax shields on interest paid. Besides, according to Ross (1977), a firm's capital structure might also be influenced by the information asymmetry between the insiders and the outsiders. Based on the agency costs, signalling, and the information asymmetry problems, Myers (1984) developed the pecking-order theory.

Unlike the trade-off theory, pecking-order theory did not suggest a well-defined capital structure for firm rather it suggested a financial hierarchy. According to this theory, firms follow a pecking order of various sources of finance; and thus, they first prefer retained earnings, i.e., internal over external financing; and if they find any need of external financing, then they prefer debt over equity. It also suggested that a firm that faces large information asymmetry should opt for debt financing, and minimise the selling of underpriced securities.

A plethora of empirical studies tried to verify the validation of the above-mentioned theories and identified various firm-specific determinants of capital structure. However, most of these studies were focused on the non-financial firms; and only a handful of previous studies examined bank capital structures. For example, Gropp and Heider (2010) examined the determinants of bank capital structure for the US and the European banks and confirmed that the standard determinants of capital structure for the non-banking firms also hold for banks. They measured bank capital structure through the market leverage and book leverage. And, they used a set of firm-specific variables such as profitability, size, collateral, and risk as the explanatory variables. Similar findings were documented by Octavia and Brown (2010) which examined the determinants of bank capital structure for a set of developing countries, such as Brazil, India, Jordan, Korea, Malaysia, Mexico, Pakistan, Thailand, Turkey, and Zimbabwe.

Earlier to these studies, Yu (2000) tried to examine the relationship between bank liquidity and bank capital structure for the Taiwanese banks. He reported that leverage had a direct relationship with liquidity ratio. Amidu (2007) studied the determinants of banks' capital structure decision for Ghana and found that profitability, corporate tax, growth opportunities, asset structure, and bank size significantly determined the bank capital structure decisions. Similarly, Brewer et al. (2008) examined the determinants of bank capital structure using the bank-specific factors along with some macroeconomic factors and documented that bank leverage ratio had significantly affected by profitability, credit risk, and asset size.

While most of the previous studies found bank-specific factors to significantly affect bank leverage, the signs of most variables were inconsistent across studies. For example, Antoniou et al. (2008) studied the determinants of capital structure for the market-oriented economies and the bank-oriented economies using a dynamic panel data model. They found that leverage had positively associated with tangibility and size; but negatively associated with profitability, growth opportunities, and share price performance. Caglayan and Sak (2010) modelled the bank-specific factors, such as market-to-book, profit, size, and tangibility as a function of book leverage for banks in Turkey. Their findings indicated that while the size and the market-to-book variables were positively related to leverage, the profitability and tangibility are inversely related to leverage. Amjad et al. (2013) examined the determinants of capital structure for banks in Pakistan and documented that size and liquidity had a positive effect; whereas, tangibility, profitability, and growth opportunities were inversely related to leverage. Gocmen and Sahin (2014) investigated the factor determining bank capital structure in Turkey and found that profitability negatively influenced leverage, whereas the size and the growth opportunities of the bank have positively associated with bank leverage. Sheikh and Qureshi (2017) examined the determinants of the capital structure of Islamic and conventional commercial banks in Pakistan. They found that profitability and tangibility negatively influenced the capital structure, while bank size positively influenced capital structure for both Islamic and conventional banks. Examining the determinants of leverage in US commercial and saving banks Laux and Rauter (2017) concluded that leverage was positively associated with asset growth and GDP growth.

For India, Ghosh and Chatterjee (2015) examined the factors determining bank capital structure using data over 1992–2012 periods employing the static panel data method. Along with the standard determinants of capital structure, they also used variables such as bank ownership, regulatory pressure, and the financial crisis as the other

explanatory variables. Their findings showed that the book leverage was negatively associated with profitability and growth.

3 Data and methods

3.1 Data, sample, and description of variables

To investigate the determinants of bank's debt financing decisions, data for bank-specific factors and macroeconomic factors have been extracted from the Database of Indian Economy of Reserve Bank of India for the period from 2005 to 2016. The sample consists of 26 public-sector banks including six state banks of India and their subsidiaries, and 20 nationalised banks. Accordingly, I formed a balanced panel with 26 cross-sectional units over 12 years comprising 312 observations for the analysis.

- *Dependent variable:* DEBT is considered as the dependent variable and defined as the ratio of the book value of total debt (both short run and long run) to book value of the total asset. Since this variable reflects the characteristics of a firm's indebtedness and simple in computation it is the most popular measure of financial leverage and debt financing.
- *Independent variables:* previous studies, such as Flannery (1994), Rajan and Zingales (1995) and Diamond and Rajan (2000), argued that the usual determinants of the capital structure of non-banking firms might not be identical to the banking firms as the asset portfolio and purpose of leverage is different for later from the formers. On the other hand, Gropp and Heider (2010) showed that the standard determinants of the firm's capital structure also hold for banking firms. Following the previous literature and the suitability of the behaviour of Indian banks, I have considered the following bank-specific factors as the potential determinants of bank debt financing.

Firm *size* is a well-acknowledged factor determining the capital structure both in the case for non-banking as well as for banking firms, and hence it is used as the explanatory variable. Bank *size is measured as the natural logarithm of total assets*. The total assets are as defined by the RBI and thus include the cash equivalent of off-balance sheet items. According to the trade-off theory, large banks usually take advantage of scale economy, and thus more efficient in minimizing the operational costs and probability of insolvency. Moreover, as compared to the smaller banks, larger banks attract more finance at a lower cost of debt since the information disclosed by them is more visible; they are less prone to agency conflicts and asymmetric information, enabling them to issue long-term debt. Thus, the trade-off theory implies a positive relationship between size and debt financing. On the other hand, the pecking-order theory postulates a negative relationship between size and leverage. It argues that smaller banks often face high costs of issuing new equity capital as compared to larger banks, and often use the short-term borrowings. Further, larger banks may be more potentially used their retained profit and less likely to rely on debt capital. The actual relationship between size and debt decision is theoretically ambiguous.

Another variable that most studies considered is *profitability*. The theoretical prediction of the relationship between profitability and firm leverage is mixed too. While

the trade-off theory predicts a positive relationship between firm leverage and profitability, the pecking-order theory predicts the opposite. According to pecking order theory, profitable firms may use their accumulated retained profits enabling them to generate internal financing and thus less prone to debt. On the other hand, the trade-off theory argues that more profitable firms prefer debt financing to get the benefit from tax shields and the bankruptcy costs (Gonzalez and Gonzalez, 2012). *Profitability is measured as the ratio of operating profit to total assets*.

Two more bank-specific variables namely, *collateral* and *liquidity*, have been frequently used in the previous literature of determinants of bank capital structure. Collateral represents the tangible assets available to the banks. Both the pecking-order theory and the trade-off theory suggest a positive relationship between collateral and a firm's debt financing. It has been argued that the tangible assets of firms have higher liquidation value that enables them to reduce the bankruptcy costs of debt (Titman and Wessels, 1988; Harris and Raviv, 1991; Gropp and Heider, 2010). Also, firms with a higher level of tangible assets can ensure a higher level of security. Since these assets are usually fixed and can be collateralised, they can attract more long-term debt. I use collateral as a proxy for tangibility. *Collateral is measured as the ratio of fixed assets to total assets*.

Previous studies such as Lipson and Mortal (2009) include *liquidity* as one of the explanatory variables in determining a firm's capital structure. The trade-off theory suggests a positive relationship between liquidity and capital structure decision; whereas, the pecking-order theory suggests an inverse relationship between them. *I measure liquidity as the ratio of total loans and advances to total assets*. This measure of liquidity provides an assessment of the aggressiveness of the lending activity of banks. I also use the capital to asset ratio as another independent variable to incorporate the *financial strength* of the bank. Banks can increase their capital ratio by issuing new equity shares or by reducing the growth of their assets. Higher capital may imply more equity financing relative to debt financing. Thus, a negative relationship between financial strength and debt level is expected.

Along with the above-mentioned variables, I re-estimated the empirical model after considering two important macroeconomic variables, such as the rate of *inflation* and *GDP growth of the country*. Further, I constructed a dummy variable for 2009 to control for the impact of the US sub-prime crisis, if any, on PSBs debt decision. The consideration of 2009 as dummy is because the immediate impact of sub-prime-crisis was felt only at the end of 2008; in 2009 most of the banks in India were reported larger borrowing on their financial accounts.

3.2 The empirical models

Using the above-mentioned bank-specific variables the capital structure regression model can be specified in a linear-framework as follows:

$$Debt = f(size, profitability, collateral, liquidity, financial\ strength)$$

The testable model therefore becomes,

$$DEBT_{it} = \beta_0 + \beta_1 SIZE_{it} + \beta_2 PROF_{it} + \beta_3 COLL_{it} + \beta_4 LQ_{it} + \beta 5 FS_{it} + u_{it} \quad (1)$$

Where, DEBT represents the debt financing of bank or the bank borrowing, SIZE represents the bank size in terms of total assets, PROF represents the profitability, COLL represents the collateral, LQ represents the liquidity and FS represents the financial strength. *it* is the usual subscript used in the panel data representing the i^{th} bank in the t^{th} year.

Incorporating the macroeconomic factors and the dummy variable, the regression model becomes

$$DEBT_{it} = \beta_0 + \beta_1 SIZE_{it} + \beta_2 PROF_{it} + \beta_3 COLL_{it} + \beta_4 LQ_{it} + \beta_5 FS_{it} + \beta_6 INF_{it} + \beta_7 GDP_{it} + \beta_8 DUMMY_{it} + u_{it} \quad (2)$$

where the new term INF represents the rate of inflation, GDP represents economic growth and DUMMY represents a dummy variable that takes 1 for 2009 and 0 otherwise. u_{it} is the random error term and assumed to be normally distributed with zero mean and constant variance.

Besides, pooled OLS this study employs both static as well as dynamic panel data (system GMM) methods to analyse the determinants of banks' debt. The static panel data model in this can be represented as follows:

$$DEBT_{it} = \beta_0 + \beta_1 SIZE_{it} + \beta_2 PROF_{it} + \beta_3 COLL_{it} + \beta_4 LQ_{it} + \beta_5 FS_{it} + \beta_6 DUMMY_{it} + \upsilon_{it} \quad (3)$$

where $\upsilon_{it} = \alpha_{it} + u_{it}$, with α_i being bank's unobservable individual effects. When choosing between the random effects and fixed effects approach, an important consideration is whether αi is correlated with the regressors? To test the hypothesis that α_i is uncorrelated with the regressors, the Hausman test has been performed. Under the Housman test, significant chi-squared statistics allows the fixed effects model to be chosen over the random effects. Further, the Breusch-Pagan LM test has been performed to test the presence of unobservable individual effects. A significant LM statistic allows the random-effects model to be chosen over the pooled OLS.

To examine the possible dynamism in the bank's capital structure decision I employ the dynamic panel data model. The advantage of the dynamic panel data model is that it can control for endogeneity and measurement errors, especially when the explanatory variables include a lagged dependent variable. It also enables us to determine the speed of adjustment factor determining the level of adjustment of debt towards the optimal debt level.

Thus, following the study of Flannery and Rangan (2006), Antoniou et al. (2008) and Gropp and Heider (2010) the level of adjustment process has been described as follows.

Under the ideal condition, a bank's observed debt is assumed to be equal to the optimal debt, $DEBT_{it} = DEBT_{it}^{*}$ where $DEBT^{*}$ is the optimal level of debt of the bank. In a dynamic setting, it may be expressed as $DEBT_{it} - DEBT_{i,t-1} = \lambda(DEBT_{it}^{*} - DEBT_{i,t-1})$; and solving for $DEBT_{it}$ we have

$$DEBT_{it} = (1-\lambda)DEBT_{i,t-1} + \lambda DEBT_{it}^{*} \quad (4)$$

where λ is the adjustment parameter. A high value of λ indicates quicker adjustment. If $\lambda = 1$, then, the observed debt level is equal to the optimal, i.e., $DEBT_{it} = DEBT_{it}^{*}$ implying that the entire adjustment is made within one period; and if $\lambda = 0$, then,

$DEBT_{it} = DEBT_{i,t-1}$ implying the adjustment of the level of observed debt towards the optimal debt is being nil.

The optimal debt level is expected to be determined by the bank-specific factors and also by the macroeconomic factors. Along with the bank-specific variables and the macroeconomic factors, namely, inflation rate and GDP growth rate, the bank's optimal leverage can thus be expressed as:

$$DEBT^{*}_{it} = \delta_0 + \delta_1 SIZE_{it} + \delta_2 PROF_{it} + \delta_3 COLL_{it} + \delta_4 LQ_{it} + \delta_5 FS_{it} + \delta_6 INF_{it} + \delta_7 GDP_{it} + \delta_8 DUMMY_{it} + \alpha_i + u_{it} \quad (5)$$

Substituting equation (5) in equation (4) and solving for the observed debt level, $DEBT_{it}$, yields

$$DEBT_{it} = \beta_0 + \gamma DEBT_{i,t-1} + \beta_1 SIZE_{it} + \beta_2 PROF_{it} + \beta_3 COLL_{it} + \beta_4 LQ_{it} + \beta_5 FS_{it} + \beta_6 INF_{it} + \beta_7 GDP_{it} + \beta_8 DUMMY_{it} + \upsilon_{it} \quad (6)$$

where $\beta_0 = \lambda\delta_0$, $\gamma = (1 - \lambda)$, $\beta_1 = \lambda\delta_1$, $\beta_2 = \lambda\delta_2$, $\beta_3 = \lambda\delta_3$, $\beta_4 = \lambda\delta_4$, $\beta_5 = \lambda\delta_5$, $\beta_6 = \lambda\delta_6$, $\beta_7 = \lambda\delta_7$ and $\upsilon_{it} = (\lambda\alpha_i + \lambda u_{it})$.

In a dynamic setting, the presence of a lagged dependent variable may produce bias and inconsistent estimators if it is not instrumented. To avoid this problem, the system GMM methods (developed by Arellano and Bover (1995) and Blundell and Bond (1998)) have been employed. One advantage of the system GMM method is that it transforms the regressors by first difference, assuming that the first difference of the instrumental variables is uncorrelated with the fixed effects; thus, it is free from endogeneity bias and measurement errors (Roodman, 2009). The system GMM is suitable for small sample cases, i.e., small T and large N; and also it has smaller finite sample bias (Bond, 2002). However, the estimators are consistent only if the instruments are valid; and the error terms are serially uncorrelated, i.e., they are free from second-order autocorrelation. Hansen's J-statistic is employed to check the validity of instruments. Under the null hypothesis that *the over-identifying restrictions are valid* against the alternative hypothesis that the *restrictions are not valid* the J-test follows a χ^2 distribution with *m-k* degrees of freedom, where, *m* represents the number of instruments and *k* represents the number of endogenous variables. Further, to check the existence of second-order autocorrelation the Arellano-Bond AR(2) test has been performed. In both cases, the estimated model is valid if one fails to reject the null hypothesis.

4 Results and discussion

I start the analysis by observing the debt behaviours of 26 public sector banks in India both year-wise and bank-wise. Figure 1 shows the average debt to asset ratio calculated for each bank over the sample period. The year-wise average debt ratio calculated for all the public sector banks is presented in Table 1. This table indicates that the mean debt ratio of the public sector banks over the sample period ranges from 3% to 15%. It also shows that in 2009, the debt ratio went to the peak, i.e., around 15% with a minimum of

0.09% and the maximum of 61% implying that most banks had adopted debt financing in the aftermath of the financial crisis.

Figure 1 Bank-wise leverage ratio averaged over 2005–2016 (see online version for colours)

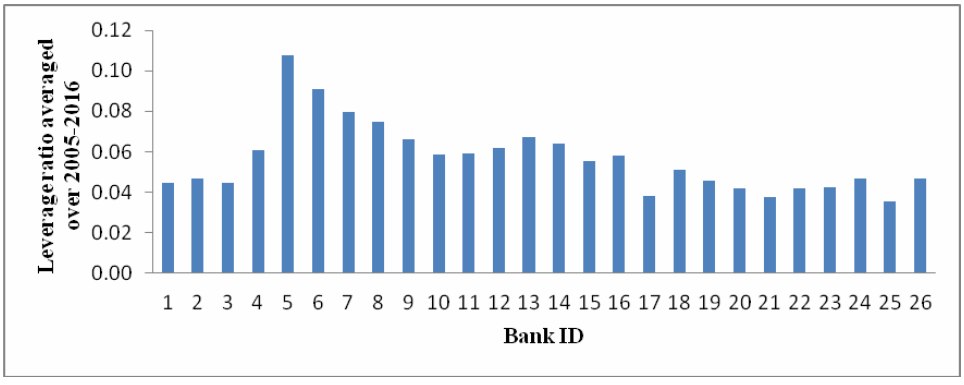

Table 1 Year-wise leverage ratio averaged across banks

Year	*Obs*	*Mean*	*Std. dev.*	*Min*	*Max*
2005	26	0.043	0.025	0.001	0.083
2006	26	0.050	0.025	0.004	0.084
2007	26	0.037	0.028	0.000	0.110
2008	26	0.049	0.027	0.000	0.111
2009	26	0.150	0.167	0.009	0.615
2010	26	0.046	0.033	0.008	0.108
2011	26	0.048	0.030	0.000	0.096
2012	26	0.048	0.019	0.008	0.074
2013	26	0.065	0.028	0.018	0.108
2014	26	0.056	0.031	0.004	0.110
2015	26	0.053	0.022	0.005	0.087
2016	26	0.035	0.023	0.001	0.093

Source: Author's calculations

Table 2 Descriptive Statistics

Variable	*Obs*	*Mean*	*Std. dev.*	*Min*	*Max*
DEBT	312	0.056	0.061	0	0.615
Size	312	14.028	0.903	11.965	16.933
Profitability	312	0.017	0.004	0.004	0.031
Collateral	312	0.008	0.004	0.002	0.027
Liquidity	312	0.602	0.055	0.391	0.706
Fin. strength	312	0.005	0.008	0	0.104

Tables 2 and 3 represent the descriptive statistics and the correlation matrix respectively. From Table 2, it can be observed that the mean borrowing in the sample period is around

5%. This provides the primary motivation to explore the determinants of debt ratio. The possibility of correlation among the variables can be observed from the corresponding correlation matrix of the explanatory variables. Considering a 50% benchmark, it can be concluded from Table 3 that the multicollinearity is less severe. It can also be observed that debt is negatively associated with profitability and financial strength, while it shows a positive association with size, tangibility, and liquidity.

Table 3 Correlation matrix

Variable	*DEBT*	*Size*	*Profitability*	*Collateral*	*Liquidity*	*Fin. strength*
DEBT	1					
Size	0.270***	1				
Profitability	–0.041	0.047	1			
Collateral	0.146***	–0.009	0.004	1		
Liquidity	0.222***	0.409***	0.008	–0.112**	1	
Fin. strength	–0.132***	–0.3479***	–0.122**	0.170***	–0.483***	1

Notes: *** represents statistically significant at 1% level.
** represents significant at 5% level.

The macroeconomic variables were first tested for unit root using the Levin, Lin and Chu (LLC) and Im, Pesaran and Shin (IPS) tests and found that they are stationary. We estimate equations (1) and (2) using the OLS model and equation (3) using the fixed-effects and random-effects models. The standard errors and t-statistics are corrected for heteroscedasticity.

Table 4 presents the regression results of both pooled and static panel data models. The insignificant chi-squared value of the Hausman test indicates that the random-effects model to be chosen over the fixed effects model. However, it can be observed from the table that the results of both fixed effects and the random effects are similar. From these results, it is evident that after controlling for individual heterogeneity, the PSBs debt financing is significantly determined by the bank-specific factors, such as bank size, collateral, and bank liquidity.

After estimating the robust random-effects model, we also test for its validity against the pooled OLS model by employing the Breusch-Pagan Lagrange multiplier (B-P LM) test. The chi-squared value of this test is statistically insignificant at a 5% level implying that the pooled OLS model should be chosen over the robust random-effects model. Thus, the results of pooled OLS have been considered. Nevertheless, the analysis shows similar results in both cases. It can be observed from both pooled OLS and random-effects model that bank size, tangibility, and liquidity are positively and significantly associated with debt. Profitability is turning out insignificant in determining the debt level. It can also be observed that the explanatory power has been improved significantly (the R-squared increased from 11% to 31%) after controlling for macroeconomic factors. The dummy variable appears to be highly significant implying that bank's borrowing is significantly affected by the financial crisis. Further, it is also evident that while economic growth is inversely related to bank borrowings, the inflation turns insignificant.

Finally, I analyse the determinants of bank's debt behaviour in a dynamic panel framework applying the system GMM method. According to Roodman (2009), system GMM is superior to the difference GMM since it allows for more instruments, and thus it

is more efficient. The analysis has been done by employing one step and two steps system GMM methods. It is argued that the asymptotic standard errors from a two-step panel estimator are a poor guide for hypothesis testing due to the large number of instruments used, especially, in the case of a small sample. For this reason, I estimate the one-step system GMM. However, I also re-estimate model 1 and model 2 using a two-step system GMM for the robustness check. The results are reported in Table 5. Following Arellano and Bond (1991) I conduct the post-estimation specification tests for the presence of second-order autocorrelation and the validity of instruments used. It can be observed that both Hansen's J statistic and Arellano and Bond AR (2) statistics are statistically insignificant, implying that the estimated model is consistent with GMM theory.

From Table 5, it is evident that the lagged dependent variable is positive and highly significant. This implies that debt is consistent over time. The coefficients of lagged debt are 0.08 and 0.09 in the one-step system GMM and two-steps system GMM estimations respectively. From these results, it can be inferred that the Indian public sector banks quickly adjust their debts towards the optimal debts, and the speed of adjustments, with $\gamma = (1 - \lambda)$, is approximately 91% to 92% per annum. When the equation is re-estimated after controlling for the crisis dummy and the macroeconomic variables, the results obtained are still similar. The coefficients of lagged debt increased in magnitude, i.e., the coefficients of lagged leverage are 0.13 and 0.12 in the one-step system GMM and two-step system GMM respectively. In this case, the speed of adjustments becomes 87% to 88% per annum.

As far as the other explanatory variables are concerned, Table 5 indicates similar findings with those obtained from the pooled OLS and random effects estimations reported in table 4. The positive association between size and leverage implies that larger banks opt for large debt financing consistent with the trade-off theory. This finding implies that large banks enjoy the scale economies, having less chance to insolvency and thus attract more debt finance at fewer costs. Profitability turns insignificant (although the coefficients are negative), in explaining the debt decision of the banks in the three types of tests considered in this study. Thus, this finding fails to support either the trade-off theory or the pecking order theory in this regard. The reason might be the fact that the public sector banks earn, on average, only 1% of profit compared to their total assets and thus their earning might not influence their capital structure decision. Tangibility appeared to be significant at a 10% level and positively influence the debt level when the regression model estimated by only considering the bank-specific factors. This seems to support the theoretical predictions based on both the trade-off theory and the pecking order theory. However, this variable turns insignificant once the macroeconomic factors are controlled for.

Bank liquidity turned highly significant and positively associated with the banks' debt decision. This finding strongly supports the prediction in line with the trade-off theory. It implies that banks might choose higher debt financing to provide higher short term loan facilities to the corporate sectors. The variable financial strength appeared negative and insignificant when considered only bank-specific factors; however, it turned out significant at 10% level with the same sign once the crisis dummy and macroeconomic variables are incorporated into the regression. Economic growth has a significant and negative effect on the banks' borrowings is evident in the system GMM estimation. This finding indicates that well off the economic condition lower is the banks' debt decision.

Finally, the significant dummy variable implies the evidence of a difference in debt level between the crisis and non-crisis period.

Table 4 Regression results (static panel data models)

Variable	*Pooled OLS (robust)*		*Static panel data analysis*		
	Model 1	*Model 2*	*Fixed effects*	*Random effects*	*Random effects (robust)*
Size	0.014 [6.76]***	0.012 [5.83]***	0.014 [3.53]***	0.014 [3.47]***	0.011 [5.13]***
Profitability	–0.802 [–1.08]	–0.632 [–0.96]	–0.503 [–0.53]	–0.779 [–1.00]	–0.695 [–0.98]
Collateral	2.540 [1.70]*	0.505 [0.44]	2.553 [3.05]***	2.542 [3.12]***	0.240 [0.21]
Liquidity	0.160 [3.96]***	0.157 [3.98]***	0.146 [2.00]**	0.158 [2.23]**	0.152 [3.95]***
Fin. strength	–0.184 [–0.92]	–0.543 [–1.70]*	–0.226 [–0.49]	–0.189 [–0.43]	–0.620 [–1.83]*
Dummy_09		0.103 [3.09]***			0.104 [3.19]***
Inflation		–0.0002 [0.38]			
GDP growth		–0.0022 [–2.27]**			
Cons.	–0.242 [–6.08]***	–0.195 [–4.30]***	–0.244 [–3.75]***	–0.243 [–3.82]***	–0.192 [–4.43]***
Obs.	312		312		312
F-stat/Wald χ^2	23.83***	36.62***	7.86***	41.48***	464.33***
R^2	0.119	0.315	R^2 within = 0.122 R^2 between = 0.067 R^2 overall = 0.118	R^2 within = 0.122 R^2 between = 0.080 R^2 overall = 0.119	R^2 within = 0.332 R^2 between = 0.061 R^2 overall = 0.311
			F test that all $u_i = 0$: F(25, 281) = 0.99 Pr > F = 0.477	rho = 0.010 (fraction of variance due to u_i)	rho = 0.038 (fraction of variance due to u_i)
Hausman test	$\chi^2(5) = 1.32$ $Pr > \chi^2 = 0.932$ (RE chosen over FE)				
B-P LM test for random effects	$\bar{}\chi^2$ (01) = 0.01 Pr > $\bar{}\chi^2$: 0.451 (POLS have chosen over RE)			$\bar{}\chi^2$ (01) = 0.95 Pr > $\bar{}\chi^2$: 0.164 (POLS have chosen over Robust RE)	

Notes: *** represents statistically significant at 1% level; ** represents significant at 5% level; * represents significant at 10% level; t-statistics are corrected for heteroscedasticity and reported in [ ]; model 1 estimates the bank-specific determinants of leverage, and model 2 estimates the determinants of leverage by incorporating the after crisis dummy and macroeconomic factors.

Table 5 Results of dynamic panel data analysis (System GMM)

Variables	*One-step system GMM (robust)*		*Two-step system GMM (robust)*	
	Model 1	*Model 2*	*Model 1*	*Model 2*
$DEBT_{t-1}$	0.085 [2.65]***	0.139 [3.63]***	0.090 [2.51]**	0.120 [2.47]**
Size	0.013 [9.78]***	0.012 [6.04]***	0.013 [8.41]***	0.012 [6.41]***
Profitability	–0.913 [–1.07]	–0.827 [–0.98]	–0.866 [–0.74]	–1.072 [–0.95]
Collateral	2.94 [1.94]*	1.148 [0.96]	2.886 [1.88]*	1.274 [1.11]
Liquidity	0.137 [4.78]***	0.152 [3.92]***	0.144 [2.87]***	0.167 [4.03]***
Fin. strength	–0.224 [–0.97]	–0.577 [–2.00]**	–0.184 [–0.46]	–0.498 [–1.11]
Dummy_09		0.106 [3.43]***		0.110 [4.10]***
Inflation		–0.0005 [–1.16]		–0.0001 [–0.21]
GDP growth		–0.0042 [–4.20]***		–0.0037 [–3.62]***
Cons.	–0.229 [–7.02]***	–0.186 [–4.93]***	–0.234 [–4.72]***	–0.193 [–3.87]***
No. of obs.	286	286	286	286
No. of instruments	126	129	126	129
Wald χ^2	184.61***	438.86***	161.40***	317.38***
	Specification tests			
A-B AR(1)	–2.05**	–2.18**	–1.85*	–1.91*
A-B AR(2)	–0.10	0.84	–0.06	0.70
Sargan	199.09***	197.87***	199.09***	197.87***
Hansen	25.09	20.20	25.09	20.20

Notes: *** represent statistically significant at 1% level, ** represents significant at 5% level, and * represents significant at 10% level; t-statistics are corrected for heteroscedasticity and reported in [ ]; model 1 estimates the bank-specific determinants of leverage, and model 2 estimates the determinants of leverage by incorporating the after crisis dummy and macroeconomic factors.

5 Concluding remarks

In recent years, the importance of the capital structure of firms has been extended to the banking sectors, especially after the realisation of the financial crisis and the guideline of Basel III. This motivates an increasing body of scholars, both in the academic and professional level, to examine the capital structure decision of banks and the factors determining bank capital structure decision. This study examines the borrowing behaviours of the public sector banks in India by extracting data from 2005 to 2016

periods. A balanced panel of 26 public sector banks over 12 years is formed, and both static as well as dynamic panel data methods, along with the pooled OLS method are employed. The findings largely support the arguments of the trade-off theory of corporate finance literature.

The main findings of the study may be summarised as follows:

1 The lagged debt ratio positively explains the banks' debt decision, and it is found that the public sector banks adjust the actual debt towards the optimal debt very quickly with a speed of adjustment of around 92% per annum.

2 Three out of five bank-specific determinants, namely bank size, tangibility, and liquidity are found to significantly determine banks' debt level. All of them have a positive impact on bank debt. Profitability is found to be insignificant in explaining the bank's debt decision.

3 With the presence of macroeconomic variables and an after crisis dummy, financial strength turned out significant and negative influence on leverage.

4 The dummy variable is significant in explaining the differences in borrowing decisions of banks in the crisis and non-crisis period.

5 Out of the two macroeconomic variables considered in this study, economic growth is found to be inversely associated with the debt financing decision of banks while the rate of inflation is insignificant.

Thus, it can be concluded that the standard determinants of leverage as discussed in the corporate finance literature also hold for public sector banks in India, except the profitability. The positive relationship between bank size and banks' debt implies that larger banks might enjoy the economies of scale, access to better conditions in credit facilities and might take advantage of lower information asymmetry and thus go for more debt financing than smaller banks. The higher the commitment to provide loans and advances higher is debt financing. And finally, the well-off of the overall economic growth of the country banks may have high confidence in generating revenue from sources other than debt and thus reduce the debt financing.

While these findings have important practical implications both in academic as well as the policy perspective, it is limited to only the public sector banks in India with five standard bank-specific factors. Thus, future studies may include more such factors, for instance, the risk-taking ability of banks, taxes paid, etc. extending it to all the commercial banks, and may compare the findings for the public, private and foreign banks.

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Notes

1 It should be noted that the ten public sector banks are now (in 2019) merged with four big public sector banks, i.e., Syndicate Banks merged with Canara Bank, Allahabad Bank merged with Indian Bank, Oriental Bank of Commerce and United Bank of India are merged with Punjab National Bank, and Andhra Bank and Corporation Banks are merged with Union Bank Of India. Thus the total number of public sector banks now is reduced to 12 and similarly, the total number of private sector banks is now reduced to 22.