The microeconomic effects of Indian banking reforms on economic growth[*]

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Abstract

Macroeconomic models of endogenous growth and cross-countries studies have demonstrated that financial development enhances investments and economic growth. To understand the mechanisms at stake, we investigate the microeconomic effects of banking reforms on one of the determinants of firm efficiency: capital investments. The empirical study is based on Indian firm level data and the identification strategy relies on the deregulation of the banking system in India over the 90s. Our findings shed new light on the relationship between financial development, capital accumulation and economic growth. Banking reforms have a positive effect on firms' capital investments. Disentangling the channels of transmission suggests that these results are driven by the expansion of private and foreign banks over the period. Moreover, the impact of financial development is stronger for initially more productive, liquid and profitable firms. These empirical findings are robust to alternative specifications that control for industry and firm characteristics and that address directly potential reverse causality concerns.

Keywords: Banking reforms, firm panel data, firm growth and capital investments.

JEL Classification: O160, G210.

1 Introduction

Financial liberalization has been at the core of economic reforms implemented by several developing countries in the past two decades. The liberalization of the banking system aims at fostering investments and economic growth. Endogenous growth literature has provided theoretical grounds for the role of financial development in enhancing efficiency gains at the aggregate level (e.g Greenwood and Jovanovic (1990), Saint-Paul (1992), Bencivenga and Smith (1991), Pagano (1993)). Based on cross-countries studies, a positive relationship between financial development and economic growth has been well established since the pioneering works of King and Levine (1993), Levine and Zervos (1998), Rajan and Zingales (1998), Levine et al. (2000) and Ranciere et al. (2006). Microeconomic studies on financial liberalization have received less attention. Using firm level data from France, Bertrand et al. (2007) show that the deregulation of the banking system affects firms' entry and exit and the reallocation of resources among firms.

In this paper we focus on the microeconomic effects of banking reforms on economic growth by looking at one of the determinants of firm efficiency: capital accumulation. We expect a positive effect of financial development on firms' capital accumulation. The deregulation of the banking sector reduces the cost of external finance and increases firm liquidity relaxing credit constraints to invest in modern technologies. Relative to macroeconomic studies, one of the advantages of relying on microeconomic analysis is to provide a better understanding of the mechanisms driving the link between financial development and economic growth. While at the aggregate level the empirical evidence confirms that financial liberalization spurs economic growth, the effect of financial development on firm growth might be heterogeneous across firms. Relying on firm-level data allows identifying the sectors where the gains from this reform are concentrated. We look precisely at the different effect of financial development across firms depending on their previous performance.

To the best of our knowledge, this is the first attempt to relate the liberalization of the banking system to the increased ability of manufacturing firms to invest in capital goods using detailed firm-level data for a developing country. Our empirical analysis is based on the Indian firm-level dataset, Prowess,

over the 1997-2006 period. This dataset provides information on financial characteristics of firms in the manufacturing sector. We focus on banking reforms in India over the 1990s. The Indian case provides a suitable environment to test this relationship. Financial reforms began in 1994 with promotion of private banks and then, with the removal of restrictions for the entry of foreign banks.[1] The time period of this study (1997-2006) allows us to analyze the effect of development of the banking system on firms' investments.

One important concern that arises when addressing this question is how to deal with the potential reverse causality between firms' investment decisions and financial development. Our identification strategy relies on exploiting the variation across 21-regions in the credit over GDP ratio. We provide evidence that this proxy of financial development is exogenous and unlikely to be affected by firms' decisions. First we show that credit ratios at the region level are weakly correlated with region characteristics such as capital stock and wage-bill. Moreover, we also demonstrate that changes in credit ratio over the period were not related to initial firm characteristics. We then exploit this exogenous variation in credit ratios across regions to identify the microeconomic effects of financial development on firms' investments in capital goods. As additional robustness tests to deal with the potential endogeneity issues we follow two strategies. First, we use the measure of external dependence proposed by Rajan and Zingales (1998) to identify an exogenous effect of financial development on firms' growth and capital accumulation across different industries. Second, we rely on instrumental variables estimation using monetary policy shocks interacted with initial development of financial institutions among Indian states to instrument the credit ratios.

Our empirical findings shed new light on the micro foundations of economic growth. We first show that firms producing in regions with higher degree of financial development have experienced greater sales growth. Once we have demonstrated a positive effect of financial development on firms' growth, we show that firms producing in regions with a greater expansion of credit invest more in capital goods. Our estimates suggest that the average annual increase of the credit ratio (8 percentage points) is associated with 1.4 to 1.9 p.p. growth of sales and 2.3 to 2.6 p.p. increase in capital stock for the average firm.

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[1]Next section describes these reforms.

These results are robust when we control for firm unobservable characteristics, region-time varying and industry-time varying observable and unobservable characteristics. This strategy allows us to take into account other reforms that took place during the same period in India like trade liberalization and labor market deregulation. Our findings are also robust when we include firm observable-time varying characteristics such as the age and size of the firm.

Next we disentangle the possible mechanisms by which banking reforms, through financial development, affect firms' investments. First, our findings suggest that the type of bank matters. We find that firms located in regions where the presence of private and foreign banks increased over the period have greater capital growth. Second, we find the effects of banking liberalization are heterogeneous across firms depending on firm previous performance. Initially more productive, liquid and profitable firms benefitted the most from the credit expansion across regions. Third, we demonstrate that firm ownership and trade status are not driving our results. Fourth, we show that banking reforms is also affecting firms' decision to upgrade foreign technology embodied in imported capital goods for the most efficient firms. Finally, we show that financial development of the region is positively correlated with other technological investments such as royalties and know how and R&D investments and expenditures on marketing, distribution and communication. We also present evidence on a positive effect of banking reforms on other firm performance measures: domestic sales, export sales, imports and wage-bill.

This paper contributes to the literature on the microeconomic effects of financial development on economic growth. Using industry level dataset for US and cross-country dataset for financial development, Rajan and Zingales (1998) show that industries that depend on external finance grow faster in countries with better developed financial systems. Using cross-country and industry level dataset, Levchenko et al. (2009) show that financial liberalization has a positive effect on economic growth across industries due to increased entry of firms, higher capital accumulation, and an expansion in total employment. Firm level studies on the effects of financial development on firm performance are more scare. One exception is the work of Bertrand et al. (2007) on French banking reforms implemented in 1984. Using firm level data from France and relying on the identification strategy developed by Rajan and Zingales (1998), they

find that after the deregulation of the banking system firms producing in sectors that depend more on external finance are more likely to carry out restructuring activities related to cost-minimizing measures. They also show that banking reforms increase asset and job reallocation towards more efficient firms in sectors more depending on the banking system. Using Firm-level data for 26 countries (1980-1991), Demirgüç-Kunt and Maksimovic (1998) explore whether financial development affects the degree of credit constraints of firms. They find that both banking system development and stock market liquidity are positively associated with firm growth.[2] Our paper complements these works by looking how financial development shapes one of the determinants of firm growth: capital investments.

This work is also related to microeconomic studies that looked at how firms' financial wealth affects their investments. We argue here that banking reforms enhance financial development easing credit constraints and increasing firms' financial resources to invest in capital goods. The link between firms' financial health and capital investment has been empirically observed for a number of countries and surveyed by Hubbard (1998). These studies (Fazzari et al., 1988; Whited, 1992; Bond and Meghir, 1994; Bond et al., 2003) use firms' financial indicators such as the cash flow, the debt to assets ratio, or the liquidity ratio, as proxies for firms' net worth or collateral. Most of these papers rely on data for OECD economies and show that wealthier firms invest more. Similar evidence is found for Ecuador (Haramillo et al., 1996) and Ivory Coast (Harrison and McMillan, 2003).[3]

The findings of this paper also complete the existing evidence regarding the microeconomic effects of structural reforms on firm performance in the case of the Indian economy. Many of these works use the Prowess data over a comparable period of time. Khandelwal and Topalova (2010) and Goldberg et al. (2010, 2009) show that input liberalization has contributed significantly to firm productivity growth and also to the ability of firms to introduce new products. Using an index of services reforms in India during the early 1990's, Arnold et al. (2010) show that these reforms have improved firm productivity in India. Evidence regarding the importance of financial factors in explaining Indian firm performance is more

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[2]They use as dependent variable the proportion of firms whose growth rates exceed the estimate of the maximum growth rate that can be financed by relying only on internal and short-term financing.

[3]In a different setting, Gorodnichenko and Schnitzer (2010) use a survey of firms in Eastern European Countries and show that financial constraints decrease investment in innovation by domestic firms. Aghion et al. (2008) alternatively use measures of firms' payment incidents for France to analyze the relation between credit constraints and research and development along the business cycle.

scarce: Topalova (2004) shows that although Indian firms improved their financial statements during the period of economic reforms, some firms still face problems servicing their debt obligations. Bas and Berthou (2011) show that Indian firms with a lower leverage and higher liquidity are more likely to source their capital goods from foreign countries. Two related previous works study the characteristics of the the banking system in India. Banerjee et al. (2004) show that the Indian financial system is characterized by under-lending and credit rationing due to the high presence of nationalized banks. Cole (2009) investigates the effects of the banks nationalization wave in 1979-80 on banks performance, as well as employment and agricultural investment across villages consecutive to the reform. Our work rather focuses on the effects of financial development, as induced by the banking reforms in the 1990's, on firms' growth and capital investments during that period.

The next section describes the banking reforms in India over the nineties. Section III presents the firm level data and the financial data at the region level. Section IV describes the estimation strategy and the baseline results. Section V disentangles the possible channels through which banking reforms affect firms' capital accumulation. Section VI includes alternative robustness tests to deal with the potential reverse causality issues. The last section concludes.

2   Banking reforms in India

After the independence in 1947, the Government introduced several reforms aiming at nationalized private banks in India. The first wave of bank nationalization started in 1955 when the Imperial Bank of India was nationalized and became the State Bank of India. In 1959 the State Bank of India took over seven private banks as its subsidiaries. The second and third waves of nationalization occurred between 1969 and 1980 when twenty of the largest private banks in India were also nationalized. The goal was to expand the credit towards areas considered as priority by the Government. The banking system, during this period, was dominated by the presence of public banks and by a significant role of the State Bank of India. The financial regime was characterized by an administered interest rate and a pre-emption of a large proportion of bank deposit.

At the beginning of the 90s, the government undertook a package of reforms to deregulate and liberalize the Indian economy. In this context of economic reforms, the aim of financial liberalisation was to increase competition in the banking sector and to improve the efficiency of the allocation of credits. The main reforms in the financial sector were implemented between 1994 and 2004. These reforms consisted in (i) an increase in the approval rate for new private banks, (ii) the liberalisation of the interest rate, (iii) allowing banks the freedom to choose their deposit and lending rates, (iv) promoting the entry of foreign banks and (v) diversification of the ownership of state-owned banks.

During the financial liberalization period, the banking system was completely transformed from the domination of state-owned banks during the post-independence period, towards a predominant role of private and foreign banks. In 2004, the Indian banking system was characterized by 40 private sector banks, 33 foreign banks and 27 state-owned banks in which Government has majority ownership. At the beginning of the 90s, before the financial reforms, state-owned banks had more than 90 percent share in the assets of the banking system, while in 2004 their share decreased up to 75 percent.

3 Data

3.1 Firm level data

The Indian firm-level dataset is compiled from the Prowess database by the Centre for Monitoring the Indian Economy (CMIE)[4]. This database contains information from the income statements and balance sheets of listed companies comprising more than 70 percent of the economic activity in the organized industrial sector of India. Collectively, the companies covered in Prowess account for 75 percent of all corporate taxes collected by the Government of India. The database is thus representative of large and medium-sized Indian firms.[5] As previously mentioned this dataset was already used in several studies on the performance of Indian firms.[6]

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[4]The CMIE is an independent economic center of India. For more information see: http://www.cmie.com/database.

[5]Since firms are under no legal obligation to report to the data collecting agency, the Prowess data do not allow properly identifying entry and exit of firms.

[6]See Khandelwal and Topalova (2010), Topalova (2004), Goldberg et al. (2010), (Goldberg et al., 2009) Alfaro and Chari (2009).

The dataset covers the period 1997-2006 and the information varies by year. It provides quantitative information on sales, capital stock, income from financial and non financial sources, consumption of raw material and energy, compensation to employees and ownership group.

The dataset contains also comprehensive information about the financial statements of firms such as total assets, current assets, total debt and liabilities. We construct the liquidity ratio measured by the ratio of current assets over total liabilities of the firm.[7]

The Appendix Table provides summary statistics on the main firm, region and industry level variables used in our econometric analysis. Our sample contains information for almost 3,300 firms on average each year in organized industrial activities from manufacturing sector for the period 1997-2006. The total number of observations firm-year pairs is 32,876. In order to keep a constant sample throughout the paper and to establish the stability of the point estimates, we keep firms that report information on all the firm and industry level control variables. Firms are categorized by industry according to the 4-digit 1998 NIC code (116 industries). Most of the firms in our sample are private-owned firms (81%). 39% of firms are largest firms belonging to local business groups and only 7% are multinational firms. Although our panel of firms is unbalanced, there is no statistical difference in the average firm characteristics presented in the Appendix Table between the initial year (1997) and the final year (2006) of our sample. Section 6.1. deals with the possible selection issues related to the unbalanced nature of the data.

3.2   Banking and financial data

At the beginning of the 90s, the Indian government carried out several economic reforms to deregulate the economy. Financial liberalization was at the core of the package of economic reforms. The reform of the banking system consisted in increasing the competition in the banking sector by the creation of new private banks and by allowing the entrance of foreign banks. During the nineties, the number of private and foreign banks more than double after the reform.

In our empirical analysis we identify financial reforms by the ratio of credit over GDP for 21 regions

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[7]This financial ratio is used by several works studying the impact of access to external finance on export participation (Greenaway et al., 2007; Berman and Héricourt, 2010; Manova et al., 2009).

in India. We also distinguish the evolution of the number of agencies in each region by type of bank: State Bank of India (SBI), public, private and foreign banks. This dataset comes from the Reserve Bank of India (RBI). Figure 1 (Appendix) shows the evolution of the average credit over GDP ratio over the period. As can be seen, the credit ratio growth boosts up after 2000.

This figure might hide heterogeneous patterns at the region level. Figure 2 plots the evolution of the credit ratio for selected regions in the sample. This figure shows that there exists an important variation across regions in the expansion of credits that we exploit in our empirical analysis. Figure 3 also shows that the ratio of branches by type of bank (SBI, public, private and foreign) over total branches varies across different regions.

4 Estimation Strategy

4.1 Exogenous banking measure

One of the challenges in the investigation of the relationship between financial development and firm performance in the manufacturing sector is potential reverse causality between the credit over GDP ratio of the region and firms' capital accumulation which would bias our estimates. The question here is whether regions that increased their capital stock were also able to lobby for liberalizing the financial markets. In this case, changes in credit ratios could reflect some omitted region characteristics.

In this section we present evidence against this reading of India's banking reforms. First, the ensuing credit expansion of the regions was only weakly correlated with other region characteristics. The correlation between the credit over GDP ratio and sales at the region level is 0.34, while that with capital stock is 0.32 and with wage-bill is 0.36. As such, it seems unlikely that firms producing in regions that experienced greater banking development were able to lobby for financial liberalization.

An additional step towards addressing this issue, which makes economic sense, is to see whether changes in the credit ratio at the region level are exogenous to initial firm characteristics. The idea is that if the government targeted specific firms or regions via its financial policies, we would expect credit changes to be correlated with initial firm performance. We regress firm characteristics in 1997 on credit

Table 1: Changes in credit ratio and initial firm characteristics

Dependent variable	Sales$_{(i,97)}$	Capital stock$_{(i,97)}$	Wages$_{(i,97)}$	Cash ratio$_{(i,97)}$	Profit ratio$_{(i,97)}$
	(1)	(2)	(3)	(4)	(5)
Δ Credit ratio$_{(r)(2006-1997)}$	0.181	0.082	0.037	0.020	0.001
	(0.134)	(0.134)	(0.137)	(0.042)	(0.021)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	3060	3031	3066	3060	2187
R^2	0.037	0.032	0.052	0.015	0.029

ratio changes between 1997-2006. A similar approach is taken by Goldberg et al.(2010), Teshima (2009) and Bas (2010) in their study of the impact of trade reform, to test whether tariff changes are exogenous to initial firm characteristics. We provide some evidence that credit over GDP changes between 1997 and 2006 were uncorrelated with initial firm-level outcomes in 1997, such as sales, capital stock, wage-bill, cash ratio and profit ratio.

Table 1 shows the coefficients on the change in credit over GDP of the region (1997-2006) from firm-level regressions of initial firm characteristics on these credit changes and 2-digit industry fixed effects. There is no statistically significant correlation between firm initial characteristics and credit expansion of the region.

4.2 The microeconomic effects of financial liberalization on economic growth

Before analyzing the relationship between banking reforms and firm capital accumulation, we provide some evidence on how the liberalization of the banking system in India affected firms' sales growth. Deregulation of the banking system might affect positively firms' production decisions through improvements in the efficiency of credit allocation within firms.

The identification strategy relies on variations in the credit over GDP ratio across regions to identify exogenous changes in access to external finance of firms located in different regions in India. We estimate the following model using a within-estimator:

$$\text{Y}_{isrt} = \beta_1 \text{ Credit ratio }_{r(t\text{-}1)} + \beta_2 \text{ X}_{s(t\text{-}1)} + \beta_3 \text{ Z}_{r(t\text{-}1)} + v_t + \mu_i + \epsilon_{it} \text{ (I)}$$

Here $Y_{(isrt)}$ corresponds to the logarithm of sales of the firm i producing in a region r and a manufacturing industry s in year t. Credit ratio$_{r(t-1)}$ represents the financial development measure proxied by the ratio of total credit over the GDP of the region r in year $t-1$. Our specification shows how an expansion of credit in a region over time affects firms' performance. We expect a positive and significant coefficient of β_1 indicating that firms located in regions with improvements in credit allocation have expanded their sales. All explanatory variables are expressed in logarithm and they are lagged of one period. Since our variable of interest is the credit ratio of the region that varies over time, standards errors are clustered at the region-year level.

Unobserved firm characteristics could lead to inconsistent estimates. For this reason, all estimations include firm-level fixed effects (μ_i). The introduction of firm fixed effects is important to control for unobservable firm characteristics that do not vary over time. We introduce year fixed effects to control for other macroeconomic shocks experienced during the period (υ_t). Estimates also include controls for industry characteristics that vary over time. We introduce a set of industry level variables $X_{s(t-1)}$ that control for observable industry characteristics that might also affect firms' sales. Since at the beginning of the nineties India experienced a unilateral trade liberalization process, we include the average effectively applied import tariffs for final goods at the 4-digit NIC industry level. Tariffs data is provided by WITS and is available at the industry level ISIC (rev 2) 4-digit.[8] Tariff changes capture the degree of foreign competition faced by firms at the industry level. Several studies show that competition might enhance firm efficiency and create incentives for firms to invest in R&D activities increasing their sales.[9] To control for competition in the domestic market, we constructed a Herfindahl index at the 2-digit NIC industry level. Since the variable of interest varies at the region level, we control for observable characteristics of the 21-regions that might be correlated with the credit over GDP ratio. The vector $Z_{r(t-1)}$ is a set of region level control variables such as capital intensity and wage-bill. We rely on the firm-level data to calculate the region level variables. The median of the wage-bill and capital intensity (total capital stock

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[8]We use correspondence tables to convert tariffs into ISIC rev 3.1. that match almost perfectly with NIC 4-digit classification. This dataset is available at http://wits.worldbank.org/wits/.

[9]This is the theoretical mechanism highlighted by Aghion et al. (2005) of an inverted U shape relationship between competition and R&D investments.

over the wage-bill) measures are calculated for each of the 21 regions in our sample.

Table 2 reports the estimation results of equation (I) using a within estimator. Column (1) shows that the coefficient of the financial development proxy is positive and significant. This finding suggests that firms located in regions that experienced an improvement of financial resources over time, have increased their sales. These results are robust and stable when we control for trade liberalization in column (2) including lagged output tariffs. These findings remain unchanged to the introduction of the Herfindhal index measuring the concentration of the domestic market (column (3)). We next include additional region level variables to control for characteristics at the region level that vary over time and which could be related to our variable of interest. The estimated credit ratio coefficient is robust and stable to the inclusion of the median wage-bill and capital intensity of the region (column (4)). This implies that the expansion of credit across regions is not picking up the effect of changes in other observable characteristics of the Indian states. In the last column, we include industry-year fixed effects that captured all other possible shocks affecting industries and varying over time. The coefficient of interest is still positive and significant. This result suggests that other reforms that took place in India during the nineties are not capturing the effect of the banking system reform on firms' sales growth.

During the period under analysis the annual variation of the average credit ratio is 8 percentage points. Our estimates indicate that an increase of the credit ratio of 8 p.p. is associated with 1.4 to 1.9 p.p. increase in sales for the average firm.

4.3 Banking reform and firms' investments in capital goods

The previous findings demonstrate that financial globalisation has a positive effect on economic performance at the microeconomic level. One possible mechanism through which the liberalization of the banking sector affects firms' sales growth is by increasing firms' investments. In this section we look at the effects of financial development on one of the determinants of economic growth: capital accumulation. The theoretical literature suggests that financial liberalization, through an increase in firms' financial ressources, has a positive effect on firms' investment decisions. Credit expansion creates incentives to

Table 2: The effect of financial development on firms' sales growth

Dependent variable	logarithm of firm sales$_{it}$				
	(1)	(2)	(3)	(4)	(5)
Credit ratio(r)(t-1)	0.228***	0.223***	0.223***	0.206***	0.163**
	(0.067)	(0.066)	(0.066)	(0.065)	(0.064)
Output tariff(s)(t-1)		-0.318***	-0.318***	-0.287**	
		(0.113)	(0.113)	(0.112)	
Herfindhal index(s)(t-1)			0.004	0.004	
			(0.005)	(0.005)	
Wage-bill(r)(t-1)				0.100***	0.072**
				(0.036)	(0.034)
Capital intensity(r)(t-1)				-0.298***	-0.294***
				(0.075)	(0.071)
Firm fixed effects	Yes	Yes	Yes	Yes	
Year fixed effects	Yes	Yes	Yes		
Industry-Year fixed effects				Yes	
Observations	32876	32876	32876	32876	32876
R^2	0.023	0.024	0.024	0.025	0.044

Notes: The table reports estimates from OLS estimations of Equation (I) with firm and year fixed effects in columns (1) to (4) and firm and industry-year fixed effects in column (5). In parentheses we report heteroskedasticity-robust standards errors clustered at the region and year level. The dependent variable is the logarithm of sales$_{it}$ of firm i in year t. All explanatory variables are lag of one period. The credit ratio(r)(t-1) is the ratio of total credit over GDP of the region (21 regions). The output tariffs are at the 4-digit NIC industry level and the Herfindahl index is at the 2-digit NIC industry level. Wage-bill(r)(t-1) and capital intensity(r)(t-1) correspond to the median of firms' wage-bill and capital intensity measures calculated for each of the 21 regions in our sample.***,**, and * indicate significance at the 1, 5 and 10 percent levels respectively.

develop investment projects enhancing capital accumulation.

Table 3 reports the estimation results of equation (I) using as dependent variable the logarithm of capital stock of firm i producing in industry s and located in region r in year t. Similarly to the previous results, we find a positive effect of the credit ratio on firms' capital stock (column (1)). Firms located in regions with a higher degree of financial development have improved their capital accumulation. This finding is robust to the introduction of observable and unobservable industry characteristics varying over time (columns (2) and (3)). Column (4) shows that the results are robust and stable when we include the region level controls capturing changes over time across the 21-regions in capital intensity and size proxied by the median wage-bill of the region. The coefficient of interest remains almost unchanged when we control for other reforms implemented in the period and affecting all industries in the same way in the last column.

To have an order of idea of the economic effects of financial development on firms' capital investments: our estimates suggest that the average annual increase of the credit ratio (8 percentage points) is associated with 2.3 to 2.6 p.p. growth of capital stock for the average firm.

4.4 Controlling for firm characteristics

In this section, we explore whether our previous results are robust when we explicitly take into account changes in observable firm characteristics varying over time that could affect firms' performance.

When we focus on firms' sales, we include in the previous specification the age and the past capital intensity of the firm measured as total capital stock over the wage-bill. For capital accumulation, we control for the age of the firm and the size. Several empirical works show evidence of a positive impact of firms' size on factor demands. To reduce potential reverse causality issues between firms' sales and capital stock, we include two dummy variables indicating if the firm is medium or large size. These variables are constructed based on lagged sales. The omitted category is small firms.

Table 4 reports the results. To explore the stability and robustness of our estimates, columns (1) and (4) present the previous findings. Columns (2) and (3) show the effect of firms' age and capital intensity

Table 3: The effect of financial development on firms' capital accumulation

Dependent variable	logarithm of firm capital stock$_{it}$				
	(1)	(2)	(3)	(4)	(5)
Credit ratio(r)(t-1)	0.313***	0.314***	0.314***	0.299***	0.276***
	(0.052)	(0.052)	(0.052)	(0.051)	(0.050)
Output tariff(s)(t-1)		0.099	0.099	0.108	
		(0.096)	(0.096)	(0.097)	
Herfindhal index(s)(t-1)			0.002	0.002	
			(0.004)	(0.004)	
Wage-bill(r)(t-1)				0.074**	0.058**
				(0.031)	(0.027)
Capital intensity(r)(t-1)				-0.038	-0.056
				(0.063)	(0.059)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	
Industry-Year fixed effects					Yes
Observations	32876	32876	32876	32876	32876
R^2	0.024	0.024	0.024	0.024	0.047

Notes: The table reports estimates from OLS estimations of Equation (I) with firm and year fixed effects in columns (1) to (4) and firm and industry-year fixed effects in column (5). In parentheses we report heteroskedasticity-robust standards errors clustered at the region and year level. The dependent variable is the logarithm of capital stock$_{it}$ of firm i in year t. All explanatory variables are lag of one period. The credit ratio_$(r)(t-1)$ is the ratio of total credit over GDP of the region (21 regions). The output tariffs are at the 4-digit NIC industry level and the Herfindahl index is at the 2-digit NIC industry level. Wage-bill(r)(t-1) and capital intensity(r)(t-1) correspond to the median of firms' wage-bill and capital intensity measures calculated for each of the 21 regions in our sample. ***,**, and * indicate significance at the 1, 5 and 10 percent levels respectively.

Table 4: Controlling for firm characteristics

Dependent variable	sales$_{it}$			capital stock$_{it}$		
	(1)	(2)	(3)	(4)	(5)	(6)
Credit ratio(r)(t-1)	0.206***	0.195***	0.211***	0.299***	0.295***	0.251***
	(0.065)	(0.061)	(0.060)	(0.051)	(0.050)	(0.045)
Age(i)(t-1)		0.348***	0.298***		0.121***	-0.012
		(0.035)	(0.035)		(0.026)	(0.027)
Capital intensity(i)(t-1)			-0.110***			
			(0.018)			
Medium(i)(t-1)						0.376***
						(0.019)
Large(i)(t-1)						0.827***
						(0.035)
Output tariff(s)(t-1)	-0.287**	-0.272**	-0.258**	0.108	0.113	0.163
	(0.112)	(0.112)	(0.113)	(0.097)	(0.097)	(0.102)
Herfindhal index(s)(t-1)	0.004	0.004	0.003	0.002	0.002	0.002
	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)
Wage-bill(r)(t-1)	0.100***	0.081**	0.077**	0.074**	0.067**	0.059*
	(0.036)	(0.035)	(0.035)	(0.031)	(0.032)	(0.030)
Capital intensity(r)(t-1)	-0.298***	-0.252***	-0.236***	-0.038	-0.022	0.004
	(0.075)	(0.073)	(0.072)	(0.063)	(0.062)	(0.057)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	32876	32876	32876	32876	32876	32876
R^2	0.025	0.030	0.038	0.024	0.025	0.093

Notes: The table reports estimates from OLS estimations of Equation (I) with firm and year fixed effects. In columns (1) to (3) the dependent variable is the logarithm of sales$_{it}$ of firm i in year t. In columns (4) to (6) the dependent variable is the logarithm of capital stock$_{it}$ of firm i in year t. In parentheses we report heteroskedasticity-robust standards errors clustered at the region and year level. All explanatory variables are lag of one period. The credit ratio(r)(t-1) is the ratio of total credit over GDP of the region (21 regions). The output tariffs are at the 4-digit NIC industry level and the Herfindahl index is at the 2-digit NIC industry level. Wage-bill(r)(t-1) and capital intensity(r)(t-1) correspond to the median of firms' wage-bill and capital intensity measures calculated for each of the 21 regions in our sample. Medium(i)(t-1) and large(i)(t-1) correspond to dummy variables indicating the size of the firm and constructed based on lagged sales. The omitted category is small firms.***,**, and * indicate significance at the 1, 5 and 10 percent levels respectively.

on firms' sales. The age of the firm is positively correlated with firms' growth, while capital intensity is negatively correlated with firms' sales. Comparing the coefficients on credit ratio in column (1) to (3) reveals that the positive effect of the credit ratio of the region on firms' growth remains stable and robust to the inclusion of firm level controls. In columns (5) and (6) we investigate the impact of firms' age and size on capital accumulation. The age of the firm affects positively capital stock (column 5). However, when we control for firm size the effect of age is no longer significant on capital stock (column (6)). As expected medium and large size firms invest more in capital goods than small ones. As can be seen in column (6), the coefficient of interest on banking reform remains robust by the inclusion of these controls.

5 Disentangling the channels of transmission

In this section we explore the different mechanisms through which the reform of the banking system in India affects firms' investments in capital goods. First, we investigate the role of the entry and expansion of private and foreign banks in India on firms' capital accumulation. Second, we ask whether financial development has affected firms differently by disentangling the effects of the banking reform depending on firm previous characteristics. Third, we study if the type of capital goods matters by looking at how financial development affects firms' decision of importing capital goods. Finally, we explore if the type of ownership of the firm and trade status are driving our previous results on the relationship between credit expansion and firms' investments in capital goods.

5.1 Does the type of bank matter?

Banking reform in India during the nineties consisted in an increasing role of private and foreign banks as shown in Section 2. We explore further the compositional effects of financial development on firms' factor accumulation. We disentangle these compositional effects by using the growth in the number of agencies by type of bank at the region level. We consider the presence of four types of banks: State Bank of India (SBI), public, private and foreign banks.

The baseline estimation presented in equation (I) is extended by including the ratio of branches by type of bank over total branches of the region. Table 5 reports the results controlling for unobservable and observable firm characteristics and observable region and industry characteristics varying over time. Column (1) shows that the coefficient of the ratio of agencies of SBI is not significant. Looking at the effect of public banks, the coefficient is negative and significant (column (2)). Since the average number of public banks over the period has been reduced, this finding suggests that firms located in regions where there was a contraction of public banks relative to other type of banks, increased their capital and labor accumulation.[10] Column (3) presents the results for the ratio of private banks and columns (4) for foreign banks. In both cases, the coefficients are positive and significant suggesting that the higher

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[10]The Appendix table presents descriptive evidence on the average number of agencies by type of bank in the initial and last year. The average number of branches of public banks over total branches has been reduced from 8% in 1997 to 3% in 2006.

presence of private and foreign banks in the region has a positive effect on firms' investment. Comparing the magnitude of the coefficients reveals that the effect of foreign banks is much higher than the effect of private domestic banks.

The effect of expansion of foreign banks could be associated to the presence of foreign companies in the region. To address this issue, we restrict the sample to the sub-sample of domestic firms excluding multinational firms in column (5). The magnitude of the coefficient of the ratio of foreign agencies is higher when we exclude foreign firms from the sample. This finding suggests that the entry and expansion of foreign banks in a region has a positive effect on capital investment for the average domestic firm. The potential links between foreign banks and multinational firms in a region are not driving our results.

In the last column, we introduce all branches ratios except by the ratio of branches of SBI over total offices. All results are thus interpreted relative to the number of agencies of SBI (the omitted category). While the coefficient of private banks remain unchanged and the one of foreign bank is slightly higher, the estimate of public banks is now non significant. These findings suggest that the results of the baseline specification are mainly driven by the expansion of private and foreign banks in the region.

5.2 The heterogeneous effect of financial development depending on firm characteristics

Banking reform might affect firms differently according to their characteristics. Some firms may benefit more from the development of the financial sector than do others. We explore in this section whether the impact of credit changes across regions depends on firms' past efficiency. Three measures of firm performance are used: (i) firm total factor productivity (TFP), (ii) the liquidity ratio and (iii) firm profitability. Firm TFP is computed using semi-parametrical estimations developed by Levinsohn and Petrin (2003). The liquidity ratio is the ratio of current assets over total liabilities of the firm and firm profitability is measure by firms' profits.

To investigate this heterogeneity, we introduce interactions between credit ratio changes and firms' TFP. Firms are divided up into four TFP quartiles, with the first quartile representing the least productive

Table 5: The effect of banking reforms on capital accumulation, by type of banks

Dependent variable	logarithm of firm capital stock$_{it}$					
	(1)	(2)	(3)	(4)	(5) Non-MNF	(6)
Credit ratio(r)(t-1)	0.260***	0.196***	0.165***	0.236***	0.222***	0.216***
	(0.047)	(0.050)	(0.050)	(0.042)	(0.044)	(0.056)
# Branches SBI/total(r)(t-1)	-0.038					
	(0.065)					
# Branches public banks/total(r)(t-1)		-0.098*				0.125
		(0.051)				(0.072)
# Branches private banks/total(r)(t-1)			0.238***			0.238***
			(0.072)			(0.080)
# Branches foreign banks/total(r)(t-1)				1.497***	1.805***	2.081***
				(0.496)	(0.545)	(0.659)
Herfindhal index(s)(t-1)	0.002	0.002	0.002	0.002	0.002	0.002
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Output tariff(s)(t-1)	0.164	0.163	0.168	0.160	0.135	0.164
	(0.102)	(0.102)	(0.102)	(0.102)	(0.104)	(0.102)
Wage-bill(r)(t-1)	0.058*	0.063**	0.059**	0.058*	0.048	0.054*
	(0.030)	(0.030)	(0.030)	(0.031)	(0.031)	(0.030)
Capital intensity(r)(t-1)	0.009	0.001	0.026	0.020	0.010	0.052
	(0.056)	(0.056)	(0.055)	(0.055)	(0.056)	(0.053)
Medium(i)(t-1)	0.376***	0.376***	0.375***	0.376***	0.378***	0.376***
	(0.019)	(0.019)	(0.019)	(0.019)	(0.020)	(0.019)
Large(i)(t-1)	0.827***	0.826***	0.825***	0.826***	0.826***	0.824***
	(0.035)	(0.035)	(0.035)	(0.035)	(0.036)	(0.035)
Age(i)(t-1)	-0.011	-0.015	-0.011	-0.017	0.015	-0.015
	(0.027)	(0.027)	(0.027)	(0.027)	(0.028)	(0.027)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	
Year fixed effects	Yes	Yes	Yes	Yes	Yes	
Observations	32876	32876	32876	32876	30494	32876
R^2	0.093	0.093	0.093	0.093	0.097	0.094

Notes: The table reports estimates from an extension of Equation (I) by including the ratio of branches by type of bank over total branches of the region. The industry, region and firm level controls are the same as in the previous tables.

firms and the omitted category. We then interact the credit ratio of the region with the firm's TFP(t-1) quartiles. We estimate the following specification:

$$\text{K}_{isrt} = \sum_{\rho=1}^{4} \chi^{\rho} (\text{Credit ratio}_{r(t\text{-}1)} \times Q_{it}^{\rho}) + \sum_{\rho=2}^{4} \lambda^{\rho} Q_{it}^{\rho} + \beta_2 \, \text{X}_{s(t\text{-}1)} + \upsilon_{rt} + \mu_i + \epsilon_{it} \text{ (II)}$$

Here $K_{(isrt)}$ corresponds to the logarithm of capital stock of the firm i producing in a region r and a manufacturing industry s in year t. Credit ratio$_{r(t\text{-}1)}$ represents the financial development proxy measured by the ratio of total credit in region r over the GDP of the region r in year $t-1$. Firms are classified into four quartiles (Q) of TFP by ρ: Q_{it}^{2} is a dummy variable for firm i belonging to the second TFP quartile and so on. Credit ratio$_{r(t\text{-}1)} \times Q_{it}^{\rho}$ are the interaction terms between the quartiles of TFP and the credit over GDP ratio of the region. Moreover, we include region-year fixed effects that control for all other unobservable characteristics varying over time at the state level (υ_{rt}). Since our variable of interest, the interaction between the credit ratio of the region and firm efficiency, varies at the firm-region-year level, the inclusion of region-year fixed effects allows us to test that our coefficient of interest is not picking up the effects of other region characteristics varying over time. Our specification shows how an improvement of the financial system of the region over time affects firms' factor accumulation depending on past firm productivity relative to the least productive firms (the omitted category is the first TFP quartile).

The estimation results for equation (II) are presented in table 6. After controlling for firm, industry and region characteristics varying over time, the effect of credit expansion on firms' capital stock in t is greater for the most productive firms in $t-1$ relative to the least productive ones. The coefficients on the interaction terms are positive, significant and increasing in the TFP quartiles (column 2). In columns (3) and (4), we interact the credit ratio of the region with quartiles of firm' liquidity ratio in $t-1$. This identification strategy allows us to explore if the effects of the reform are different depending on previous financial health of the firm. The estimates suggest that the initially more liquid firms have benefited the most from financial liberalization (column (3)). This finding remains robust after introducing firm and industry level controls varying over time (column (4)). Finally, we use as an alternative proxy of firm profitability a dummy variable equal to one if the firm has positive profits in $t-1$ and we interact this

Table 6: Heterogeneous effect of banking reforms

Dependent variable	logarithm of firm capital stock$_{it}$					
	(1)	(2)	(3)	(4)	(5)	(6)
Credit ratio(r)(t-1) × dummy=1 if profits(i)(t-1) > 0					0.479***	0.484***
					(0.052)	(0.052)
Credit ratio(r)(t-1)× Second Q TFP(i)(t-1)	0.117***	0.116***				
	(0.034)	(0.034)				
Credit ratio(r)(t-1) × Third Q TFP(i)(t-1)	0.214***	0.209***				
	(0.054)	(0.054)				
Credit ratio(r)(t-1) × Fourth Q TFP(i)(t-1)	0.360***	0.350***				
	(0.063)	(0.063)				
Credit ratio(r)(t-1) × Second Q liquidity(i)(t-1)			0.153**	0.157***		
			(0.059)	(0.060)		
Credit ratio(r)(t-1) × Third Q liquidity(i)(t-1)			0.247***	0.255***		
			(0.068)	(0.070)		
Credit ratio(r)(t-1) × Fourth Q liquidity(i)(t-1)			0.343***	0.357***		
			(0.082)	(0.084)		
Second, Third and Fourth Quartiles (Q)	Yes	Yes	Yes	Yes	Yes	Yes
Industry level controls	No	Yes	No	Yes	No	Yes
Firm level controls	No	Yes	No	Yes	No	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Region-Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	32876	32876	32876	32876	32876	32876
R^2	0.037	0.037	0.036	0.037	0.072	0.074

Notes: The table reports estimates from OLS estimations of Equation (II) with firm and region-year fixed effects. In parentheses we report heteroskedasticity-robust standards errors clustered at the region and year level. The dependent variable is the logarithm of capital stock$_{it}$. All explanatory variables are lag of one period. Columns (1) and (2) include interactions between the credit ratio of the region and quartiles of firm TFP in $t-1$. Columns (3) and (4) include interactions with quartiles of firm liquidity in $t-1$. In both cases the omitted variable is the first quartile. All specifications include second to fourth quartile of firm TFP or firm liquidity in year $t-1$, respectively. Firm and industry level controls are the same as in table 4.***,**, and * indicate significance at the 1, 5 and 10 percent levels respectively.

variable with the banking reform proxy. Columns (5) and (6) report these results. The coefficient on the interaction term is positive and significant indicating that firms with positive profits in the previous period benefit more from credit expansion in the region than firms experiencing negative profits.

To sum up, these findings suggest that banking reforms boost firms' investments in capital goods of those firms that faced less credit constraints and were profitable in the previous period. This finding is at odds with the idea that banking reforms should relax credit constraints for small firms. One possible explanation for this result is that since the Indian banking reform consisted in an expansion of private and foreign banks, these types of financial institutions are more willing to lend to more profitable firms that have higher collateral and are less risky.

5.3 Does the type of firm matter?

This section presents alternative sensitivity tests related to other firm-characteristics that might be driving our results.

Previous studies on multinational firms show that foreign firms in developing countries are bigger and tend to use more advanced technologies and invest more relative to domestic firms (Javorcik, 2004). One reason may be that foreign multinationals have a better access to finance. Javorcik and Spatareanu (2009) show for instance that the suppliers of multinationals are less credit constrained. [11] In order to see whether our previous results are not picking up omitted variable issues related to multinational firms, we exclude from our sample these firms in column (1) of Table 7. Our coefficient of interest on the total credit ratio over GDP of the region remains robust and stable when we restrict the sample to domestic firms.

Previous works using the same firm-level dataset emphasize the role of state-owned firms in India (Topalova (2004) and Alfaro and Chari (2009)) even after the structural reforms implemented in the early 1990s. State-owned firms might benefit from special access to credit from the Central Bank of India. In order to address this issue, we restrict the sample to private firms (columns (2)). The point estimates of the credit ratio remain robust and stable. Similar to multinational companies, the largest domestic firms belonging to the local business groups in India benefit from access to finance and are able to do greater investments in capital goods. Our results are robust to the exclusion of these groups from the estimation sample (columns (3)).

Finally, it is well-documented in the literature of international trade that firms engaged in global activities are larger in terms of sales and more capital intensive. Column (4) shows that the estimate of banking reform is robust to the inclusion of an indicator variable for the firms' export status in $t-1$ indicating if the firm reports positive export sales in the past year. In column (5) we include an indicator variable for the firms' import status in $t-1$ and in the last column, we introduce both indicator variables, export and import status, in the same specification. The coefficient of interest remain stable and robust

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[11]Manova et al. (2009) also show that in the case of China, multinationals have a better propensity to export in sectors where firms are typically more financially vulnerable.

Table 7: Other firm characteristics

Dependent variable	logarithm of firm capital stock$_{it}$					
	(1) Non-MNF	(2) Private	(3) Non-group	(4) Exporter	(5) Importer	(6) Exporter-importer
Credit ratio(r)(t-1)	0.240***	0.282***	0.333***	0.215***	0.255***	0.218***
	(0.049)	(0.053)	(0.048)	(0.045)	(0.044)	(0.045)
Exporter status(i)(t-1)				0.102***		0.094***
				(0.016)		(0.015)
Importer status(i)(t-1)					0.181***	0.156***
					(0.014)	(0.014)
Region level controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm level controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry level controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	30494	26730	20033	25335	32876	25335
R^2	0.096	0.102	0.109	0.094	0.106	0.105

Notes: The table reports estimates from OLS estimations of Equation (I) with firm and year fixed effects for different samples of firms. In parentheses we report heteroskedasticity-robust standards errors clustered at the region and year level. All explanatory variables are lag of one period. Exporter(i)(r-1) is a dummy variable equals to one if the firm exports in year $t-1$ and importer(i)(r-1) is a dummy variable indicating the import status of the firm in year $t-1$. Industry, region and firm level controls are included in all columns. ***,**, and * indicate significance at the 1, 5 and 10 percent levels respectively.

to the inclusion of firm' trade status. As expected, importers and exporters invest more in capital goods.

These tests confirm that different firm ownership and trade status are not picking up our results.

5.4 Does banking reform affect imports of capital goods decision?

We found a positive effect of banking reform on firms' investment in capital goods. Using the same dataset, Bas and Berthou (2011) show that firms' financial health is an important determinant of firms' decision to source capital goods from abroad. Since India is a developing country dependent on foreign technology, we investigate if banking reforms through credit expansion affect firms' decision to import capital goods.

Using a linear probability model, we estimate the probability that firm i imports capital goods from abroad in year t as a function of the credit ratio of the region. Column (1) of table 8 shows that there is no significant effect of credit expansion on the probability of importing capital goods for the average firm. In the next columns, we explore if there is a different effect of banking reform depending on firms' past efficiency levels. Similarly to the previous specification presented in equation (II), we include interaction

Table 8: The effect of banking reforms on foreign technology upgrading

Dependent variable	dummy equal to one if the firm imports capital goods$_{it}$						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Credit ratio$_{(r)(t-1)}$	0.001 (0.022)						
Credit ratio$_{(r)(t-1)}$ × dummy=1 if profits$(i)(t-1)>0$						0.118*** (0.011)	0.118*** (0.011)
Credit ratio$_{(r)(t-1)}$ × Second Q TFP$(i)(t-1)$		0.050*** (0.017)	0.052*** (0.017)				
Credit ratio$_{(r)(t-1)}$ × Third Q TFP$(i)(t-1)$		0.054** (0.024)	0.055** (0.024)				
Credit ratio$_{(r)(t-1)}$ × Fourth Q TFP$(i)(t-1)$		0.052** (0.021)	0.050** (0.021)				
Credit ratio$_{(r)(t-1)}$ × Second Q liquidity$(i)(t-1)$				0.046* (0.024)	0.045* (0.024)		
Credit ratio$_{(r)(t-1)}$ × Third Q liquidity$(i)(t-1)$				0.072*** (0.027)	0.069** (0.027)		
Credit ratio$_{(r)(t-1)}$ × Fourth Q liquidity$(i)(t-1)$				0.090** (0.036)	0.086** (0.035)		
Second, Third and Fourth Quartiles (Q)	Yes	Yes	Yes	Yes	Yes	Yes	
Industry level controls	No	No	Yes	No	Yes	No	Yes
Firm level controls	No	No	Yes	No	Yes	No	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes						
Region-year fixed effects		Yes	Yes	Yes	Yes	Yes	Yes
Observations	32876	32876	32876	32876	32876	32876	32876
R^2	0.010	0.017	0.017	0.018	0.018	0.022	0.022

Notes: The table reports estimates from a linear probability model with firm and year fixed effects in column (1) and region-year fixed effects in columns (2) to (7). In parentheses we report heteroskedasticity-robust standards errors clustered at the region and year level. The dependent variable is the logarithm of capital stock$_{it}$. All explanatory variables are lag of one period. The explanatory variables are defined in table 6.***,**, and * indicate significance at the 1, 5 and 10 percent levels respectively.

terms between the credit ratio of the region and the TFP quartiles in column (2) and region-year fixed effects. Relative to least productive firms, the more efficient ones (second to fourth quartiles of TFP) have benefited from the credit expansion to import capital goods from abroad. Columns (3) and (4) shows that the effects of banking liberalization on the probability of importing foreign technology are positive and significant for more liquid firms and for those firms that have positive profits.

5.5   Technological investments and other firm outcomes

The previous results show that banking deregulation affects positively firms' capital accumulation and foreign technology upgrading. We should also expect a positive effect on other investments, expenditures related to technological upgrading and other firm performance measures. In this section, we explore the relationship between credit expansion in the region and the growth in two types of technological

Table 9: Other firm investments

	(1) Royalties	(2) R&D	(3) Marketing	(4) Distribution	(5) Communication
Credit ratio(r)(t-1)	0.482***	0.386***	0.284***	0.326***	0.113**
	(0.177)	(0.128)	(0.061)	(0.065)	(0.047)
Region level controls	Yes	Yes	Yes	Yes	Yes
Firm level controls	Yes	Yes	Yes	Yes	Yes
Industry level controls	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	5486	7936	27460	24767	12179
R^2	0.064	0.075	0.089	0.148	0.078

Notes: The table reports estimates from OLS estimations of Equation (I) with firm and year fixed effects using as dependent variables different types of firm investments. In parentheses we report heteroskedasticity-robust standards errors clustered at the region and year level. All explanatory variables are lag of one period. Industry, region and firm level controls are included in all columns and they are defined in table4. ***,**, and * indicate significance at the 1, 5 and 10 percent levels respectively.

investments of the firm: royalties and technical Know How and research and development investments. We also look at the effect of banking reforms on expenditures in marketing, distribution and communication. We thus estimate Equation (I) with these firm performance variables as the dependent variables. Finally, we present evidence on the relationship between the liberalization of the banking system and other firm performance measures.

The ensuing estimation results are presented in Table 9. We first regress the logarithm of royalties and technical Know How fees on the credit ratio of the region in column (1) and the logarithm of research and development investments in column (2). Firms located in regions that experienced a greater credit improvement have higher investment rates on royalties and R&D. Columns (3) to (5) report the estimations on marketing, distribution and communication expenditures. The estimates are positive and significant in all cases indicating that credit expansion across regions allow firms to increase their investments in marketing, distribution and communication activities.

Table 10 reports the estimation results on other firm outcomes. We have already showed evidence on how financial development affects firms' growth using total sales as dependent variable. We now provide additional evidence on the effect of banking reforms on domestic sales, value added, export sales, imports and the wage-bill.[12]. The estimates are positive and significant for all variables indicating that firms

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[12]Unfortunately, the Prowess dataset does not provide information on the number of employees. We thus rely on the wage-bill reported by the firm

Table 10: Other firm outcomes

	(1) Domestic sales	(2) Value Added	(3) Exports	(4) Imports	(5) Wage-bill
Credit ratio(r)(t-1)	0.210***	0.232***	0.374***	0.249**	0.190***
	(0.065)	(0.062)	(0.088)	(0.115)	(0.041)
Region level controls	Yes	Yes	Yes	Yes	Yes
Firm level controls	Yes	Yes	Yes	Yes	Yes
Industry level controls	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	30948	32323	18943	22084	32791
R^2	0.023	0.028	0.105	0.044	0.111

Notes: The table reports estimates from OLS estimations of Equation (I) with firm and year fixed effects using as dependent variables different types of firm outcomes. In parentheses we report heteroskedasticity-robust standards errors clustered at the region and year level. All explanatory variables are lag of one period. Industry, region and firm level controls are included in all columns and they are defined in table4. ***,**, and * indicate significance at the 1, 5 and 10 percent levels respectively.

located in regions that experienced a higher expansion of credits, have increased their domestic sales, total production, sales in the foreign market, imports and wage-bill.

When we use as a proxy of banking reform the ratio of branches by type of bank, we find similar results as the ones presented in the previous section. Firms producing in regions where private and foreign banks agencies extended have performed better. These results are available upon request.

6   Robustness tests

6.1   Sample issues

The results reported in the previous estimations are for the full unbalanced panel with entry and exit of firms. In order to test if the unbalance nature of the panel is driving our results, we restrict the sample to firms present during the ten years of the period.

Table 11 reports the results. When we restrict the sample to continuing firms present in the entire sample period, the coefficient of credit ratio over GDP is still positive and significant (column (1)). Once we control for industry characteristics in column (2) and firm observable characteristics in column (3), the coefficient is almost unchanged relative to the baseline specification relying on the full sample of firms and presented in column (4) of table4.

Table 11: Sample of firms present the entire period 1997-2006

Dependent variable	logarithm of firm capital stock$_{it}$			
	(1)	(2)	(3)	(4)
Credit ratio(r)(t-1)	0.263***	0.265***	0.256***	0.234***
	(0.038)	(0.039)	(0.037)	(0.034)
Region level controls	No	Yes	Yes	Yes
Industry level controls	No	No	Yes	Yes
Firm level controls	No	No	No	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	12819	12819	12819	12819
R^2	0.030	0.030	0.031	0.098

Notes: The table reports estimates from OLS estimations of Equation (I) with firm and year fixed effects for the sample of firms present the entire period. In parentheses we report heteroskedasticity-robust standards errors clustered at the region and year level. All explanatory variables are lag of one period. Industry, region and firm level controls are defined in table4. ***,**, and * indicate significance at the 1, 5 and 10 percent levels respectively.

6.2   Endogeneity issues

One of the challenges of investigating the relationship between banking reforms and firms' performance is the potential reverse causality concern that could bias our estimates. Section 3.1. presents some evidence suggesting that it is unlikely that firms located in regions with greater credit expansion might have influenced the monetary policy. In this section we perform additional robustness checks to deal with this issue following two different strategies: (i) we rely on the widely used Rajan and Zingales methodology, and (ii) we use instrumental variables estimator.

Dependence with Respect to External Finance

The empirical strategy used by Rajan and Zingales (1998) allows to identifying an exogenous effect of financial development on firm growth and capital accumulation based on variations across industries on external dependence. In the presence of financial constraints, the borrowing capacity of a firm is closely related to its financial statement. Banking reforms, through easing financial constraints, are therefore expected to affect more the investments in sectors where firms rely more on the use of external finance.

Relying on industry data for US and cross-country data on financial development, Rajan and Zingales (1998) propose to identify the effect of financial development on economic growth using an interaction term between the country's degree of financial development and the industry level of external dependence.

The degree of dependence on external finance is a technology parameter measured using Compustat data at the 2-digit industry level for the United States. We use this measure of firms' dependence on external finance ("external dependence") at the 2-digit industry level, proposed by Rajan and Zingales (1998) and updated by Braun (2002) and Braun and Larrain (2005).

The measure of external dependence is interacted with our proxy of banking reforms based on the credit over GDP ratio at the region level. Since the external dependence measure varies across industries and is constructed with US data, it is independent of the characteristics of regions in India. The interaction term is therefore expected to be unrelated to region characteristics and unaffected by future firm growth and capital investments. The coefficient on the interaction variable is expected to be positive: in the presence of financial constraints, variations on credit expansion across regions are expected to have a stronger effect on firm growth and capital investments for firms that rely more on the use of external finance.

Columns (1) and (2) of Table 12 report estimation results for firm sales and columns (3) and (4) for capital stock. The coefficient on the interaction variable reports a positive sign, confirming that the positive impact of credit expansion of the region on firms' sales is higher in sectors where firms require more external finance. Column (2) replicates this estimation, including region-year fixed effects. Our variable of interest, the interaction between the credit ratio of the region and the external dependence of the industry, varies at the industry-region-year level, the inclusion of region-year fixed effects allows us to test that our coefficient of interest is not picking up the effects of other region characteristics varying over time. The coefficient on the interaction term remains almost unchanged when including region-year fixed effects. Columns (3) and (4) provide similar analysis using as a dependent variable firms' capital stock. The coefficient on the Credit ratio$_{(r)(t-1)}$ × External Dependence$_{(s)}$ is positive and significant (column 3) and it remains robust and stable when we introduce region-year fixed effects in column (4). Firms located in regions with higher credit expansion tend to invest more in capital goods and this effect is stronger in industries that rely more on external finance. These sensitivity tests therefore provide additional evidence confirming that banking reforms have causal effects on firm growth and capital investments.

Table 12: Dependence on external finance

Dependent variable	sales$_{it}$		capital stock$_{it}$	
	(1)	(2)	(3)	(4)
Credit ratio$(r)(t-1)$ × External Dependence$_{(s)}$	0.508***	0.506***	0.253***	0.244***
	(0.069)	(0.070)	(0.047)	(0.046)
Credit ratio$(r)(t-1)$	-0.031		0.157***	
	(0.072)		(0.049)	
Output tariff$(s)(t-1)$	-0.260**	-0.187	0.139	0.182*
	(0.114)	(0.115)	(0.105)	(0.107)
Herfindhal index$(s)(t-1)$	0.001	0.001	0.003	0.002
	(0.005)	(0.005)	(0.004)	(0.004)
Medium$(i)(t-1)$			0.385***	0.383***
			(0.020)	(0.020)
Large$(i)(t-1)$			0.831***	0.825***
			(0.036)	(0.036)
Age$(i)(t-1)$	0.333***	0.298***	-0.011	-0.016
	(0.035)	(0.033)	(0.027)	(0.028)
Capital intensity$(i)(t-1)$	-0.036**	-0.036**		
	(0.014)	(0.014)		
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes		Yes	
Region-Year fixed effects	No	Yes	No	Yes
Observations	32540	32540	32028	32028
R^2	0.029	0.039	0.093	0.102

Notes: The external dependence variable is constructed at the 2-digit industry level with information on US industries by Braun and Larrain (2005). Industry, region and firm level controls are defined in table**??**. ***,**, and * indicate significance at the 1, 5 and 10 percent levels respectively.

Instrumental variables

We carry out an additional test to verify whether there is a causal effect of banking reforms through an expansion of the credit across regions on firm growth and capital accumulation. We proceed to Instrumental Variable estimations.

The empirical strategy relies on using the monetary policy applied by the Reserve Bank of India (RBI). The interest rate is an important monetary policy instrument of the RBI, which it is unlikely to be affected by firms' decisions. The interest rate that is used in this exercise is the RBI "monetary rate" and not the one at which firms borrow from banking institutions. It is therefore independent from the the functioning of banking institutions in one particular region. However, changes in the level of interest rate as set by the RBI at the country level can have different effects according to the banks characteristics in each State. To capture differences across regions we interact the interest rates with the initial level of credit over GDP of the region in 1997. We thus instrument the credit ratio at the region level by an interaction term between the interest rate (in t-1) and the credit ratio of the region on the initial year (1997).

To complete our set of instruments, we construct a similar variable using the Cash Reserve Ratio that is decided by the RBI. Indian banks are required to keep only a fraction of their deposit liabilities in the form of liquid cash with the central bank for ensuring safety and liquidity of deposits. The Cash Reserve Ratio (CRR) refers to this liquid cash that banks have to maintain with the Reserve Bank of India (RBI) as a certain percentage of their demand and time liabilities.

A reduction of the interest rate at which the RBI supplies money to the banking institutions, or a reduction of the cash reserve ratio, is generally expected to increase the volume of credit that is circulated within the economy through the banking institutions. Our hypothesis is that regions with initially more efficient banking institutions (a higher Credit ratio ratio in 1997) are transmitting more efficiently monetary policy shocks. If this is the case, we expect that our instruments are negatively related to the evolution of financial development within each Indian State. We can therefore use monetary policy decisions designed at the country level, and initial heterogeneity among Indian States, to predict the

evolution of financial development within each state.

Table 13 reports the estimation results. Column (1) shows the results from the first stage of the IV estimation regressing the credit ratio of the region on the instruments. These results validate our choice of instruments since they are negatively correlated with credit expansions at the region level. In the IV specifications, we restrict the sample to 1999-2006 to ensure that the instruments will not be affected by firms' sales growth and capital investments. Thereby, we first replicate the baseline estimation for the sub-sample of firms present in 1999-2006 to have benchmark estimations. Columns (3) and (4) report the benchmark and IV estimation for firms' sales and columns (5) and (6) for firms' capital stock. Results of within fixed-effect estimations confirm previous findings that firms located in regions with higher credit expansion have a higher sales and capital stock growth (columns (3) and (5)). This result is validated when the credit ratio is instrumented in columns (4) and (6) using the monetary policy variables defined above. The instrumental variable estimations confirm that there is a causal effect of financial development on firm growth and capital investments. Moreover, the Hansen tests from the IV estimations confirm that we cannot reject the validity of our instruments.

7   Conclusions

This paper sheds new light on the microeconomic effects of financial development on firm growth and investments. The deregulation of the banking sector relaxes firms' credit constraints, increasing their external finance sources to invest in modern technologies. This paper investigates how banking reforms affect capital accumulation within firms. We use the case of India's banking reforms over the 90s as an empirical study case. Financial reforms are identified by variations across 21-regions on credit over GDP ratio and the ratio of branches of different type of banks (State Bank of India, nationalized, private and foreign banks).

Our findings show that banking reforms have a positive effect on firms' capital investments. These results are robust to alternative specifications that control for industry and firm characteristics and that address directly potential reverse causality concerns. We next disentangle the possible channels of

Table 13: Instrumental variables

Dependent variable	Credit ratio$_{rt}$	sales$_{it}$		capital stock$_{it}$	
	(1)	(2)	(3)	(4)	(5)
	First stage	Benchmark	IV	Benchmark	IV
IR(t-1)× credit(r)(97)	-5.384***				
	(0.263)				
CRR(t-1)× credit(r)(97)	-10.163***				
	(0.211)				
Ratio total Credit ratio_(r)(t − 1)		0.126**	0.153**	0.171***	0.201***
		(0.056)	(0.060)	(0.050)	(0.053)
Age(i)(t)	0.011*	0.127**	0.126**	0.175***	0.175***
	(0.006)	(0.051)	(0.053)	(0.042)	(0.042)
Medium size(i)(t-1)	-0.000	0.594***	0.594***	0.365***	0.365***
	(0.002)	(0.042)	(0.030)	(0.025)	(0.020)
Large size(i)(t-1)	0.004	1.088***	1.087***	0.762***	0.761***
	(0.003)	(0.068)	(0.040)	(0.042)	(0.030)
Capital intensity(i)(t-1)	0.001	-0.066***	-0.066***	0.310***	0.310***
	(0.001)	(0.018)	(0.019)	(0.020)	(0.016)
Output tariff(s)(t-1)	-0.051***	-0.428***	-0.425***	0.224**	0.227**
	(0.014)	(0.127)	(0.118)	(0.110)	(0.102)
Herfindhal index(s)(t-1)	0.001	0.004	0.004	0.002	0.002
	(0.001)	(0.004)	(0.005)	(0.003)	(0.004)
Wage bill(r)(t-1)	0.055***	0.119***	0.117***	0.122***	0.120***
	(0.004)	(0.029)	(0.028)	(0.028)	(0.026)
Capital intensity(r)(t-1)	-0.007	-0.449***	-0.458***	0.129	0.119
	(0.013)	(0.112)	(0.098)	(0.102)	(0.095)
Observations	22010	22010	22010	22010	22010
p-value of Hansen			0.113		0.879

Notes: Columns (4) and (6) correspond to the IV estimations. Instruments for Credit ratio are : (i) the interest rate in t-1 interacted with the level of Credit ratio of the the region in 1997 (IR(t-1)× credit(r)(97)); and (ii) the Cash Reserve Ratio (CRR) in t-1 interacted with the level of Credit ratio of the the region in 1997 (CRR(t-1)× credit(r)(97)). Both the interest rate and Cash Reserve Ratio are determined at federal level by the Reserve Bank of India. ***,**, and * indicate significance at the 1, 5 and 10 percent levels respectively.

transmission. Our findings are driven mainly by the expansion of private and foreign banks over the period. Moreover, the impact of banking reforms is stronger for initially more productive, liquid and profitable firms. We show that our results are not driven by the type of firm ownership or trade status. Finally, the effect of credit expansion is also related to other technological investments, expenditures and firm' outcomes.

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A   Appendix

Appendix Table : Descriptive statistics of Indian manufacturing firms (1997-2006)

	Mean	Std. Dev.
Number of firms		
Average number of firms per year	3,300	
% Private firms	81%	
% Local business groups	39%	
% of foreign firms	7%	
Firm level characteristics		
Capital stock	74	341
Sales	110	433
Value added	52	220
Wage bill	7.94	47
Region level variables		
1997		
Credit over GDP	0.37	0.20
branches SBI over total	0.32	0.31
branches public banks over total	0.08	0.20
branches private banks over total	0.28	0.31
branches foreign banks over total	0.02	0.02
2006		
Credit over GDP	0.77	0.47
branches SBI over total	0.35	0.30
branches public banks over total	0.03	0.12
branches private banks over total	0.36	0.30
branches foreign banks over total	0.03	0.02
Industry level controls		
Effectively applied output tariffs (NIC 4 digit)	0.30	0.13
Herfindahl index (NIC 2 digit)	0.94	0.78

Notes: Mean values and standard errors in parentheses are reported. Leverage(i) is the ratio of borrowings over total assets and liquidity ratio(i) is the ratio of current assets over total liabilities of the firm.

Figure 1: Evolution of Credit / GDP in India (1997 - 2006)
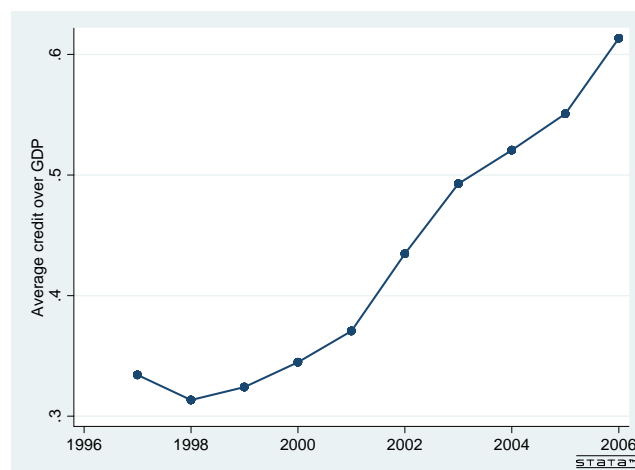
Source: Author's calculation using credit over GDP ratios of 21 regions in India from the Reserve Bank of India.

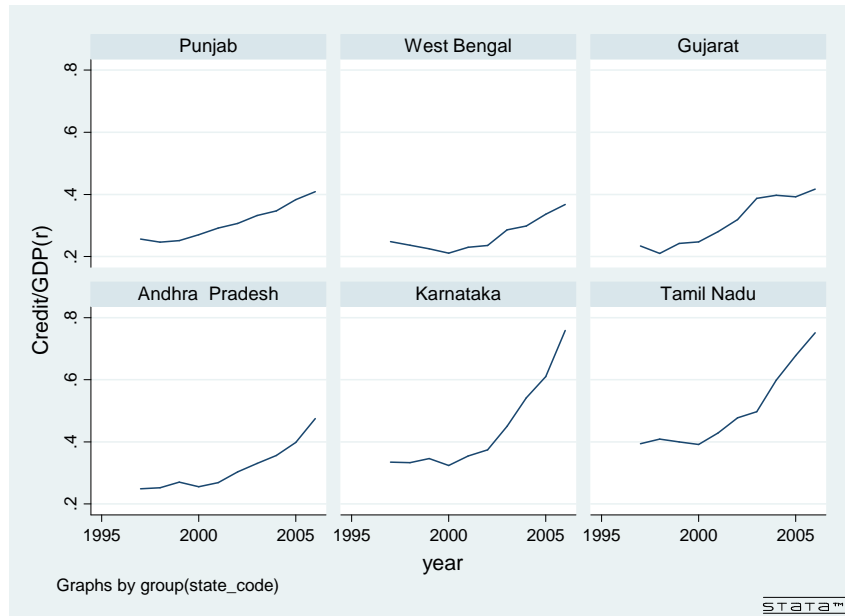Figure 2: Evolution of Credit / GDP in India (selected regions)

Graphs by group(state_code)

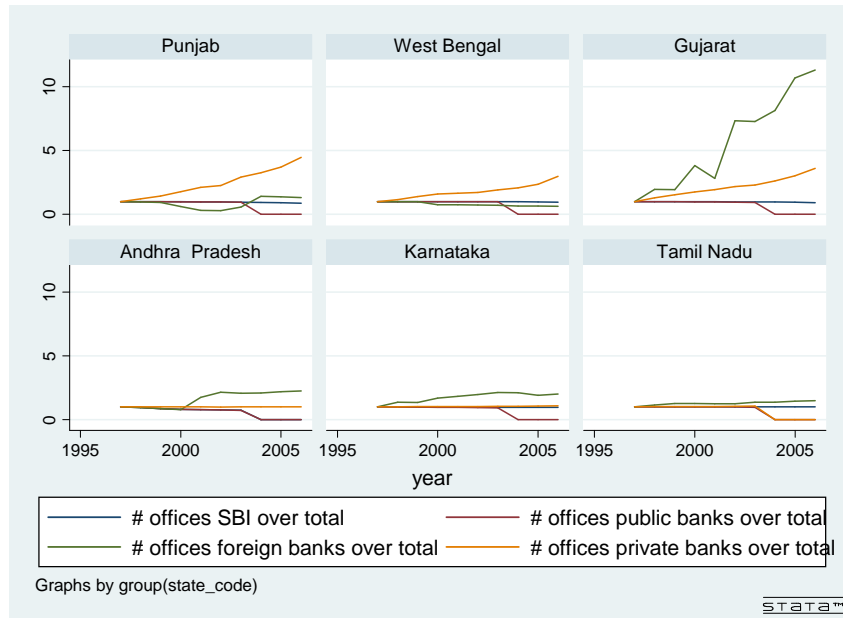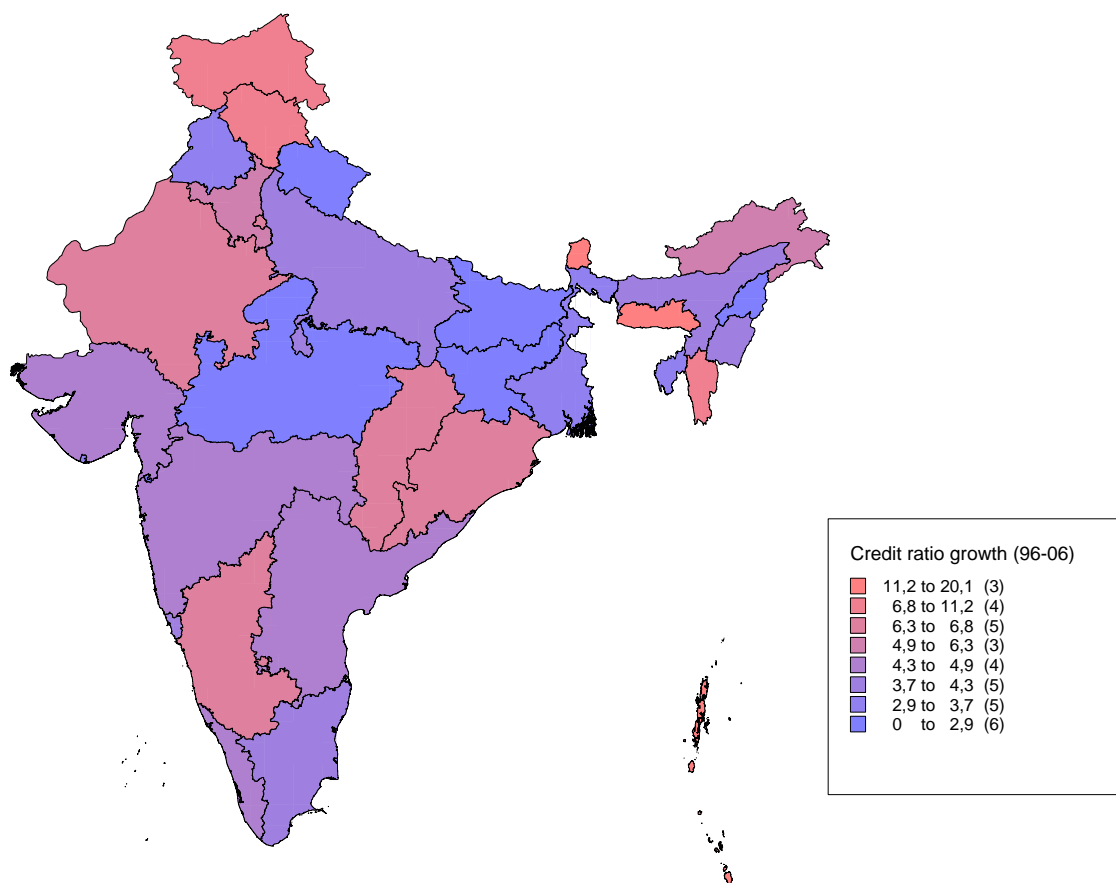Figure 3: Evolution of Credit / GDP in India (selected regions)

Source: Author's calculation using credit over GDP ratios of India from the Reserve Bank of India.

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Figure 4: Credit / GDP growth (1996-2006) in India by regions

Credit ratio growth (96-06)

11,2 to 20,1	(3)
6,8 to 11,2	(4)
6,3 to 6,8	(5)
4,9 to 6,3	(3)
4,3 to 4,9	(4)
3,7 to 4,3	(5)
2,9 to 3,7	(5)
0 to 2,9	(6)

Source: Author's calculation using credit over GDP ratios of India from the Reserve Bank of India.