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India's Banks: Lending to Productive Firms?

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Prepared by Siddharth George, Divya Kirti, Soledad Martinez Peria, and Rajesh Vijayaraghavan*

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ABSTRACT: Capital misallocation is widely thought to be an important factor underpinning productivity and income gaps between advanced and emerging economies. This paper studies how well Indian banks allocate capital across firms with varying levels of productivity. The analysis reveals that the link between productivity and bank credit growth is weaker for firms with significant ties to public sector banks, especially in years when public sector banks represent a large share of new credit. Large flows of credit to unproductive firms represent important missed growth opportunities for more productive firms. These results suggest that measures to improve governance of public sector banks, potentially including privatization, would help reduce capital misallocation.

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* Yang Liu, Armaghan Naveed, and François-Clément Charbonnier provided excellent research assistance.

WORKING PAPERS

India's Banks: Lending to Productive Firms?

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Introduction

Capital misallocation is widely thought to be an important factor underpinning productivity and income gaps between advanced and emerging economies.¹ In the case of India, several studies suggest that the extent of capital misallocation, reflected in an unusually high dispersion of productivity across firms, is large (Hsieh and Klenow 2009). The literature has examined a wide range of potential drivers of capital misallocation, ranging from property rights and contract enforcement to licensing rules and infrastructure.²

Capital misallocation could also be driven by credit market misallocation, with credit flowing to less productive firms, and more productive firms facing credit constraints that impede growth. Moreover, credit misallocation might give rise to a large presence of zombie—i.e., unviable—firms, which can be a barrier to the entry and growth of other firms. This phenomenon has been shown not only for Japan (Caballero, Hoshi, and Kashyap 2008), and other OECD countries (McGowan, Andrews, and Millot 2017), but also in the case of India (Chari, Jain, and Kulkarni 2021).

Since banks in India are an important source of finance for the economy, it is critical to understand how banks allocate credit, particularly public sector banks (PSBs), which are majority owned by the government and play an outsized role in credit markets. Banerjee, Cole, and Duflo (2004) examine the allocation of credit across sectors in India comparing the behavior of PSBs and private banks, finding that the former lend more to agriculture, rural areas, and the government and less to trade, transport, and finance. Research has also shown that bank lending allocation in India is sensitive to election cycles. Cole (2009) finds that PSBs increase agricultural credit during election years, but that these lending booms are not associated with larger agricultural output. Kumar (2020) goes further, showing that bank lending to farmers increases before elections at the expense of lending to manufacturing firms, which cut their production and operate below full capacity. D'Souza and Surti (2021) develop a model in which state-owned banks tend to lend excessively to previously bad borrowers when they benefit from public guarantees that are not dependent on the prompt recognition of loan losses. They argue that their model is consistent with credit dynamics in India. Finally, Chakraborty, Javadekar, and Ramcharan (2021) examine how branch deregulation affects bank lending in India and find that PSBs reduce their lending to poorly performing firms (i.e., those with low return on assets) when branching expands in a district, suggesting that competition has a positive impact on credit allocation. Despite this active literature, the link between bank lending and firm-level productivity in India is not well understood.

This paper studies how well Indian banks allocate capital across firms with varying levels of productivity. It develops simple metrics to investigate whether firms' productivity is associated with more financing from banks, and then examines whether this association depends on the extent to which firms maintain banking relationships with PSBs and the share of new credit in the economy provided by these banks.

The analysis shows a stark difference between firms with and without significant ties to PSBs in the importance of productivity in determining the allocation of credit in years where PSBs account for a large share of new credit. Credit growth is strongly associated with productivity for firms with limited reliance on PSBs. For firms that do heavily rely on PSBs, the relationship between credit growth and productivity is weaker.

¹ A survey of this literature can be found in Restuccia and Rogerson (2017).

² Prior work has examined the role of property rights and contract enforcement (Bloom and others 2013), land regulation (Duranton and others 2015), industrial licensing (Chari 2011; Alfaro and Chari 2015), privatization (Gupta 2005; Dinç and Gupta 2011), reservation laws (Garcia-Santana and Pijoan-Mas, 2014; Martin, Nataraj, and Harrison 2017; Rotemberg 2019), highway infrastructure (Ghani, Goswami, and Kerr 2016), roads (Asher and Novosad 2020), electricity shortages (Allcott, Collard-Wexler, and Connell 2016), labor regulation (Amirapu and Gechter 2019), land market frictions (Sood 2020), and capital market integration (Bau and Matray 2020).

The findings are driven by large firms, which receive the bulk of corporate credit in India. While large firms that tend to have more ties with PSBs see stronger growth in years in which these banks account for a larger share of new credit, this credit growth is concentrated in unproductive firms. These results do not change when the analysis controls for the extent to which firms have ties with banks that are less capitalized, rely more on sticky deposit funding, and have higher ratios of nonperforming or restructured loans. This suggests that the effects of firms' reliance on PSBs are most likely related to these banks' governance and supervision as opposed to performance. Hence, adoption of policies that aim to improve the governance and supervision of PSBs or that reduce public bank ownership (via privatizations) may be necessary to address the misallocation of credit in the economy and hence foster economic growth.

The results imply that reallocating the credit channeled to large unproductive firms by Indian banks could markedly lift the amount of credit available to more productive large firms. A simple counterfactual exercise for 2010–2014, a period during which PSBs had a large overall footprint that excludes the impact of the global financial crisis, indicates that shifting half of the credit allocated by banks to large unproductive firms to more productive large firms could have raised credit growth for the more productive firms from 9 to more than 13 percentage points per year. Credit growth would have risen to over 17 percentage points if all the credit to unproductive firms were to be allocated to more productive firms. In the context of meaningful credit constraints for firms (Banerjee and Duflo 2014), this represents an important missed opportunity.

The remainder of the paper describes the data, presents some stylized facts, and then turns to our empirical findings before concluding.

Data

The analysis combines firm-level balance sheet and income statement data for non-financial firms from Centre for Monitoring Indian Economy (CMIE) Prowess with bank-level balance sheet and income statement data from the Database of Indian Economy (DBIE) from the Reserve Bank of India (RBI).³ In addition to the financial statement items, DBIE also includes information on bank-level nonperforming assets and restructured loans, and selected performance and financial soundness ratios for scheduled commercial banks.⁴

The paper matches firm-level bank information from Prowess to bank financial information from the DBIE database. Given that there is no common identifier between the Prowess and RBI databases, the paper matches the list of firms' banks (reported in the variable "Banker") in the Prowess database to the banks in the RBI database using a name-matching approach. First, the list of all bank names in the RBI DBIE database is standardized to ensure consistency. The analysis then relies on descriptions provided by RBI of bank name changes to construct a list of bank names at the year level.⁵ The paper implements an algorithm that begins with a fuzzy match, by year, between bank names in the Prowess data and the list of banks in the RBI database. It then manually confirms the accuracy of this match. The approach matches over 99 percent of the bank–firm links reported by Prowess firms in the sample described below.⁶

The main variables of interest from Prowess for our analysis are the stock of bank credit and the variables used to measure firm capital productivity, namely: sales and physical capital (net plants, property, and equipment). We also collect other variables from Prowess to control for firm characteristics beyond productivity, including firm

³ Bank-level data can be downloaded at <https://dbie.rbi.org.in/DBIE/dbie.rbi?site=statistics>.

⁴ Commercial banks that maintain required cash reserves with RBI are listed on the second schedule of the Reserve Bank of India Act (1934) and hence referred to as scheduled commercial banks. See <https://rbi docs.rbi.org.in/rdocs/Publications/PDFs/RBIA1934170510.PDF>.

⁵ See Notes on Tables at <https://dbie.rbi.org.in/DBIE/dbie.rbi?site=publications#!4>.

⁶ See Chari, Jain, and Kulkarni (2021) and Ghosh, Narayanan and Garg (2021) for examples of other work matching Prowess and RBI based on bank names.

size (log of assets), age (in years), sector (as measured by 5-digit level National Industrial Classification codes),⁷ location (measured at the district level), sales growth (log growth in sales), leverage (debt to assets ratio), and interest coverage (earnings before taxes to interest expenses). The paper also collects information on the firm ownership type (including government ownership).

The focus of the paper is on studying how the link between firm productivity and the growth of bank credit changes depending on the characteristics of the banks that firms borrow from. Hence, the paper uses RBI data to construct bank-level variables that identify banks' ownership (public, new private and other),⁸ capitalization (capital to asset ratio), funding mix (share of non-deposit liabilities), and asset quality (nonperforming plus restructured loans to assets ratio). In firm-level analyses, the analysis collapses these variables to the firm-year level by weighting by bank loans among the set of banks listed by the firm in that year.

The datasets cover the period 2005–2020. In the regression analysis described below, the sample includes firms in the following sectors: manufacturing, electricity and gas supply, construction, wholesale and retail trade, transportation, accommodation and food services, information and communication, professional and scientific activities, administrative and support service activities, and other service activities.⁹ The sample is restricted to firms with at least five years of non-missing data on total assets, net plant, property and equipment, sales, total borrowing and bank borrowing. The analysis also imposes the condition that there be at least 5 firms in each 5-digit National Industrial Classification sector-year pair. Lenders not included in the RBI database are dropped from the analysis. The sample is also restricted to firms for which there is a non-missing data on the firm-level controls and at least one bank reported by the firm with matched data from RBI.

Stylized Facts

The paper presents four stylized facts about banks in India and the allocation of credit. First, it documents that PSBs account for a sizeable share of bank credit. Since 2005, PSBs have accounted for 60–80 percent of outstanding loans, with total loans growing to about 100 trillion rupees, more than 50 percent of GDP, by 2020 (Figure 1). Most of the remaining credit is disbursed by “new private banks”. These banks commenced operations following banking sector reforms introduced in 1993 to allow private entry to induce greater competition. However, this average figure masks significant year-to-year variation in the share of new credit from public sector banks relative to other banks (Figure 2). This number varies from less than 20 percent in some years (e.g., 2016 and 2017) to over 90 percent in other years (e.g., 2009, 2010). The analysis in this paper documents below that this appears to be associated with the efficiency of credit allocation in each year.¹⁰

Second, the analysis documents that PSBs have higher nonperforming asset ratios (including restructured loans, as in Chari, Jain, and Kulkarni 2021), lower Tier 1 capital ratios and a lower share of non-deposit liabilities than the new private banks (Figure 3). PSBs broadly operate at similar scales to new private banks; both are considerably larger than other banks (Figure 3).

⁷ Prowess provides National Industrial Classification codes based on the 2008 classification. 5-digit National Industrial Classification codes identify highly granular industries. Examples of 5-digit National Industrial Classification industries in our sample include *manufacture of hot-rolled and cold-rolled products of steel* (24105), *finishing of cotton and blended cotton textiles* (13131), *sale of motor vehicle parts and accessories* (45300), and *publishing of newspapers* (58131).

⁸ The paper follows RBI (2021) in identifying Axis Bank, Bandhan Bank, DCB Bank Limited, HDFC Bank, ICICI Bank, IDBI Bank Limited, IDFC First Bank, IndusInd Bank Ltd, Kotak Mahindra Bank, and Yes Bank as new private banks.

⁹ The paper retains firms in Sections C, D, F, G, H, I, J, M, N, and S in the sample. Manufacturing firms (Section C) account for about 60 percent of assets and bank credit in the sample.

¹⁰ While strong lending by PSBs in the aftermath of the global financial crisis appears to have had costs related to poor allocation of credit, it may also have supported broader economic performance by avoiding a credit crunch.

Third, the analysis finds that a significant fraction of new bank credit is extended to unproductive firms (Figure 5). In an average year, around 45 percent of new bank credit is allocated to unproductive firms (firms with sales to physical capital ratios in the bottom tercile within industry-year).¹¹ Moreover, since nearly all new credit goes to large firms (Figure 4), credit misallocation in India is a phenomenon that takes place within the sample of large firms (Figure 5).

Fourth, this average number belies significant year-to-year variation in the share of credit going to unproductive firms (Figure 5). In 2015, less than 10 percent of new credit went to unproductive firms, while this figure was over 80 percent in 2018. One important correlate of the quality of credit allocation, as Figure 5 shows, is the share of new credit in the year that is disbursed by public sector banks.

The next section investigates the link between firm productivity and bank credit growth more systematically by examining the correlation within granular industries and districts and including a battery of bank and firm controls.

Empirical Specifications

To explore the link between bank credit growth, firm productivity, and bank ownership, the analysis starts by estimating specification (1) below:

$$C_{it} = \alpha + \beta_1 \text{Productivity}_{it-1} + \beta_2 \text{PSB dependence}_{it-1} + \beta_3 \text{Productivity}_{it-1} * \text{PSB dependence}_{it-1} + \beta_4 \text{Productivity}_{it-1} * \text{PSB share of credit}_{t-1} + \beta_5 \text{PSB share of credit}_{t-1} * \text{PSB dependence}_{it-1} + \beta_6 \text{Productivity}_{it-1} * \text{PSB share of credit}_{t-1} * \text{PSB dependence}_{it-1} + \theta X_{it-1} + \delta_{st} + \mu_{dt} + \varepsilon_{it} \quad (1)$$

where the dependent variable, C_{it} , denotes the bounded annual growth in the stock of bank credit received by firm i (i.e., credit granted to firm i by all banks) at time t .¹² $\text{Productivity}_{it-1}$ is the lagged ratio of sales to physical capital.¹³ The analysis identifies firm-level reliance on PSBs by combining two measures. First, *PSB dependence*, which varies by both firm and time, defined as the weighted share of PSBs with which a firm has banking relationships, where the weights are based on each bank's share of total lending in that year.¹⁴ Second, *PSB share of credit*, which captures the importance of PSBs in new lending over time, defined as the proportion of new loans granted by PSBs in each year. In contrast to PSB dependence, which varies by both firm and time, the PSB share of credit captures the importance of PSBs in new lending over time.¹⁵ X_{it-1} are firm level controls for size (log assets), sales growth (log growth in sales), leverage (debt-to-asset ratio), interest coverage ratio, and ownership.¹⁶ δ_{st} are sector-time fixed effects and μ_{dt} are district-time fixed effects. Sector-time fixed effects are important: the ratio of sales to physical capital is a tighter proxy for productivity within industry (Bau and Matray 2020).

While the direct impact of productivity on credit growth (measured by β_1 and all interactions of productivity with other terms) is also relevant, the main coefficient of interest is β_6 , which captures the extent to which firm credit growth varies depending on the extent to which the firm's banking relationships are concentrated among PSBs and the importance of these banks in providing new credit each year relative to other banks in the system. A

¹¹ Unreported analysis finds that credit allocated to state-owned firms does not account for a large share of credit allocated to unproductive firms in most years.

¹² The bounded growth of credit is defined as $\frac{C_{it} - C_{it-1}}{(C_{it} + C_{it-1})/2}$ and can take values between -200 and 200 percentage points.

¹³ To be precise, the ratio of sales to physical capital captures average revenue productivity of physical capital. Variation in this ratio within granular industries is used in the literature to proxy for the marginal revenue product of capital (e.g. Bau and Matray 2020).

¹⁴ Because this analysis cannot rely on data on how much each bank lends to each firm, it uses the share of total advances outstanding for each bank in a given year as a weight because the expectation is that banks with a larger portfolio would have a greater ability to lend to firms with which they maintain relationships and on average are expected to account for larger shares of lending to these firms.

¹⁵ PSB share of credit does not enter by itself in the equation because its effect is already captured by the sector-time fixed effects.

¹⁶ To control for firm ownership, the analysis includes a state ownership dummy and an ownership excluding large private group dummy.

negative sign on β_6 would indicate that during periods where a large share of new lending is provided by PSBs, productive firms which rely predominately on relationships with public sector banks obtain lower credit growth relative to other firms.

Because large firms account for most of the new credit provided by banks in India, it is important to consider the role of firm size in examining the link between credit growth, firm productivity, firm dependence on PSBs and the share of new credit provided by these banks. To do so the analysis estimates equation (2) below:¹⁷

$$C_{it} = \alpha + \text{Productivity}_{it-1}[\beta_1 + \beta_2\text{PSB dependence}_{it-1} + \beta_3\text{PSB share of credit}_{t-1} + \beta_4*\text{PSB share of credit}_{t-1}*\text{PSB dependence}_{it-1} + \text{Log of assets}_{it-1}(\beta_5 + \beta_6\text{PSB dependence}_{it-1} + \beta_7\text{PSB share of credit}_{t-1} + \beta_8\text{PSB dependence}_{it-1}*\text{PSB share of credit}_{t-1})] + \text{PSB dependence}_{it-1}[\beta_9 + \beta_{10}*\text{PSB share of credit}_{t-1} + \text{Log of assets}_{it-1}(\beta_{11} + \beta_{12}\text{PSB share of credit}_{t-1})] + \theta X_{it-1} + \delta_{st} + \mu_{dt} + \varepsilon_{it} \quad (2)$$

In estimating equation (2), the interest is in comparing β_4 to β_8 . In other words, the goal is to determine whether credit growth among productive firms that depend on PSBs, during periods where the latter account for a large share of new credit, changes depending on the size of the firm.

Finally, even though the focus is on the impact of bank ownership in shaping the relationship between firm credit growth and productivity, it is important to allow for the possibility that other bank characteristics (such as, capitalization, funding mix, and asset quality) might also matter. To do so an expanded version of equation (2) is estimated in which *Bank characteristics* and the corresponding interactions are added, in a similar fashion to the way *PSB dependence* above is treated.

$$C_{it} = \alpha + \text{Productivity}_{it-1}[\beta_1 + \beta_2\text{PSB dependence}_{it-1} + \beta_3\text{PSB share of credit}_{t-1} + \beta_4*\text{PSB share of credit}_{t-1}*\text{PSB dependence}_{it-1} + \beta_5\text{Bank characteristics}_{it-1} + \beta_6*\text{PSB share of credit}_{t-1}*\text{Bank characteristics}_{it-1} + \text{Log of assets}_{it-1}(\beta_7 + \beta_8\text{PSB dependence}_{it-1} + \beta_9\text{PSB share of credit}_{t-1} + \beta_{10}\text{PSB dependence}_{it-1}*\text{PSB share of credit}_{t-1} + \beta_{11}\text{Bank characteristics}_{it-1} + \beta_{12}\text{Bank characteristics}_{it-1}*\text{PSB share of credit}_{t-1})] + \text{PSB dependence}_{it-1}[\beta_{13} + \beta_{14}*\text{PSB share of credit}_{t-1} + \text{Log of assets}_{it-1}(\beta_{15} + \beta_{16}\text{PSB share of credit}_{t-1})] + \text{Bank characteristics}_{it-1}[\beta_{17} + \beta_{18}*\text{PSB share of credit}_{t-1} + \text{Log of assets}_{it-1}(\beta_{19} + \beta_{20}\text{PSB share of credit}_{t-1})] + \theta X_{it-1} + \delta_{st} + \mu_{dt} + \varepsilon_{it} \quad (3)$$

The purpose of equation (3) is to test whether the association between productivity, PSB dependence, and the share of new credit provided by PSB banks changes once other bank characteristics are controlled for capturing capitalization, asset quality, and funding mix.

Results

Table 1 shows the formal empirical results on how the extent of firms' links with PSBs affect the allocation of bank credit. The dependent variable in the regressions shown on Table 1 is the bounded growth in firms' bank credit, in percentage points. The first column examines the role of links to PSBs in shaping the allocation of bank credit without separating firms by size. The second column allows for differences between small and large firms. The final column accounts for the impact of bank characteristics beyond ownership. This section describes the results from each of these exercises in turn.

The first column of Table 1 relates bank credit growth to firm characteristics, relying on within industry-year and within district-year variation following Equation (1). The main firm-level characteristics of interest are productivity (sales per unit of physical capital), PSB dependence (fraction of links with PSBs, weighted by the share of credit at the bank level), and their interaction. The combination of PSBs' share of overall bank credit in each year and

¹⁷ In equation (2) log of assets is included among the firm characteristics represented by X..

PSB dependence at the firm-year level provides a time-varying proxy for the importance of PSBs for each firm over time. Below we discuss results including additional firm-level characteristics as controls.

When and where PSBs are more important sources of bank credit, a weaker link is found between productivity and bank credit growth at the firm level. The interaction between PSBs' share of credit in each year and PSB dependence at the firm-year level provides the sharpest proxy of the importance of PSBs. Importantly, the first column of Table 1 shows that firms with higher PSB dependence see considerably stronger credit growth in years where PSBs account for a larger share of overall credit (positive and statistically significant interaction coefficient between PSB share of credit (t-1) and PSB dependence (i,t-1)). However, this credit growth is not concentrated in productive firms: the link between productivity and credit growth is weaker for PSB dependent firms in years when PSBs account for a large share of overall credit (negative and statistically significant interaction coefficient between PSB share of credit (t-1), Productivity (i, t-1), and PSB dependence (i,t-1)). While these coefficients have a clear connection to the link between the presence of PSBs and allocation of credit, other coefficients in the first column of Table 1 are hard to interpret in isolation. For example, the small negative and statistically insignificant coefficient for Productivity (i, t-1) alone does not imply that productive firms generally see slower credit growth, as the specification includes several terms interacted with Productivity (i, t-1). Therefore, we now turn to figures that illustrate the combined implications of all coefficients in this specification for credit growth for different groups of firms.

More precisely, the analysis finds that the combination of a larger footprint of PSBs over time and across firms is associated with greater misallocation of bank credit. Panels A and B of Figure 6 show the estimated sensitivity of bank credit to productivity at the firm level for firms with different levels of productivity and for different combinations of firm-level PSB dependence and PSB share of overall credit considering all of the estimated coefficients in the first column of Table 1, evaluated at appropriate points.¹⁸ Panel A focuses on periods when PSBs account for a large share of overall credit. Credit growth for firms with high PSB dependence is shown in purple, while credit growth for firms with low PSB dependence is shown in yellow. In years in which PSBs account for a large share of overall credit, low productivity firms with low dependence on PSBs see very low credit growth, while high productivity firms with low dependence on PSBs see strong credit growth. In other words, credit growth strongly responds to productivity for firms with low PSB dependence. Crucially, the link between productivity and credit growth is weaker for firms with high PSB dependence. Low productivity firms with high PSB dependence obtain credit growth to about the same degree as medium productivity firms with low PSB dependence. This credit growth for low productivity firms represents a missed opportunity to channel credit to more productive firms. In contrast, panel B shows that in years where PSBs account for a small share of credit, while all firms struggle to obtain credit, there is little difference in the importance of productivity in determining credit growth between firms with high PSB dependence and firms with low PSB dependence.

Importantly, the link between PSBs' footprint and misallocation of credit is concentrated in larger firms. As discussed earlier, large firms dominate overall volumes of new credit, and high shares of credit allocated to large, unproductive firms constitute an important signal of credit misallocation. The second column of Table 1 introduces interactions of all of the coefficients included in the first column with firm size (log of assets), following equation (2). The results are concentrated in large firms. Large firms with higher PSB dependence see stronger credit growth in years where PSBs account for a larger share of overall credit (positive and statistically significant interaction coefficient between Log assets (i,t-1), PSB share of credit (t-1), and PSB dependence (i,t-1)). Again, this credit growth is not concentrated in productive firms: the link between productivity and credit growth is weaker

¹⁸ Low, medium, and high productivity are evaluated at sales to physical capital ratios (standardized to have unit variance) of 0.1, 1.5, and 3, respectively. Years with high and low PSB shares of credit are evaluated at 90 percent and 0 percent PSB share of credit in year, respectively. High and low PSB dependence are evaluated at PSB dependence of 10 percent and 90 percent, respectively.

for large PSB dependent firms in years when PSBs account for a large share of overall new credit (negative and statistically significant interaction coefficient between Log assets ($i,t-1$), PSB share of credit ($t-1$), Productivity ($i,t-1$), and PSB dependence ($i,t-1$)). As discussed earlier, other coefficients in the second column of Table 1 are hard to interpret in isolation. For example, the positive and statistically significant coefficient on Productivity ($i,t-1$) does not imply that all productive firms see stronger credit growth, as the specification includes several terms interacted with Productivity ($i,t-1$). The paper therefore turns to figures that illustrate the combined implications of all coefficients in this specification.

A greater role of PSBs is associated with stark differences in the allocation of credit for large firms. Panels C and D of Figure 6 show the estimated sensitivity of bank credit to productivity at the firm level for firms with different sizes and levels of productivity and for different combinations of firm-level PSB dependence and PSB share of overall credit considering all of the estimated coefficients, evaluated at appropriate points, in the second column of Table 1.¹⁹ Both panels focus on periods when PSBs account for a large share of overall credit. Panel C shows that large low productivity firms with high PSB dependence obtain stronger credit growth than large high productivity firms with high PSB dependence—nearly 4 percent credit growth per year. For large firms with low PSB dependence, on the other hand, credit growth is driven much more strongly by productivity. Again, the final quadruple interaction term in the second column of Table 1 shows that this difference is statistically significant. Panel D of Figure 6 shows a strong positive link between credit growth and productivity for small firms regardless of the level of PSB dependence. The analysis therefore finds a link between the footprint of PSBs in channeling credit and the quality of the allocation of credit with data at the firm level that corresponds to the aggregate patterns in the time series.

Improved allocation of credit could substantially increase the supply of credit to available firms. Figure 6 shows that when PSBs account for a large share of overall credit, large firms with low productivity with high PSB dependence are able to obtain meaningful credit growth. In contrast, large firms with low productivity but low PSB dependence obtain very little credit growth. Shifting some of the credit channeled to large unproductive firms by Indian banks could markedly lift the amount of credit available to more productive large firms. Figure 7 shows a simple counterfactual exercise between 2010-2014 (as Figures 2 and 4 show, this period is of interest as it represents years with a large overall footprint of PSBs and excludes the impact of the global financial crisis). Over these years, more productive large firms saw credit growth of 9 percentage points per year on average. Shifting even half of the credit allocated by banks to large unproductive firms during this period to more productive large firms could have raised credit growth for these more productive firms by nearly 50 percent (to 13.3 percentage points per year). Shifting all credit allocated to unproductive firms to more productive firms could have almost doubled credit growth for the more productive firms (to 17.3 percentage points per year). Efforts to improve the manner in which Indian banks allocate credit could therefore have important implications for aggregate productivity and economic growth.

The link between the importance of PSBs and the allocation of credit appears to reflect fundamental differences between PSBs and other banks. As mentioned above, PSBs differ from other banks on a variety of dimensions that could, in principle, matter for the allocation of credit. PSBs are less well capitalized, have weaker asset quality, and are more reliant on sticky deposit funding. The third column of Table 1, following equation (3) shows that characteristics more fundamental to the way PSBs operate—rather than these observable differences—appear to drive the results. For each characteristic (a loan-weighted average at the firm level for banks the firm has links to), the specification adds all terms and interactions included for PSB dependence in the second column of Table 1. The analysis continues to find a role for PSB dependence in explaining the flow of credit to large

¹⁹ Large and small firms are evaluated at log assets of 5 and 10, respectively (assets in millions of rupees prior to logs). See footnote 18 for details on evaluation in other dimensions.

unproductive firms: the interaction coefficient between Log assets ($i,t-1$), PSB share of credit ($t-1$), Productivity ($i,t-1$), and PSB dependence ($i,t-1$) continues to be negative and statistically significant, with a similar magnitude to the second column of Table 1.

Conclusion

The Indian banking sector is characterized by a large presence of PSBs. This paper has examined credit allocation in India by assessing the link between firm productivity and credit growth. It investigated how this link depends on (i) the extent to which firms maintain banking relationships with PSBs and (ii) the share of new credit in the economy provided by these banks.

The estimations show that the link between productivity and credit growth is weaker for PSB dependent firms in years when PSBs represent a large share of new credit in the economy. This result is driven by large firms, which account for most of the credit in India and is robust to controlling for other important bank characteristics.

From a policy perspective, the findings suggest that—in addition to important policies to strengthen PSBs such as through further recapitalization and the establishment of the [National Asset Reconstruction Co \(NARCL\)](#) to resolve bad PSB assets—plans announced by the government and RBI to privatize additional PSBs and to improve the quality of governance at PSBs more broadly could have an important role to play (IMF 2021). Acharya and Rajan (2020) review a broad range of options to improve governance of PSBs, including independent and representative boards, both partial and full privatization, and more market-based implementation of policy mandates for the banking sector. Similarly, as suggested by D'Souza and Surti (2021), improving RBI's supervisory powers vis a vis PSBs might also help to reduce credit misallocation. In particular, as with private banks, RBI should have the ability to replace management and board members from PSBs, withdraw their bank licenses and commence the resolution of failing PSBs.

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Figure 1: Outstanding bank credit by bank ownership type

Notes: This figure shows the share of public sector banks (PSBs), new private banks, and other banks in the total stock of advances outstanding by year (left hand axis), as well as the total stock of advances (right hand axis).

Sources: RBI, calculations by authors

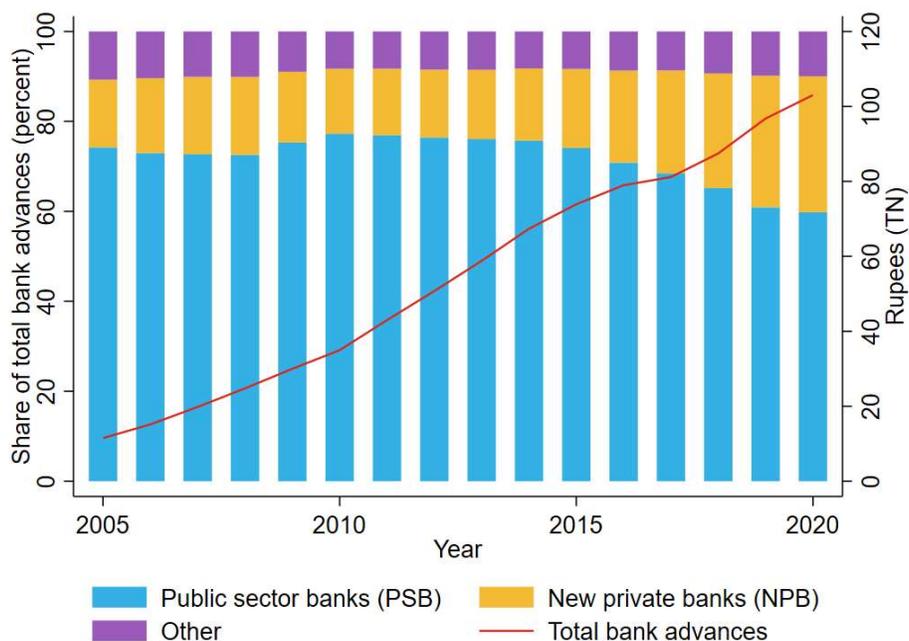


Figure 2: New bank credit by bank ownership type

Notes: This figure shows new bank credit (change in stock of advances since the previous year) by year, breaking out bank types, in trillions (lakh crores) of rupees.

Sources: RBI, calculations by authors

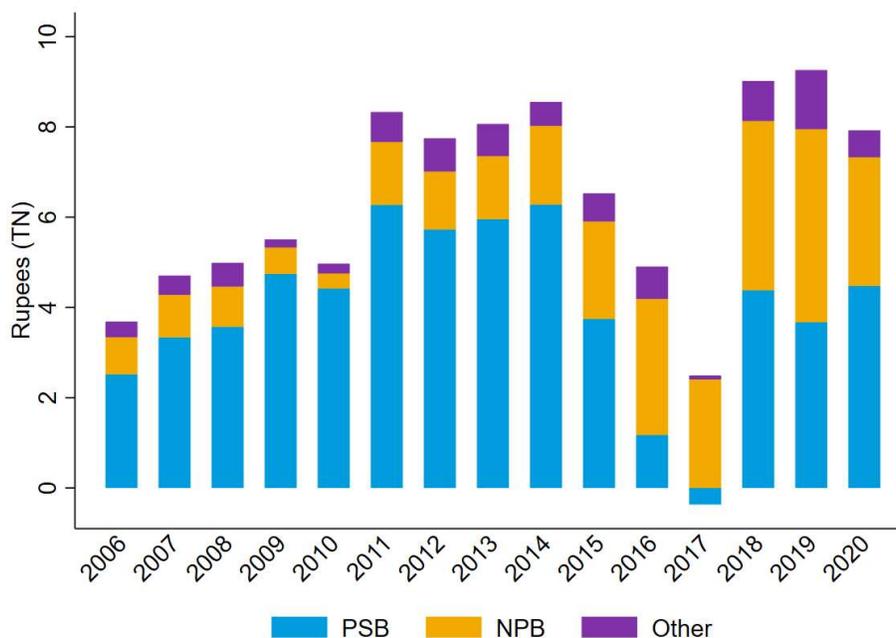


Figure 3: Differences between banks of different ownership types

Notes: This figure shows how PSBs differ from private banks and other Indian banks. Each panel shows boxplots by type of bank showing the 10th, 25th, 50th, 75th, and 90th percentiles (as well as individual outliers). Panel A shows log of bank advances in 2020 (prior to taking logs these advances are in trillions (lakh crores) of Rupees). Panel B shows the tier 1 capital ratio across 2005-2020, in percentage points. Panel C shows the nonperforming asset ratio (defined as the sum of gross nonperforming assets and restructured loans as a fraction of advances) across 2005-2020, in percentage points. Panel D shows the share of non-deposit liabilities across 2005-2020, in percentage points. The ratios shown in Panels B, C, and D are winsorized at the 5th and 95th percentiles by year. *Sources:* RBI, calculations by authors

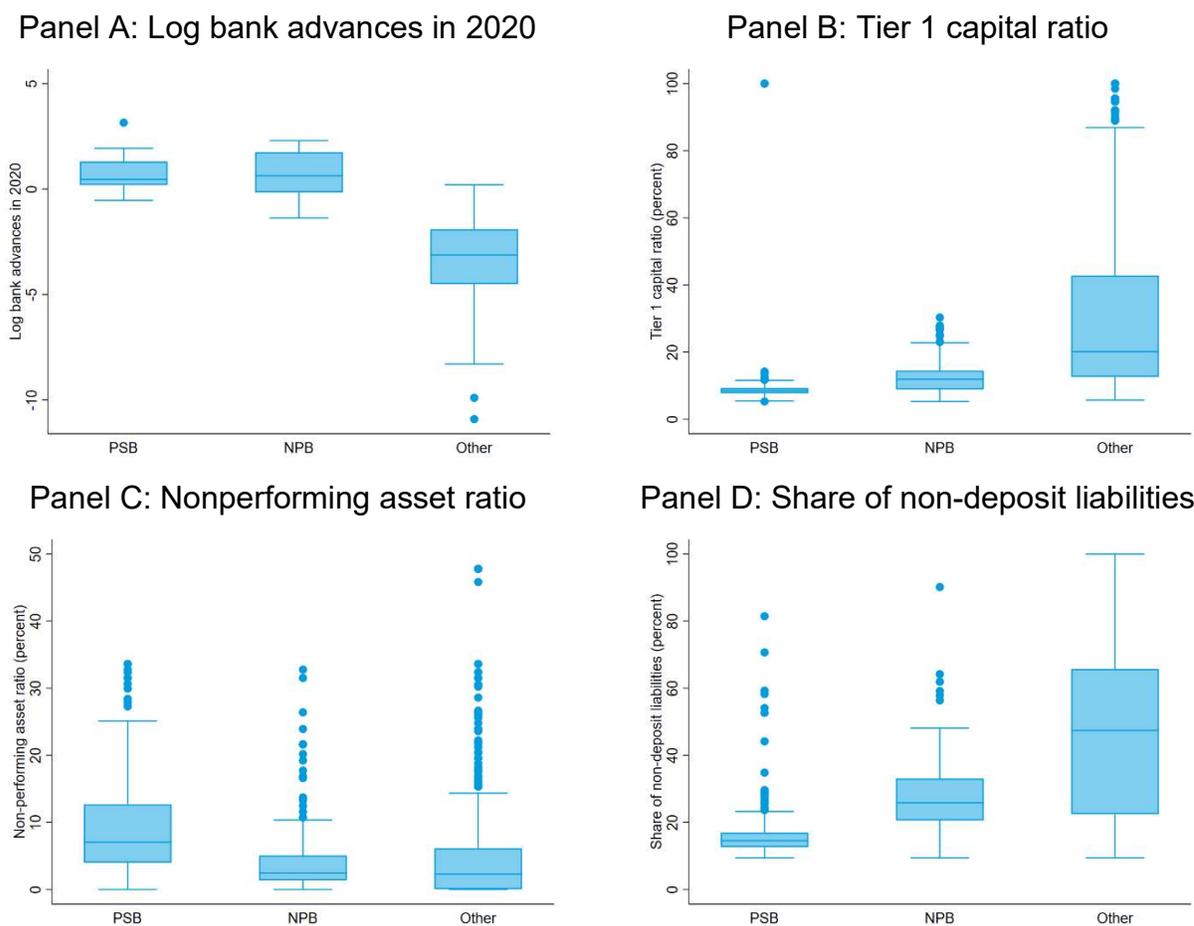


Figure 4: Share of new bank credit to large firms

Notes: This figure shows the fraction of new bank credit (change in the stock of bank credit since the previous year) that goes to large firms (top tercile of total assets within year). It is possible for new bank credit to fall for a group of firms in a given year. The sample of firm-years from Prowess described in the text.

Sources: CMIE Prowess, calculations by authors

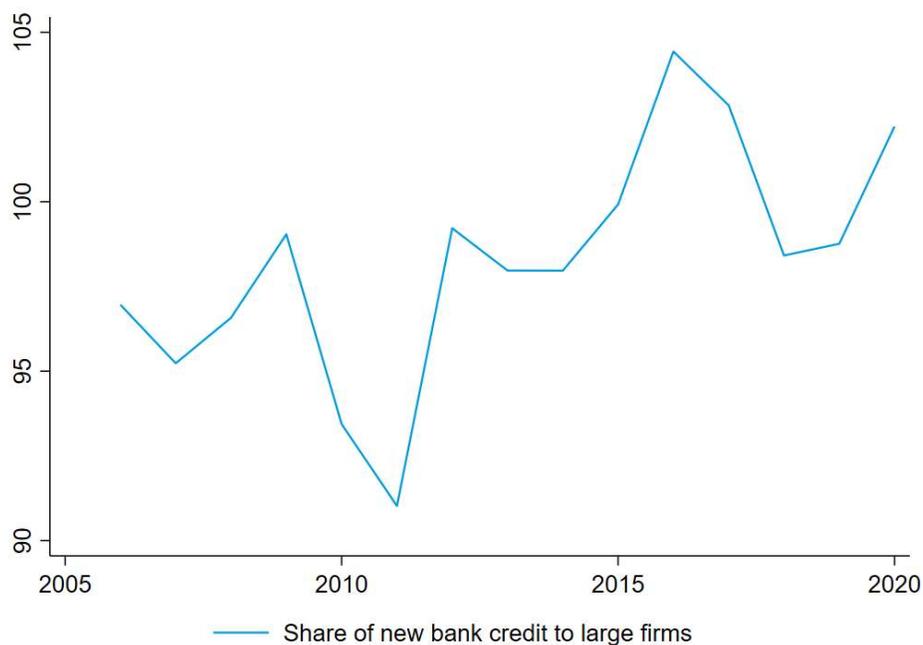


Figure 5: Share of new bank credit to large unproductive firms and PSB share of credit

Notes: This figure shows the share of new bank credit (change in stock of bank credit since the previous year) allocated to unproductive firms or to large unproductive firms (within large firms) by year in percentage points on the left vertical axis. Large firms are in the top tercile of assets within year. Unproductive firms are in the bottom tercile of productivity (lagged ratio of sales to physical capital). The figure shows PSBs' share of new bank credit (change in advances since the previous year) in the economy by year in percentage points on the right vertical axis. The sample of firm-years from Prowess described in the text.

Sources: RBI, CMIE Prowess, calculations by authors

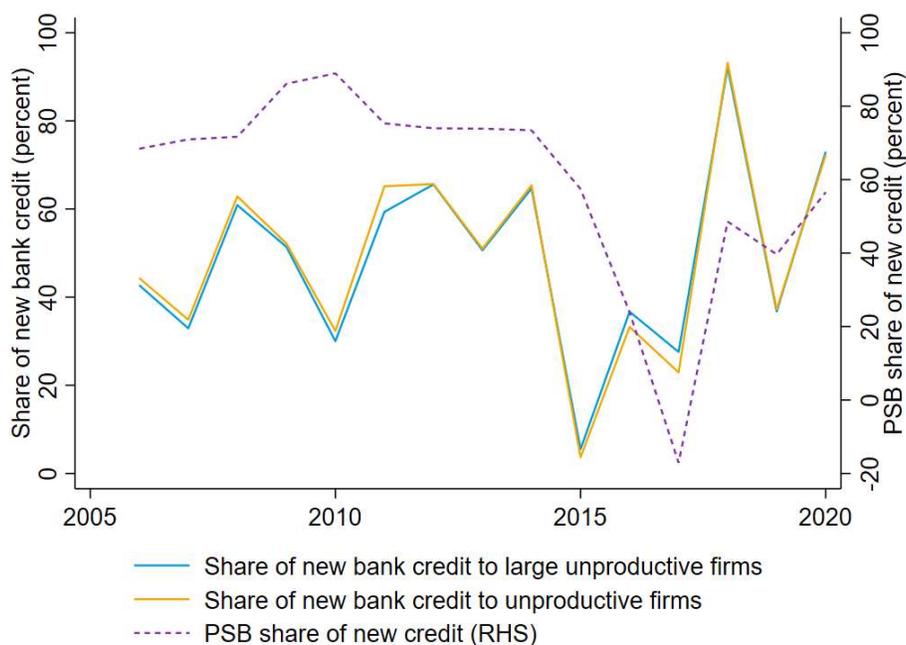
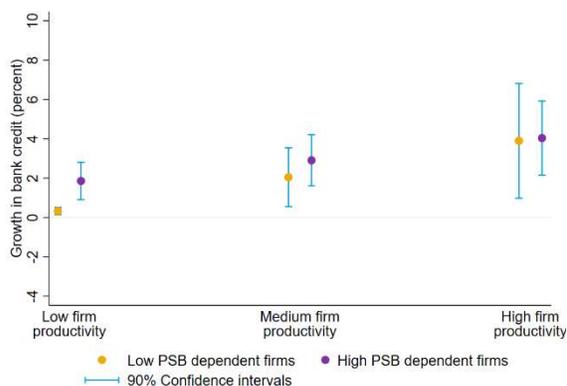


Figure 6: Sensitivity of growth in bank credit to firm-level productivity

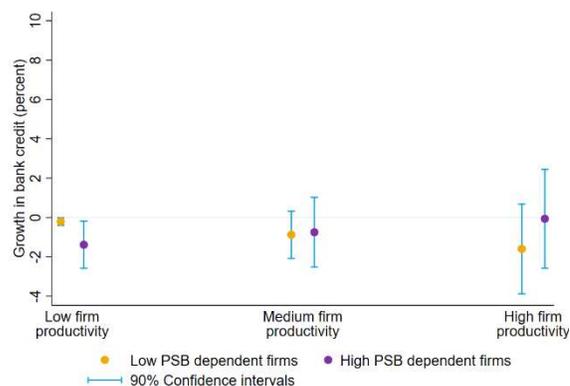
Notes: This figure shows how credit growth varies with firm productivity using all coefficients shown in Table 1, evaluated at appropriate points. 90 percent confidence intervals are shown for each point. Panels A and B use coefficients from a specification that does not split firms by size (first column of Table 1). Panels C and D use coefficients from a specification that does split firms by size (second column of Table 2). Low, medium, and high productivity are evaluated at sales to physical capital ratios (standardized to have unit variance) of 0.1, 1.5, and 3, respectively (this range spans roughly the 10th to the 95th percentiles in our data). Years with high and low PSB shares of credit are evaluated at 90 percent and 0 percent PSB share of credit in year, respectively. High and low PSB dependence are evaluated at PSB dependence of 10 percent and 90 percent respectively. Large and small firms are evaluated at log assets of 5 and 10 respectively (assets in millions of Rupees prior to logs).

Sources: RBI, CMIE Prowess, calculations by authors

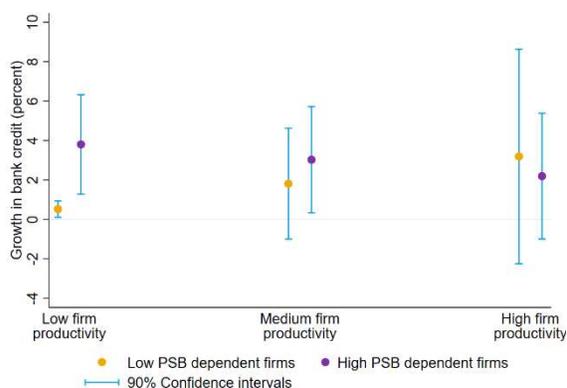
Panel A: All firm sizes, high PSB share of credit



Panel B: All firm sizes, low PSB share of credit



Panel C: Large firms, high PSB share of credit



Panel D: Small firms, high PSB share of credit

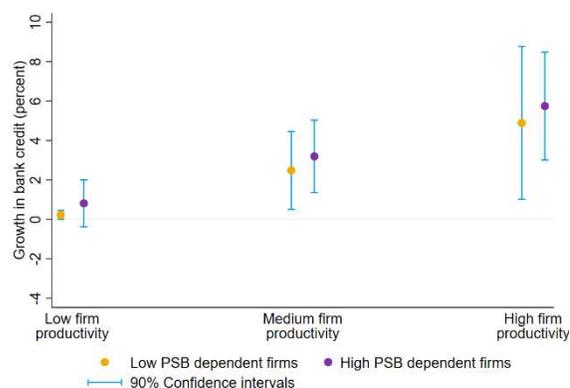


Figure 7: Room for improvement in allocation of new bank credit

Notes: This figure shows actual and counterfactual growth in bank credit (in percentage points, based on change in stock of bank credit relative to previous year) for large productive firms (top tercile of assets within year, and top two terciles of sales to physical assets within 5-digit National Industrial Classification industry and year) using the sample of firm-years described in the main text. Credit growth is value weighted by the lagged stock of bank credit across firms. The lowest line shows actual growth in bank credit for large productive firms. The middle and top lines show counterfactual growth in bank credit if 50 percent and 100 percent of the new credit, labeled as moderate and major shift respectively, were allocated to large unproductive firms (top tercile of assets within year, and bottom tercile of sales to physical assets within 5-digit National Industrial Classification industry and year) were instead allocated to large productive firms, split proportionately to the lagged stock of bank credit.

Sources: CMIE Prowess, calculations by authors

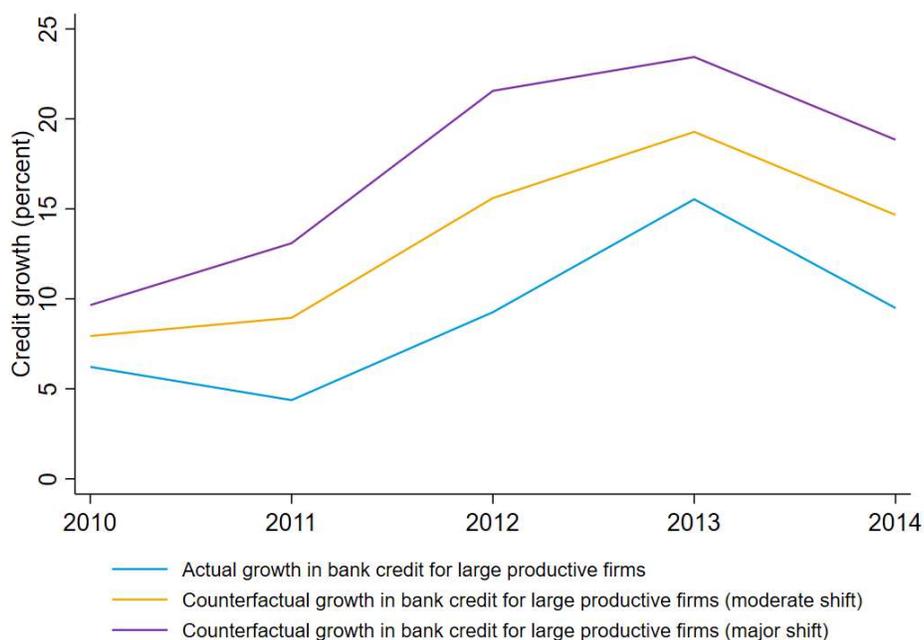


Table 1: Sensitivity of growth in bank credit to firm-level productivity

Notes: This table shows regressions where the dependent variable is bounded growth in bank credit (see the main text for a definition), winsorized at the 5th and 95th percentiles within year, in percentage points. All three columns include District x Year and 5-digit National Industrial Classification Industry x Year fixed effects. Productivity is the ratio of sales to physical capital limited to between 0 and 30, winsorized at the 5th and 95th percentiles within year, and standardized to have unit variance. PSB dependence is the share of reported bank links to PSBs, weighted by total advances for each bank as a share of advances of all banks listed by the firm. PSB share of credit is the share of new bank credit (change in stock since previous year) attributable to PSBs (based on aggregate RBI data, varying only over time). All specifications include a set of firm-level controls (log assets, log growth in sales, debt to asset ratio, interest coverage ratio, state ownership dummy, and ownership excluding large private group dummy). The final column includes weighted averages of tier 1 capital ratios, non-deposit funding, and asset quality ratios in all terms included for PSB dependence in the second column. Standard errors, double-clustered by firm and year, are shown in parentheses. *, **, and *** denote statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

Sources: RBI, CMIE Prowess, calculations by authors

	(1)	(2)	(3)
Productivity (i,t-1)	-0.60 (0.39)	3.06*** (0.62)	2.36 (3.71)
PSB dependence (i,t-1)	-1.59** (0.66)	3.05** (1.24)	2.15 (2.84)
PSB share of credit (t-1) x Productivity (i,t-1)	2.10** (0.82)	-1.09 (2.05)	-0.25 (6.04)
PSB share of credit (t-1) x PSB dependence (i,t-1)	3.97*** (1.04)	-6.56** (2.37)	-5.12 (4.00)
Productivity (i,t-1) x PSB dependence (i,t-1)	1.17*** (0.27)	-2.72** (1.12)	-3.90*** (0.73)
PSB share of credit (t-1) x Productivity (i,t-1) x PSB dependence (i,t-1)	-1.97*** (0.61)	5.33** (2.27)	6.94*** (2.25)
Log assets (i,t-1) x Productivity (i,t-1)		-0.58*** (0.15)	-0.61*** (0.15)
Log assets (i,t-1) x PSB dependence (i,t-1)		-0.71*** (0.22)	-0.76*** (0.22)
Log assets (i,t-1) x PSB share of credit (t-1) x Productivity (i,t-1)		0.54 (0.33)	0.55 (0.32)
Log assets (i,t-1) x PSB share of credit (t-1) x PSB dependence (i,t-1)		1.58*** (0.39)	1.62*** (0.40)
Log assets (i,t-1) x Productivity (i,t-1) x PSB dependence (i,t-1)		0.62** (0.21)	0.68*** (0.20)
Log assets (i,t-1) x PSB share of credit (t-1) x Productivity (i,t-1) x PSB dependence (i,t-1)		-1.13** (0.37)	-1.20*** (0.37)
District x Year FE	Y	Y	Y
National Industrial Classification x Year FE	Y	Y	Y
Firm controls	Y	Y	Y
Bank controls and interactions			Y
R ²	0.227	0.229	0.229
Within R ²	0.019	0.021	0.022
N (Firm-Years)	21,409	21,409	21,409
Firms	4,753	4,753	4,753
Districts	177	177	177
National Industrial Classifications	282	282	282



PUBLICATIONS

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