INFORMALITY AND ACCESS TO FINANCE:
EVIDENCE FROM INDIA

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Abstract: This paper gauges the effect of financial deepening and bank outreach on informality using micro data from the Indian manufacturing sector and exploiting cross-industry variation in the need for external finance. We distinguish between two channels through which access to finance can reduce informality: reducing the entry barrier to the formal sector and increasing productivity of formal firms. We find that bank outreach has a stronger effect on reducing the incidence of informality by cutting barriers to entering the formal economy, especially for smaller firms, and thus diminishing opportunistic informality. In comparison, financial deepening increases the productivity of formal sector firms while it has no significant impact on informal sector firms.

Keywords: Informality, Financial Development, India
JEL codes: G21, G28, O15, O16

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1. Introduction

A large share of private sector activity in developing countries takes place outside the formal economy. On the one hand, working in informality implies lower regulatory and tax burden. On the other hand, informal firms have limited access to formal services like the legal system and they are less likely to hire skilled labor (Boadway and Sato 2010). Critically, informality is often associated with lack of access to formal sources of external finance, as both theory and empirical work has shown (Straub, 2005; Beck, Lin and Ma, 2014). It is not clear, however, whether this relationship is a causal one and, if yes, what the driving factor is. Does lack of access to formal finance discourage entrepreneurs from entering the formal economy or does informality prevent them from accessing formal finance? How different is the effect of financial deepening on formal and informal firms? This paper exploits state-year variation within Indian manufacturing to disentangle the relationship between different types of informality and different dimensions of financial sector development, notably financial depth (commercial bank credit to SDP) and financial outreach (branch penetration). Following the seminal work by Rajan and Zingales (1998), we exploit cross-industry variation in the need for external finance to control for endogeneity biases.

Informality has different dimensions and means different things to different people. From one perspective, some firms –or workers– exit from the formal sector based on a private cost-benefit analysis of formality, while others are excluded from state benefits because of high registration costs and regulatory burden (Perry et al. 2007). From a different angle, informality has both inter-firm and intra-firm margins. At the inter-firm margin, some firms, working "underground", completely hide from the state. Others, at the intra-firm margin, are partly formal and partly informal which usually happens in the form of misreported sales and hidden workers. In this paper, we focus on the interfirm margin of

informality, i.e. the exclusion of enterprises from the formal economy, be it voluntarily or involuntarily.

Previous research has shown important links between access to finance and the incidence of informality. On the theoretical level, Straub (2005) presents a comprehensive model of a firm's decision between formality and informality, which includes the decision to tap formal or informal financial markets and shows how the different constraints discussed in the empirical literature affect the threshold size of a company indifferent between formality and informality. In this paper, we use a similar conceptual framework for addressing different dimensions of informality. Consider an economy in which firms (or entrepreneurs) are heterogeneous in initial capital k and can work in either formal or informal sector. The productivity is higher in the formal sector, due to access to formal services; however, firms have to pay an entry cost to overcome the barrier of formality. This barrier includes registration costs, indivisibility of investment and formal property claims, where the latter enables entrepreneurs to use her assets as collateral and thus gain access to formal finance. Figure 1 plots the production versus initial capital of a firm in the formal and the informal sector. The marginal production of capital is decreasing and given the real rental price, the profit maximization in the informal sector yields the optimal use of capital as k^*. The intersection of the iso-profit line of k^* and formal production curve gives the level of initial capital $\bar{k}$ above which firms decide to work in the formal sector. Based on the firm's decision, three different regions can be distinguished. In the right area, firms become formal and have the highest production and profitability. In the middle, although formality is possible, the optimal choice is producing in the informal sector and entrepreneurs thus voluntarily self-exclude from formality. The left area stands for firms not possessing enough capital to work formally and therefore excluded from the formal sector.

Insert Figure 1 here

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In this setting, better access to financial services helps reduce informality through two different channels:

(A) *Increase transparency:* Access to finance makes the operation of the enterprise at least partly observable and thus reduces asymmetric information and agency problems between lender and borrowers, hence facilitating the use of formal finance and other formal services. In this way, financial development helps the firm to overcome the barriers of formality shifting the formal sector production curve to the left (Figure 2.A).

(B) *Enhance productivity*: By facilitating transactions using short-term credit and funding long-term investment, financial development shifts the productivity of formal firms upwards, while it has no significant effect on informal firms, thus increasing the benefits of producing in the formal sector (Figure 2.B).

Insert Figure 2 here

The transparency channel helps credit constrained firms increase their credibility to overcome the entry cost into the formal sector and thus reduces the incidence of informality. In contrast, the productivity channel has two effects on informality: (i) it reduces the opportunistic informality and the number of firms that voluntarily produce in the informal sector; (ii) it increases the production of the formal sector for a fixed level of initial wealth. In this framework, Channel (A) is the main mechanism through which finance affects small firms. In contrast, the impact of financial development on firms possessing large fixed assets is through Channel (B). Moreover, we expect both channels to be stronger in industries that are more dependent on external finance.

We examine these hypotheses using Indian manufacturing data. After examining the overall effect of financial development on the incidence of informality, we inspect whether it

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helps removing formality barriers, by focusing on small firms that are more likely to be excluded from the formal sector. To control for endogeneity biases related to reverse causation and omitted variables, we follow the seminal work by Rajan and Zingales (1998) and exploit cross-industry variation in the need for external finance. Using a difference-in-difference set-up, we gauge whether firms in industries more reliant on external finance are more likely to be formal in states and years with higher levels of financial development. This allows us to control for demand-side effects and for other factors co-varying on the state-year level with financial deepening. We gauge the effect of financial development on both intensive and extensive margins of the formal sector, i.e. the number of firms and the total production share, and thus both channels discussed above, and focus on two different dimensions of financial development, namely depth, proxied by Credit to SDP, and outreach, proxied by branch penetration. Financial depth relates to the overall credit volume in the economy, independent of which enterprises have access to credit. A high credit volume could thus be mapped to different loan size distributions, including loans mainly to large firms. Financial or bank outreach relates to the ease of access to financial services, including credit. Given the importance of geographic proximity in lending relationships especially of smaller firms (Degryse and Ongena, 2005) we conjecture that small firms stand to benefit more from financial outreach than large firms. Although these dimensions are not mutually exclusive, the emphasis of one over the other can lead to different policy recommendations.

Our results suggest that both dimensions of financial development are important for increasing the share of formal production in manufacturing. Financial outreach helps reduce formality barriers and thus increases the number of formal firms (channel A), whereas financial depth mainly affects informality through channel (B), increasing productivity of industries dependent on external finance. We also find that this effect is stronger for small

firms in the case of financial outreach while financial depth is associated with the incidence of formality of larger firms.

This paper contributes to several literatures. First, we add to the literature on informality. An extensive literature has shown that informality almost always has negative consequences on the aggregate level. In addition to lack of access to formal services, hiding from the government increases distortions and reduces productivity (Gordon and Li 2009). On the other hand, informality can indirectly hamper firm growth through lack of infrastructure caused by deficits in the government revenue (Kleven et al, 2009). Based on the World Bank Enterprise Surveys, La Porta and Shleifer (2014) find high levels of informality in developing countries. One of the important differences between formal and informal enterprises is that around 44 percent of informal enterprises list access to financing as the main obstacle of doing business, whereas this number is 21 and 14 percent for small and large formal enterprises, respectively. They also document a large productivity gap between formal and informal firms. In line with this, Hesieh and Olken (2014) show sharp differences in productivity and human capital of managers between formal and informal firms. Our paper investigates how variation in financial sector development across states and over time within India can explain incidence of informality and productivity differences between the formal and informal sectors.

This paper is also related to a small but growing literature on the determinants of informality, most of which focus on specific factors that can explain the incidence and extent of informality. The literature has focused on different areas to explain informality and tax evasion. First, high tax rates and other burdensome regulations increase cost and reduce benefits of formality (de Soto, 1989; Loayza, 1996; Schneider and Ernste, 2000), although low taxation combined with deficient public services can result in similar effects (Johnson et al., 2000; Friedman et al., 2000; Dabla-Norris et al., 2008). The relationship between labor

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market rigidities and informality, on the other hand, seems to be relatively robust (Loayza, 1996; Botero et al., 2004), as is the effect of entry regulations (Djankov et al., 2003; Klapper et al., 2006). Second, weak institutions that allow rent seeking and predatory behavior by government officials drive firms into informality, an explanation often applied to post-transition economies in Eastern Europe (Shleifer and Vishny, 1993, 1994). A third explanation is that firms try to hide their profits from criminal gangs (Zhuravskaya and Frye, 2000). Fourth, deficiencies in the legal framework (Johnson et al., 1998) reduce the benefits of formality – being able to enforce contracts through the court system and thus being able to deal with a broader set of trading partners at arms-length. In our empirical assessment, we thus have to discriminate between legal system deficiencies and financial sector development not related to the legal system. Finally, several empirical papers have shown the importance of financial constraints in explaining variation in informality. A recent cross-country study shows that firms are more likely to produce in the formal sector in countries with more effective credit registries and higher branch penetration, an effect that is stronger for smaller and geographically more remote firms and firms in industries with a higher dependence on external finance (Beck, Lin and Ma, 2014). Compared to this literature, we exploit within-country variation in financial development and compare the effect of two different dimensions of financial development, depth and outreach.

Second, we add to a large literature on the real effects of financial deepening. Starting with King and Levine (1993 a,b), a large literature using different aggregation levels and measures of financial depth has shown a positive relationship between financial depth and economic growth, a relationship that goes more through productivity growth than capital accumulation (e.g., Beck et al., 2000). While the recent crisis and recent studies have shown important non-linearities (e.g., Arcand et al., 2012), there seems a wide-spread consensus in the literature on a strong effect of financial deepening on economic growth for developing

countries, such as India. The literature has also related financial development to financing obstacles of small and medium-sized enterprises, showing that obstacles are lower in countries with higher levels of financial development (Beck et al., 2006) and that these obstacles are less growth constraining in countries with deeper financial systems (Beck, Demirguc-Kunt and Maksimovic, 2005). Our paper adds to this literature by relating within-country variation in financial development to the incidence of formality, thus another important channel through which financial sector development can impact the level and structure of GDP. Unlike previous papers, we also distinguish specifically between the two dimensions of financial depth (focus of most of the finance and growth literature) and financial outreach.

Finally, our paper also adds to a flourishing literature on economic development in India, which has linked sub-national variation in historic experiences and policies to differences in growth, poverty levels, political outcomes and other dependent variables (see Besley et al., 2007 for an earlier survey). Specifically, researchers have focused on differences in political accountability (Besley and Burgess, 2002; Pande, 2003), labor market regulation (Besley and Burgess, 2004; Hasan, Mitra, and Ramaswamy, 2007; Dougherty, Robles, and Krishna, 2011), land reform (Besley and Burgess, 2000; Banerjee and Iyer, 2005), trade liberalization (Topalova, 2010; Edmonds et al., 2010) and gender inequality (Iyer et al., 2012). Directly related to our paper, Burgess and Pande (2005) relate a social banking policy on branching to differences in poverty alleviation across states. Ayyagari, Beck and Hoseini (2013) explore the relationship between financial deepening post-1991 liberalization and poverty-levels. Our paper adds to this literature by focusing on cross-state differences in financial deepening after the 1991 liberalization episode and by comparing the effects of two different dimensions of financial development – total credit volume and branch penetration of financial institutions – on the incidence of informality.

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The remainder of the paper is structured as follows. Section 2 describes the data we will be using and section 3 the methodology. Section 4 discusses our results and section 5 concludes.

2. Data

This section describes the different data sources and variables we use to gauge the relationship between the incidence of informality and access to formal sources of external finance. Specifically, this section describes (i) the indicators of informality, (ii) the indicators of financial depth and outreach, and (iii) the industry characteristics that allow us to gauge the differential impact of financial sector development on the incidence of informality across different industries.

2.1. Gauging the incidence of informality

We use firm-level surveys for the formal and informal sectors to construct gauges of the incidence of informality on the state-industry level. Specifically, we have available data for the Indian manufacturing sector for 5 years: 1989-90, 1994-95, 2000-01, 2005-06, and 2010-11. Each year has two data sources: (i) the annual survey of industries (ASI) and (ii) the national sample survey on unorganized manufacturing sectors (NSS). The ASI covers factories employing above 10 employees using power and those with 20 employees or more without using power. In each year, all factories with more than 100 employees plus at least 12% of the rest are sampled. The sample is representative at the state and 4-digit NIC code levels.[1] The second data source is the NSS enterprise survey which covers small manufacturing units that are not covered by ASI. Its sampling strategy is based on the number of enterprises in each village/town. Sample weights which show the number of firms the

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[1] Up to 4-digit level, the NIC code is identical in structure to International Standard of Industrial Classification (ISIC). In the additional digits, it incorporates the national characteristics.

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sample represents are provided for both surveys. Table 1 shows the number of observations for each ASI and NSS surveys across the five waves.[2]

Insert Table 1 here

To gauge the incidence of informality, we use two dummy variables at the enterprise level. The first one refers to **general registration** and indicates whether the enterprise is registered under any act or authority. The second one is **tax registration** and indicates whether the firm is registered with the tax authorities or not. All sampled firms in ASI are registered under the Factories Act and are taxpayers. The NSS sample surveys have information about registration under any act or agency. We can find out about tax registration by checking whether the firm pays any sales tax (distributive expenses) or not. Thus, a firm is registered for tax if it is in ASI or it is in NSS and has nonzero distributive expenses. We do not have information about tax registration or payment in NSS 89, and therefore, we use this year just for the regression of general registration.

We use the information on firms' registration status to construct six different indicators of informality on the aggregate level. Table 2.A shows the weighted averages of the different registration indices in each year. The first two rows show general and tax registration rate among firms. Each observation is weighted with the number of firms it represents. The general registration rate increased from 8 percent to 12 percent between 1989 and 1994, declined in 2000 and 2005 to 10 percent, before it went up again to 15 percent in 2010. The tax registration rate slightly increased till 2005 but doubled from 2005 to 2010, when around 3 percent of firms were registered with tax authorities. Considering the value-added share of formal and informal firms instead of the numbers gives a somewhat different picture. In rows (3) and (4) we present the weighted sum of the value-added of registered firms divided by the

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[2] Given the variation in NSS coverage, we are concerned that the surveyed firm population might vary significantly over time. When comparing the share of firms in externally dependent industries across the five survey waves, however, we cannot any significant trend correlation with NSS coverage.

weighted sum of the value-added of all firms. The numbers indicates that although the number of registered and tax-paying firms is small, they comprise a big and growing slice of the value added in the manufacturing sector, reaching 93 and 89 percent in 2010, respectively. Finally, the numbers in rows (5) and (6) are employment shares of formal firms which equal the weighted sum of the number of workers of registered firms over the weighted sum of the workers of all firms. The trends in the value-added and employment is similar to the number of firms, first dropping and then increasing again.

Insert Table 2 here

To examine the robustness of our measure, we cross-check the overall numbers with comparable GDP estimations of Indian manufacturing sector published by Central Statistical Office (CSO), Government of India. Table 2.B compares the official estimation of net manufacturing GDP in India versus our estimations of gross output and value-added, using 2005 as the base year. The official estimations are at constant price and account for depreciation. We also normalize our estimated values by state level price indices,[3] but our measures are in gross terms. There are several reasons for differences across the different variables. First, they might be due to differences in price adjustment and depreciation. In addition, the CSO publishes net GDP data on registered and unregistered manufacturing. Compared to our methodology, the CSO's estimation is based on labor input and production per labor, counting just firms in ASI as the registered sectors.[4] Since we also take into account registered enterprises in the NSS that are not covered in ASI, our estimates of formal production tend to be higher. Nevertheless, we observe parallel trends in the value-added share of firm registered under any act and in similar estimations by CSO.

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[3] The price index is published by Labour Bureau as "consumer price index for industrial workers".
[4] The methodology of CSO's is described at: http://mospi.nic.in/Mospi_New/upload/brochure_ 2004-05.pdf

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Appendix Table A1 provides the average share of registered firms across industries, both using general and tax registration and across the three dimensions of (i) share of firms, (ii) share of value added and (iii) share of employees, as well as the number of firms these averages are based on, averaged over the five survey waves. We note a substantial variation across industries in the incidence of informality. While in Mining and Quarrying 100% of activities are undertaken in registered companies, only 3% of companies in the tobacco industry are registered under any act and less than 0.5% are registered with tax authorities, even though their share in total employment is over 11% and their share in value added over 58%.

Appendix Table A2 provides similar information on the incidence of informality across states, again averaging over the five survey waves. While over 40 percent of firms are registered in Goa, only one percent are registered in Orissa. Figure 3 provides graphical illustration of cross-state variation of registration average over time and industries.

Insert Figure 3 here

We use these indices of informality on the firm-level to compute gauges of the incidence of informality on the state-year-industry level. Specifically, we combine the firm-level data of ASI and NSS and then collapse them at state-year-industry level using sample weights. Since sampling in NSS is based on location not industry, we aggregate our measure just to 2-digit industry codes. Specifically, we construct indicators of formality based on the share of firms, share of value added and share of employees, both for general registration and tax registration. Overall, we have 35 states, 5 years, and 33 industries, but the number of observations is only 4,180 because smaller states do not host all industries. In the regressions, we have fewer observations because of missing data on some of the independent variables in some states, industries and years. Table 3 Panel A provides the descriptive statistics on our

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indicators. On average, 11.3 percent of firms are registered under any act, but only 2.1 percent for tax authorities.

<center>**Insert Table 3 here**</center>

2.2. **State level indicators of financial development and control variables**

We construct several time-variant indicators of financial and economic development as well as tax enforcement on the state-level. Panel A of Table 3 provides descriptive statistics of the time-variant state-level variables. Appendix Table A2 provides state-level averages of the different variables.

The post-1991 period has seen rapid financial deepening in India, though with important differences across Indian states. As documented in Ayyagari, Beck and Hoseini (2013), following a severe balance of payments crisis in 1991, there was a substantial liberalization of India's financial sector as part of an economy-wide liberalization process. These reforms included de-regulation of interest rates, reduction in the volume of directed credit and entry of new privately-owned financial institutions. Reforms of the regulatory and supervisory framework and the contractual environment also supported financial deepening in the subsequent decades. As documented by Ayyagari et al. (2013), however, this financial deepening process was uneven across different Indian states. This heterogeneity over time and across states provides us a rich identification tool that we can relate to variation in the incidence of informality, as we will discuss in the following.

First, we use two indicators of financial sector development, capturing the two dimensions of financial depth and financial outreach. Specifically, **Credit to SDP** is outstanding amount of credit utilized in each state divided by State Domestic Product. It corresponds to a standard cross-country indicator, Private Credit to GDP, which has been extensively used in the finance-growth literature (e.g. Beck et al., 2000). We use its

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logarithmic form to control for non-linearities, as typically done in the cross-country literature exploring the effects of financial deepening. Our measure of financial outreach is **Branches per capita** and is the number of bank branches per 10,000 people in each state and year. Average Credit to SDP varies from 11% in Nagaland and Manipur to 135% in Chandigarh, while branches per capita is 0.42 in Bihar ranging up to 3.42 in Goa.

In investigating the link between financial development and informality, we also control for several other time-varying state characteristics. **SDP per capita** is net state domestic product per capita at constant price and a proxy for income levels, and **State Government Expenditure to SDP** is total state government expenses over SDP. Higher economic development and better public service provision might reduce barriers to formality for enterprises. Critically, as one of our formality gauges refers to tax payments, we control for **tax enforcement per firm,** which is the component of state government expenditure on collection of taxes and duties divided by the estimated number of firms in the state. Hence, it measures tax enforcement expenditure per firm in each state. SDP per capita ranges from 8677 in Bihar to 80935 in Chandigarh. Government expenditures average 19 percent of SDP, ranging from 0.071 in Delhi to 1.119 in Sikkim. Finally, enforcement expenditures per firm range from 0.053 in West Bengal to 4.803 in Delhi.

2.3. Industry characteristics

To explore the differential effect of state-level policies on informality in different industries, we use an industry characteristic that captures the need for financial services and thus the potential benefit of access to formal finance or opportunity costs of informality. Specifically, we use the **RZ index** of financial dependence which is from Rajan and Zingales (1998) and equals the median of firm level measure *"(capital expenditures − cash*

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flow)/capital expenditure averaged over 1980s" for 36 industries. This indicator, computed

for a group of large listed enterprises in the U.S., for which the supply curve can be expected

to be almost perfectly elastic, is supposed to indicate the need for external finance based on

inherent industry characteristics and is exogenous to the actual use of external finance by

firms in India. As our sample period spans the 1990s and 2000s in India and this measure is

computed for the U.S. in the 1980s, concerns on different technologies in both countries

might not be as critical. The level of dependence on external finance shows the potential

benefits for firms from being formal and having access to formal financial services. Appendix

Table A1 shows that external dependence ranges from -0.45 in tobacco industry to 1.06 in

office and computing machinery.

In addition, we employ another industry-level index to capture the exogenous variation

in tax compliance. The Indian taxation of enterprises comprises direct and indirect taxation

on both central and state level. While direct taxes are mainly levied by the central

government, the main source of states' tax income is their sales tax. Union excise duties on

all manufacturing products and service tax on services are also levied by the central

government. Excise duties, covering all manufacturing products, turned to the VAT –named

MODVAT– in 1985 and expanded to ad-valorem rates in 1993 for the majority of products.

Hoseini (2014) shows that under the value-added tax system, upstream industries that are

forwardly linked to others have higher risk of detection and thus are more likely to be formal.

As over the period of our study, the manufacturing sector of India has been under the value-

added tax, we measure the **forward linkages** of each industry to capture the exogenous

variation in the risk of noncompliance in the value-added tax system. The forward linkages

index, based on Rasmusen (1958), is the row sum of Leontief inverse matrix of Indian

economy reflecting the flow of products going to other industries not final consumers.

Specifically, for each industry, it is equal to the diagonal element of $X^{-1}(I-A)^{-1}X$, where X is

the diagonal matrix of production and *A* is the Leontief coefficient matrix. This index is calculated for each industry using the input-output tables of the Indian economy. The I-O tables are available for 1993-94, 1998-99, and 2003-04 and we use the average of the index over time. The indicator ranges from 0.27 in tobacco products to 2.07 in basic metals.

Panel B of Table 3 presents correlations across the different state-industry level variables. We find that the share of firms registered under any act or under tax authorities is positively correlated with both financial sector indicators, with both industry characteristics, with SDP per capita and with enforcement expenditures per firm and negatively with government expenditures to SDP. Credit to SDP and branch penetration are positively correlated with each other, with a correlation coefficient of 58 percent. However, other state-level variables are also significantly correlated with financial development. Finally, external dependence and forward linkages are positively and significantly correlated with each other, with a correlation coefficient of 0.5.

3. Ocular econometrics and methodology

Before presenting regression results on the relationship between financial development and informality this section provides some preliminary facts about this relationship using Indian manufacturing data and explains our methodology to identify the significance of each channel.

Figure 4 plots the general and tax registration rate versus our two financial development variables across states. It can be seen that both financial variables have a positive relationship with general and tax registration rates, but the observations of branches per capita and tax registration are more concentrated along the fitted line, compared to the other three

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relationships. Both relationships are significant at the 1 percent level for branches per capita and at the 5 percent level for credit to SDP.

As shown in Figure 2.A, theory suggests that one effect of access to finance on informality is cutting the barrier to formality and enabling firms to overcome the costs of formality. To identify this mechanism, we focus on the sample of smaller firms that are more likely to be excluded from the formal sector. Figure 5 plots registration rates versus our financial development indicators for the sample of smaller firms, defined as establishments with fixed assets less than the 25th percentile of the respective industry in each year. The figure suggests a positive relationship between formality and branches per capita, with a higher slope than in the overall sample (significant at the 1 percent level), while the relationship with credit to SDP is insignificant.

The second channel through which finance can alleviate informality is increasing productivity of the formal sector (Figure 2.B). As mentioned above, this channel has two effects: reducing opportunistic informality and boosting the production of formal sector firms. In order to identify this channel, we employ the exogenous variation in the dependence on external finance among industries. In Figure 6, we compare the registration and financial outreach relationship between two groups of industries: above the 75th and below the 25th percentiles of the RZ index of financial dependence. It can be clearly seen that the positive relationship is stronger for industries with larger need for external finance suggesting less opportunistic informality in these industries. In Figure 7, we use the same structure to compare the link between production and financial depth in the formal and informal sector. This figure shows that in the formal sector, production of industries more reliant on external finance is highly sensitive to credit to SDP (significant at 1 percent level), while this sensitivity is much less for other industries. One the other hand, this pattern is much weaker and insignificant in the informal sector.

To formally estimate the overall effect of state-level financial development on registration rates, we use different methodologies. First, we use the following difference-in-difference setting as the baseline.

$$inf_{ist} = a_i + b_s + c_t + \alpha_1\, FD_{st} + \alpha_2\, Enf_{st} + \alpha_3\, X_{st} + \varepsilon_{ist} \qquad (1)$$

where inf_{ist} is one of the informality indices in industry i, state s and year t. a_i, b_s, c_t are industry, state and year fixed effects, respectively, FD_{st} is one of our two financial development indicators in state s and year t, Enf_{st} is enforcement expenditure per firm in state s and year t, and X_{ist} is a vector of control variables including log of SDP per capita at constant prices and government expenditure to SDP.

Because our regressions are for the whole of India, in each regression, we use the estimated number of firms in state s, year t, and industry i as weights for the observations. In addition, to control for the underestimated standard error in the difference-in-difference setting, as suggested by Bertrand, Duflo and Mullainathan (2004), we cluster our estimation at the state level.

To estimate the differential effect of state-level financial development and enforcement activity on the incidence of informality across firms with different needs for external finance, we utilize the following difference-in-difference setting for estimation.

$$inf_{ist} = a_i + b_s \times c_t + \beta_1\, RZ_i \times FD_{st} + \beta_2\, RZ_i \times X_{st} + \beta_3\, FL_i \times Y_{st} + \varepsilon_{ist} \qquad (2)$$

where RZ_i is the Rajan-Zingales index of external dependence for industry i, and FL_i is forward linkage for industry i, Y_{st} is a vector of state-level log of enforcement per firm, and the rest of variables are the same as equation (1). By saturating the model with industry and state-year fixed effects, we focus on the relative effect that time-variant state-level variables have on the incidence of informality on the state-industry-year level. In order to examine the production enhancing effect of finance on the formal sector, we utilize the same regression

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setup as (2), but instead of the incidence of formality, we use the levels of production and value-added in formal and informal sectors as the dependent variable.

4. Empirical Results

The results in Columns (1) to (4) of Table 4 show the overall effect of financial development on the *share of firms registered under any act* or *tax authorities*. While we find a significant relationship between branches per capita and the share of formal enterprises registered under tax authorities, Credit to SDP does not enter significantly. Neither variable enters significantly in the regression of *share of firms registered under any act.* The economic effect of the relationship between branch penetration and formality is significant, however. Specifically, the standard deviation of branches per capita de-trended for state and year effects is 0.045 and this variation explains 0.045×9.09= 0.41 percentage point in tax registration which on average is 2.05 percent.

Insert Table 4 here

In the rest of Table 4, we estimate the same equation, but for sub-samples of firms with smaller fixed assets to capture the effect of financial development on firms that are more likely to be excluded from the formal sector. Specifically, we select firms whose total fixed assets are below the 25th percentile of their industries in each year, and re-compute the informality measures and the sample weights.[5] Columns (5) to (8) show that for the sample of smaller firms the effect of financial penetration is significant for both general and tax registration. Moreover, financial depth is positively associated with tax registration and less robustly with general registration for smaller firms. In terms of the economic size of the relationship, financial outreach has more explanatory power for the incidence of informality

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[5] The results are robust to using the percentiles just within industry or irrespective of the industry. They are stronger for smaller percentiles.

than financial deepening. For instance, for the sample of firms below 25th percentile, one de-trended standard deviation increase in branches per capita and credit to SDP increases tax registration rate by 0.045×16.28 = 0.73 and 0.138×2.46 = 0.34 percentage point, respectively. Overall, the estimations suggest that financial development reduces exclusion from the formal sector by reducing entry barriers to the formal sector, a relationship stronger for smaller firms; we also find that broadening access plays a more important role than financial deepening.[6] These results, however, are based on average estimations across industries with different needs for external finance. The estimates are also subject to endogeneity biases, related to reverse causation (a higher share of formal firms demanding more formal finance and thus increasing both credit volume and outreach by financial institutions) and omitted variables that might drive both reduction in informality and financial deepening and broadening. In the following, we will therefore explore the differential relationship between financial development and the incidence of informality across industries with different needs for external finance.

The results in Table 5 show that the positive association of financial development and the share of firms registered under any act and registered with tax authorities, are stronger in industries that rely more on external finance. In columns (1) and (2), we interact the two financial development variables on the state-year level with external dependence on the industry level, including state-year and industry fixed effects. Both interaction terms enter positively and significantly at 1% level. To control for the fact that financial development and formality are correlated with income levels and other government policies, we also include interaction terms of external dependence with the log of SDP per capita and government expenditures to SDP. While these interaction terms enter positively but

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[6] Given the high correlation between the two financial sector variables, we only include one of them at a time. If we include both at the same time, we find that just outreach is significant in Table 4. We also ran regressions without SDP per capita, given its high correlation with financial development and confirm our findings.

insignificantly in the regression including the interaction between Credit to SDP and external dependence, they enter negatively and insignificantly in the regression including the interaction of external dependence and branches per capita. In columns (3) and (4), we also control for the interaction of forward linkages with both state-level enforcement expenditures per firm and the log of SDP per capita, While neither of them enters significantly, the financial development interaction terms continue to enter significantly with similar coefficient sizes.

Insert Table 5 here

The results in columns (5) to (8) confirm our findings, when using the tax registration definition of formality rather than registration under any act. Both branches per capita and credit to SDP interacted with external dependence enter positively and significantly. In addition, consistent with Hoseini (2014), the forward linkage interaction terms are positively associated with tax registration (columns 7 and 8).

The findings of Table 5 are not only statistically, but also economically significant. The difference-in-differences estimation suggest that going from a state at the 25th percentile of branches per capita (Jharkhand = 0.55) to a state at the 75th percentile (Kerala = 1.14) and an industry at the 25th percentile of the RZ external dependence index (basic metals = 0.03) to an industry at the 75th percentile of external dependence (motor vehicles = 0.39) results in an increase in registration under any act by $22.71 \times 0.59 \times 0.36 = 4.8$ percentage points and an increase in tax registration by $7.55 \times 0.59 \times 0.36 = 1.6$ percentage points. The 25th and 75th percentiles of credit to SDP are Uttar Pradesh (0.19) and Andhra Pradesh (0.36); the differential effects for Credit to SDP are therefore 2.73 and 0.55 percentage points, respectively.[7] This compares to a mean registration rate of 11.3 percent and 2.1 percent under

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[7] For general and tax registration rates the effects are $11.9 \times \log(0.36/0.19) \times 0.36 = 2.73$ and $2.38 \times \log(0.36/0.19) \times 0.36 = 0.55$ respectively.

tax authorities. As in Table 4, the economic effect is thus larger for financial outreach than for financial depth.

The results reported Appendix Table A3 show that the effect of financial outreach is stronger for smaller firms, while we only find an effect of financial depth for larger firms. Here, we split the sample into firms below and above the 25th percentile of fixed assets for a specific industry and year. While estimates become less precise for the sample below the 25th percentile, the relative economic size of the effects of financial depth and outreach is confirmed. In the case of firms above the 25th percentile, only the interaction of external finance with our measure of financial depth, Credit to SDP, enters positively and significantly in the regressions. This suggests that larger firms in industries relying on external finance do not benefit from higher branch penetration, but rather from overall financial depth, as captured by credit volume on the state level. [8]

One concern regarding the impact of financial development on informality is the reverse causation in the sense that lower informality leads to higher demand for financial services, especially in industries with higher need for external finance. To control for this effect, in Appendix Table A4, we re-estimate Table 5 for the sample of industries that are below the median of production level in the respective state and year. The results suggest that even if we exclude the larger industries in each state that can create such a demand effect, the interaction of RZ with both financial penetration and financial deepening are positively associated with registration rates.

While Table 5 considers only the share of firms, we now turn to alternative indicators of informality as dependent variables. In Table 6, instead of the share of formal firms, we use

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[8] If we include both financial outreach and depth in a single regression in Table 5, for the sample of small firms (fixed asset < 25th percentile), branches per capita is positive and significant while credit to SDP becomes insignificant. In contrast, when the sample contains large firms (fixed asset > 25th percentile), credit to SDP is significant, while branches per capita is not.

value-added and employment share of formal firms in total as dependent variables. Specifically, we present results with (i) the log of share of value added produced by firms registered under any act or the tax act (columns 1 to 4) and (ii) the log of share of employment in firms registered under any act or the tax act (columns 5 to 8), with the interaction of financial development and external dependence as the main explanatory variable of interest.

The results in Table 6 show that while financial depth is positively and significantly associated with the share of formally produced value added and the employment share of firm registered under any act or tax, there is no significant impact of financial breadth on the share of value added or employment in formally registered firms. Specifically, the interaction term between Credit to SDP and external dependence enters positively and significantly at least at the 5 percent level in all four regressions, while the interactions of branch penetration and external dependence do not enter significantly in any of the regressions. This suggests that although financial outreach pushes the informal firms into the formal sector, it does not necessarily improve their value-added or production. Moreover, the results suggest that the effect of financial deepening on informality is through improving value-added and employment of formal sector firms, rather than through pulling more firms into the formal sector.

Insert Table 6 here

So far, we have focused on the relative importance of formal and informal sectors within manufacturing. We now turn our attention to production and value added in the formal and informal sectors to test the link between financial development and the second channel outlined above, i.e. the higher productivity of firms in the formal sector. We therefore use as dependent variable total production or total value added on the state-industry level for all

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firms, registered firms and unregistered firms. Specifically, Table 7 illustrates the result of estimation of equation (2) for log of production (panel A) and value-added (panel B).

The results in Panel A of Table 7 show that total production and production in registered firms increases with Credit to SDP in industries that depend more on external finance, while total production of unregistered firms is not significantly associated with the interaction of external dependence and Credit to SDP suggesting a positive and significant impact of financial deepening on production of firms registered under any act or tax, but not of informal firms. On the other hand, the interaction term of branches per capita does not enter significantly in any of the specifications. The results in Panel B of Table 7 show that total value added of registered firms increases across industries with a higher need for external finance as financial systems deepen, while value-added of informal firms and total value-added does not vary with the interaction of Credit to SDP and external dependence. Comparing 75th and 25th percentiles, the economic effect of credit to SDP interacted with RZ on the value-added of firms registered under any act is $0.641 \times \log(0.36/0.19) \times 0.36 = 0.147$ which is 32% of the de-trended standard deviation of the dependent variables (0.46). The effect for tax registered firms is $0.995 \times \log(0.36/0.19) \times 0.36 = 0.229$ accounting for 44% of de-trended standard deviation (0.52). As in Panel A, the interaction terms of branch penetration and external dependence do not enter significantly.

In summary, our empirical findings suggest an important impact of financial sector development on the incidence of formality. This impact works through different channels, with different dimensions of financial sector development dominating specific channels. Specifically, we find that branch penetration, i.e. outreach by financial institutions, is associated with a lower incidence of informality mainly through the extensive margin by helping or persuading informal firms to enter the formal sector. Financial deepening, on the

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other hand, as proxied by Credit to SDP, increases the productivity of formal sector and reduces informality mainly through this channel.

5. Conclusion

This paper explores the relationship between financial sector development and the relative importance of formal and informal manufacturing in India. Previous work and theory suggest an impact of financial development on both extensive and intensive margins, i.e. pulling more firms into the formal sector and increasing total production of the formal sector. Our results provide evidence for both channels, but also distinct roles for financial depth, as proxied by Credit to SDP, and financial outreach, as proxied by branch penetration. Specifically, exploiting variation within state-years and industries with different needs for external finance, we find that financial outreach is positively associated with a higher share of formal enterprises, especially in industries with a higher demand for external finance, i.e. where firms benefit more from access to formal finance. While we also find a positive effect of financial depth on the share of formal firms, this effect is of a smaller size. In terms of production efficiency, on the other hand, we find a positive and significant role for financial depth, especially in industries more reliant on external finance, while no significant effect for branch penetration.

Together, these results suggest an important role for finance in reducing informality, though with important differences across industries. They also suggests that policies aimed at deepening the financial system as much as policies aimed at increasing outreach are important for increasing the share and productivity of formal enterprises in manufacturing.

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Figure 1- forced and voluntary informality of firms

Production

forced
informality

voluntary
informality

formal

iso-profit line

informal

k^*

$\bar{k}$

Capital
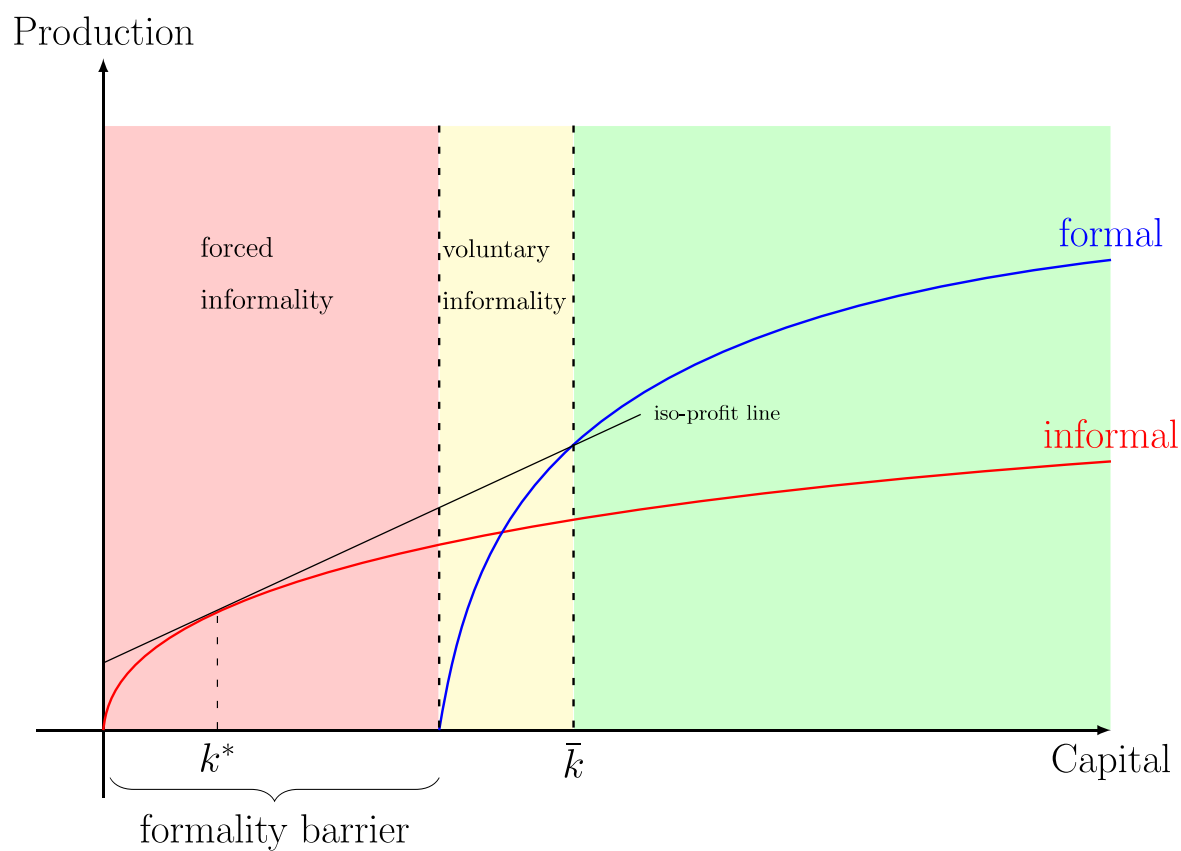
formality barrier

Figure 2- Two effects of financial development on informality: (A) reducing barriers to formality, (B) increasing productivity

Production

formal

informal

Capital

(A)

Production

formal

informal

Capital

(B)

31
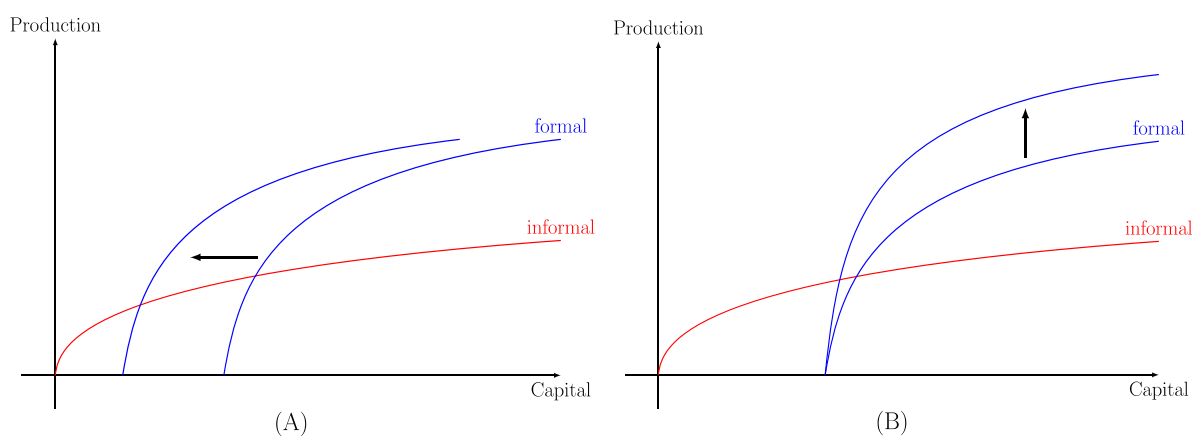
Figure 3 –registration rate across states

registration rate
under any act

percentage
62.696976

1.3298558

registration rate
under tax authority

percentage
47.06476

.3021728

32
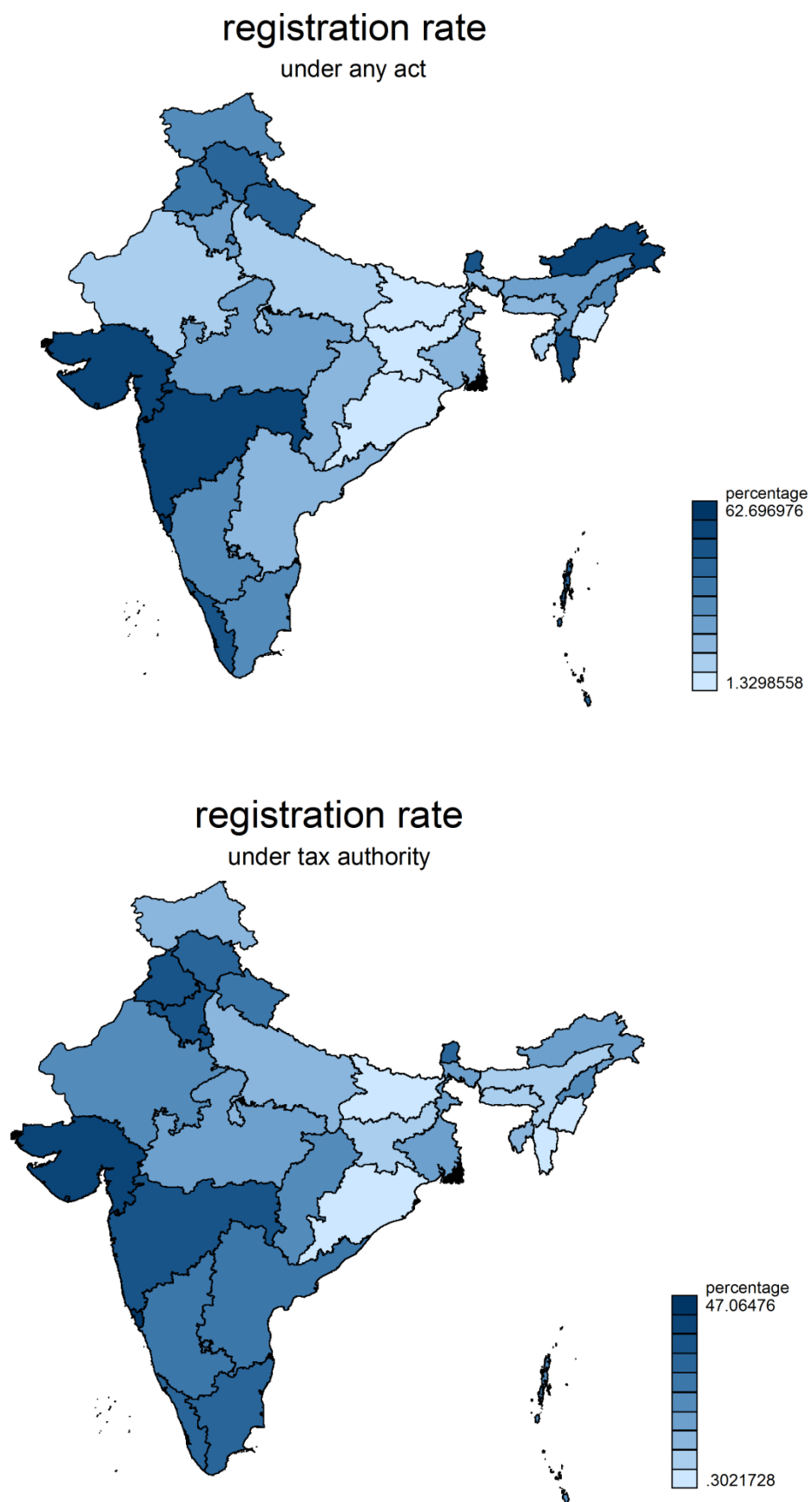
Figure 4- Registration rate vs. financial breadth and depth averaged over states
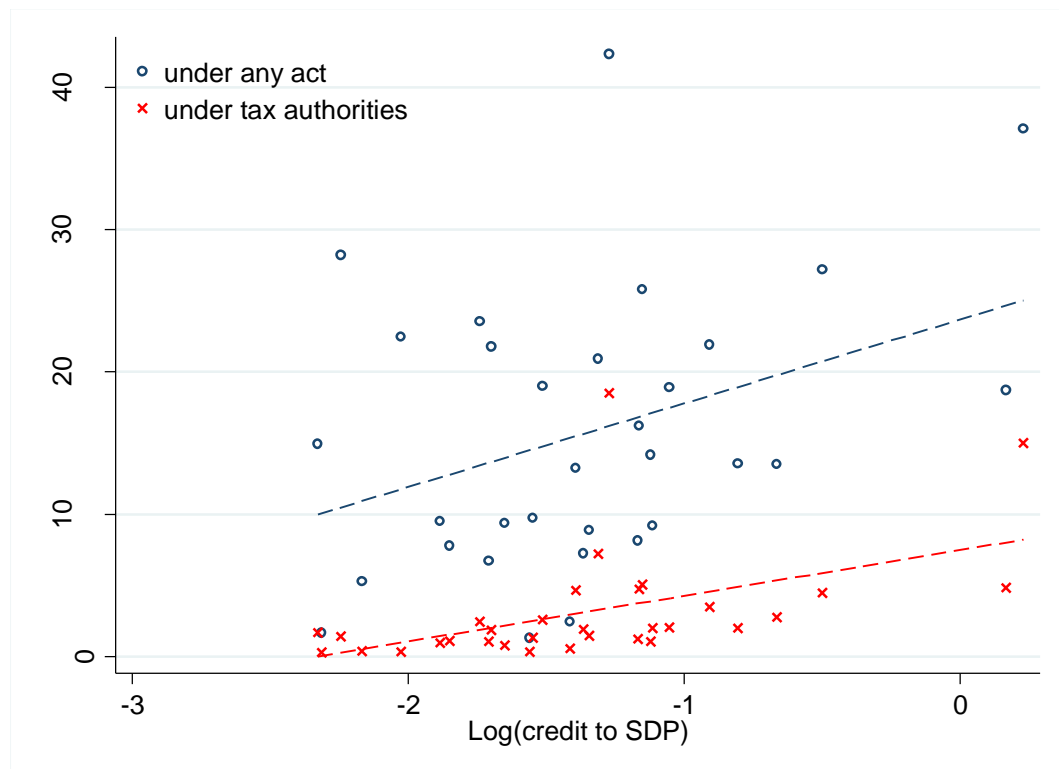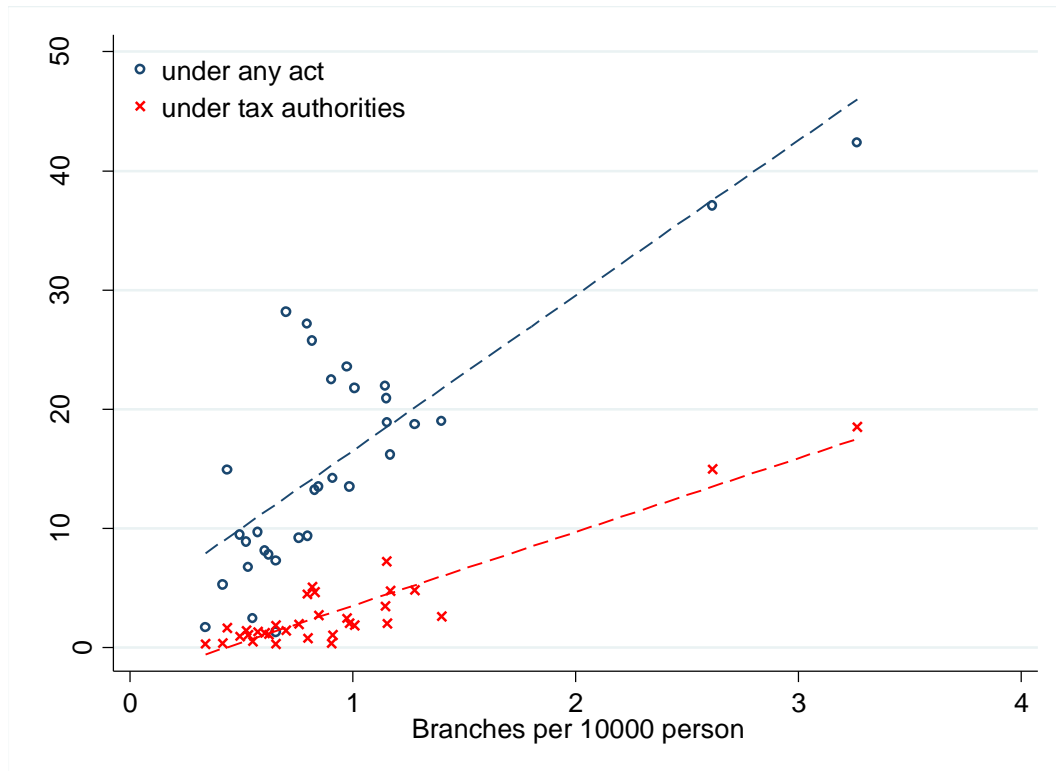
Figure 5- Registration rate vs. financial breadth and depth averaged over states for the Sample of firms with fixed assets below 25th percentile
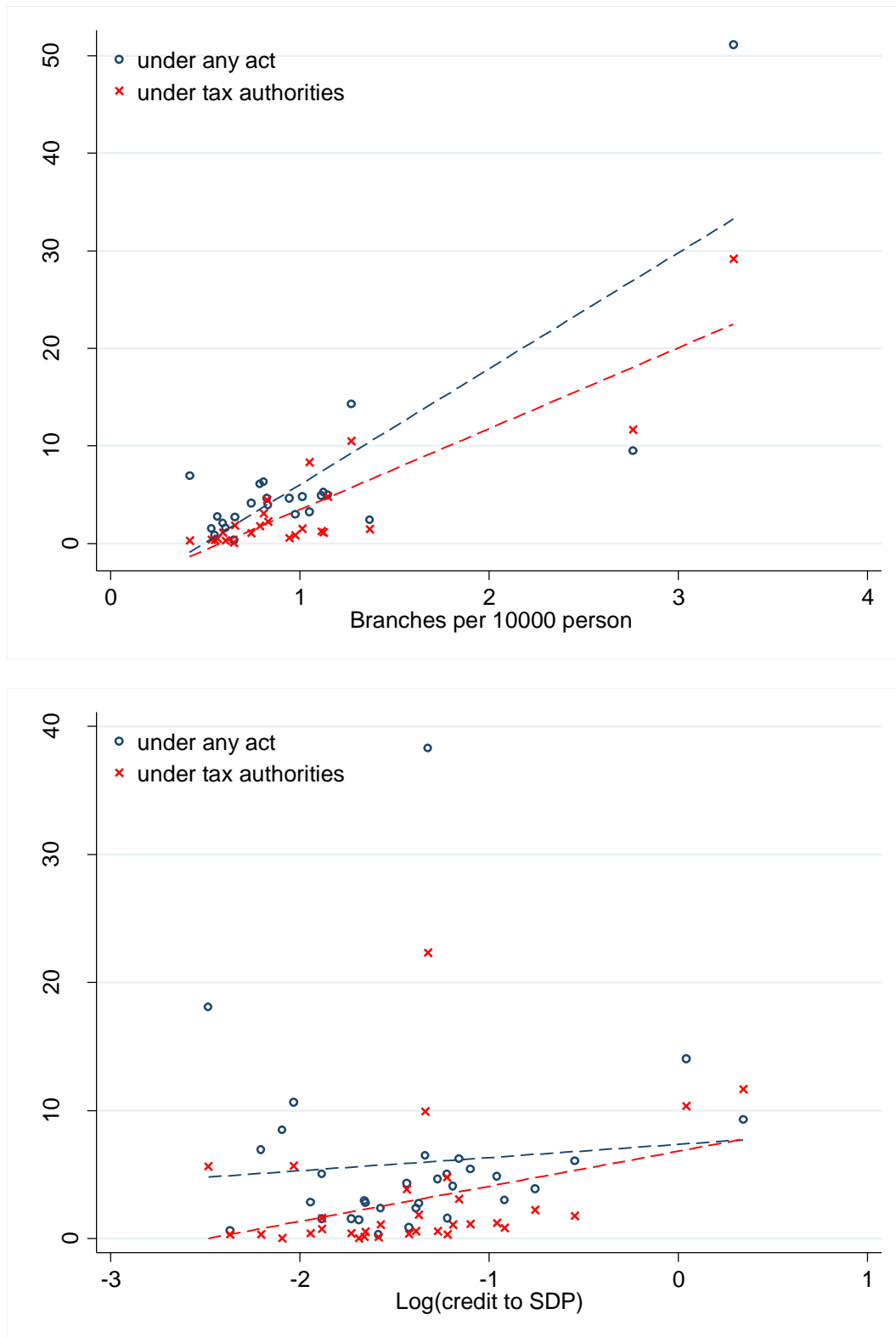
Figure 6- Registration rate, financial dependence and financial penetration averaged over states
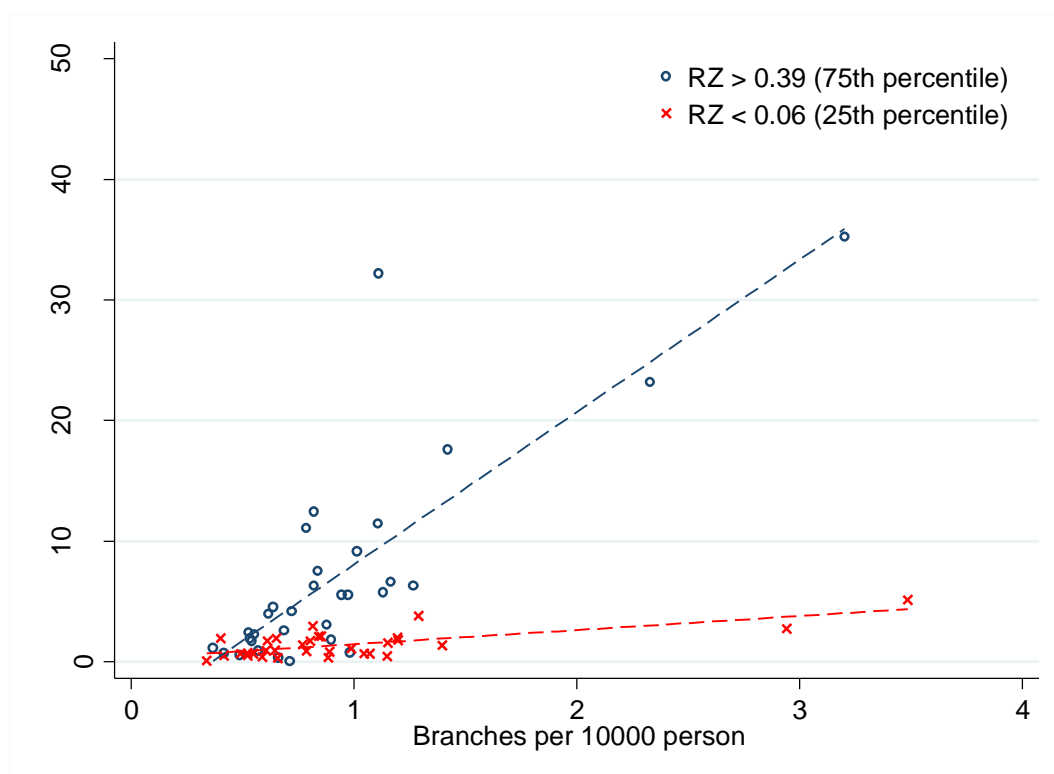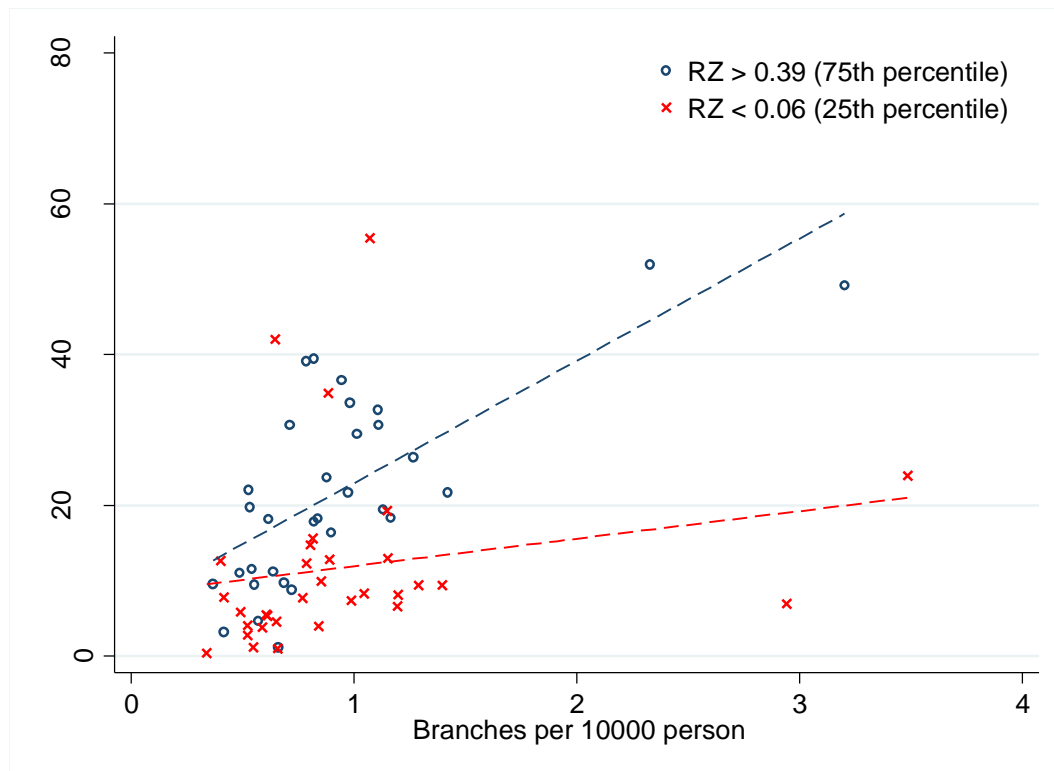
Figure 7- Production, financial dependence and financial deepening in formal sector (registered under any act) and informal sector (not registered for any act), averaged over states.
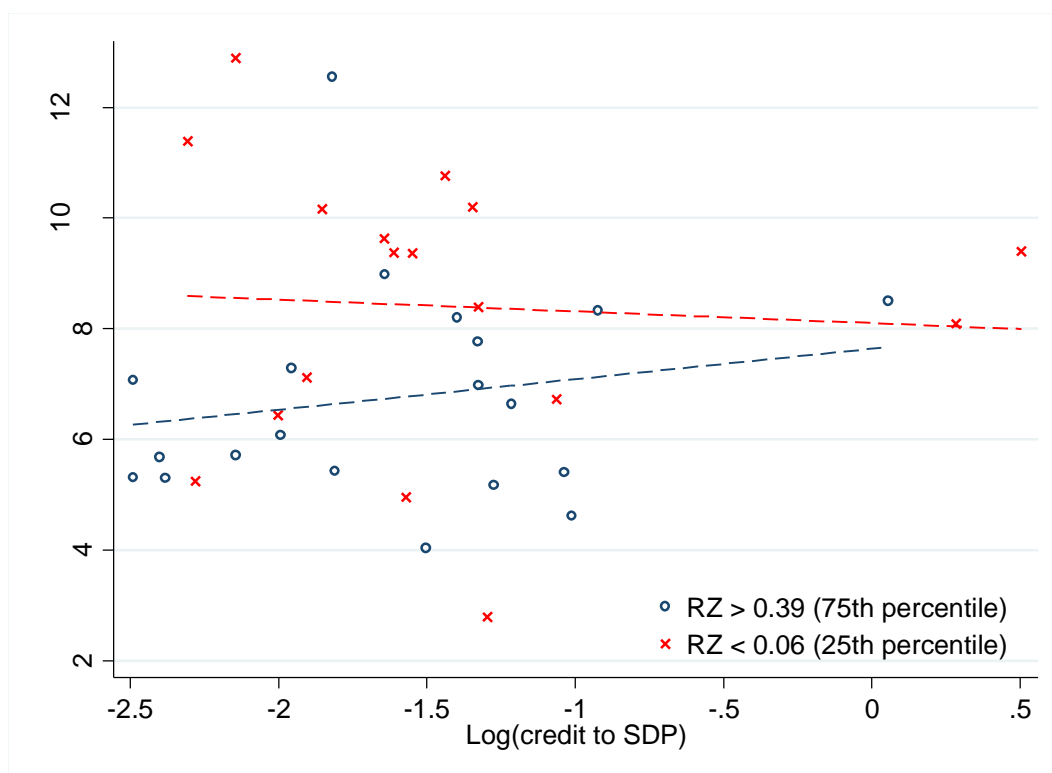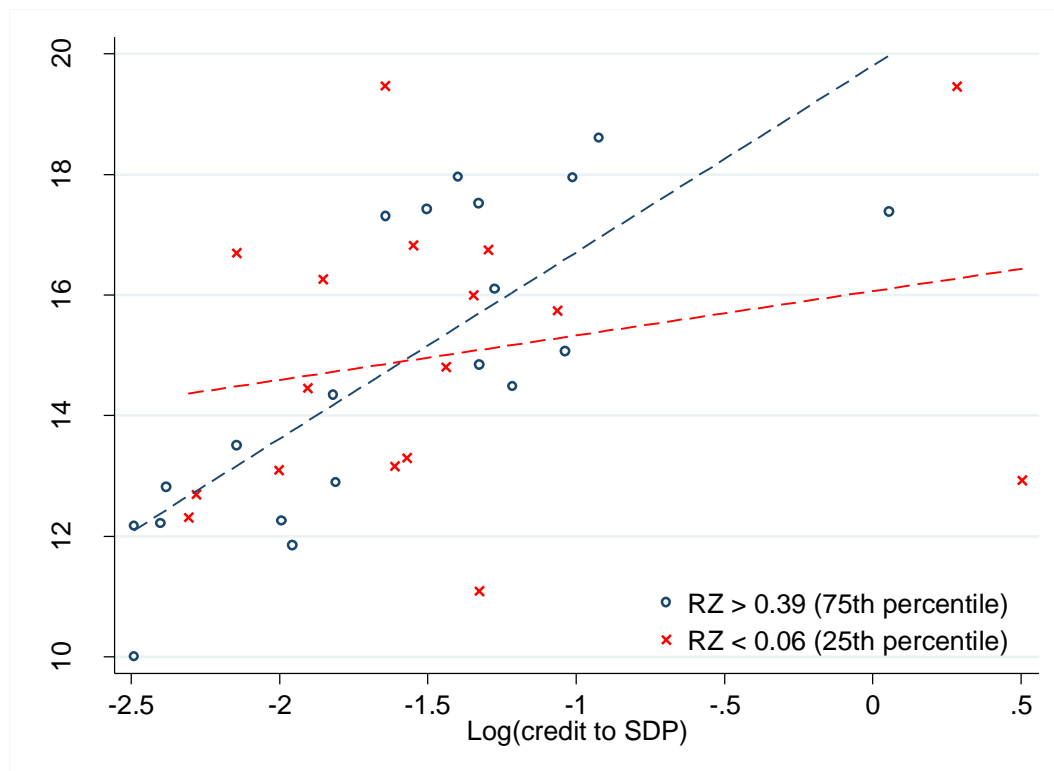
Table 1- list of surveys and the number of samples

year	1989-90	1994-95	2000-01	2005-06	2010-11
No. sample in ASI	49,323	57,908	37,055	49,637	46,843
No. sample in NSS	123,321	192,029	222,529	80,637	99,243

Table 2.A- Summary of informality measures (weights are applied)

	name	Description	1989	1994	2000	2005	2010
(1)	**Reg**	percentage of registered under any act	8.32	11.81	10.72	10.44	15.19
(2)	**Treg**	percentage of registered under tax		1.21	1.71	1.81	3.34
(3)	**Vreg**	VA share of registered under any act (%)	81.95	83.91	81.05	87.45	92.74
(4)	**Vtreg**	VA share of registered under tax (%)		76.59	71.42	80.92	88.95
(5)	**Ereg**	employment of registered under any act (%)	26.50	34.57	32.96	33.70	46.88
(6)	**Etreg**	employment of registered under tax (%)		22.41	19.40	21.69	33.12

Table 2.B- Comparison of informality measures with official estimations. The base year for the first three rows is 2005. The last row is to be compared with row (4) in Table 2.A.

	1989	1994	2000	2005	2010
Official Manufacturing GDP	38.9	49.3	72.8	100	160.6
Gross output	33.4	50.4	65.6	100	178.1
Gross value added	35.8	47.5	59.5	100	193.1
Official Registered Man. GDP (%)		63.2	61.6	67.5	69

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Table 3.A- Summary statistics. Number of firms is applied as weights.

	Reg	Treg	Vreg (log)	Vtreg (log)	Ereg (log)	Etreg (log)	Credit to SDP (log)	Branch per capita	Enf. exp. per firm (log)	SDP per capita (log)	Gov. exp. / SDP	RZ index	Forward linkages
Mean	11.34	2.05	3.65	3.26	2.60	1.76	-1.229	0.718	9.802	0.191	-0.599	0.068	0.782
Standard error	14.73	5.28	0.90	1.25	1.25	1.55	0.562	0.220	0.780	0.061	0.689	0.279	0.509
De-trended SD across:													
state	11.37	3.66	0.71	0.93	0.95	1.10	0.443	0.212	0.733	0.059	0.647	0.064	0.167
year	7.18	2.92	0.40	0.50	0.49	0.52	0.307	0.055	0.420	0.022	0.390	0.053	0.275
industry	12.14	4.88	0.70	1.06	0.94	1.29	0	0	0	0	0	0.265	0.491
state-year	6.65	2.40	0.36	0.44	0.44	0.45	0.138	0.045	0.363	0.020	0.363	0.040	0.147
state-industry	8.79	3.34	0.50	0.75	0.67	0.85	0.098	0.039	0.129	0.009	0.146	0.090	0.176
year-industry	6.24	2.76	0.35	0.45	0.42	0.46	0.127	0.017	0.146	0.007	0.119	0.069	0.270
state-year-industry	5.82	2.31	0.33	0.43	0.40	0.44	0.084	0.025	0.143	0.008	0.130	0.050	0.154

Logarithm of	Production	Production of registered	Produciton of tax registered	Production of unregistered	VA	VA of registered	VA of tax registered	VA of unregistered
Mean	15.08	14.46	14.39	13.59	14.03	13.08	12.86	13.02
Standard error	1.46	1.96	2.17	1.29	1.20	1.80	2.05	1.22
De-trended SE across:								
state	1.05	1.41	1.57	0.95	0.95	1.38	1.57	0.92
year	0.45	0.60	0.55	0.47	0.45	0.66	0.71	0.45
industry	1.08	1.44	1.69	0.99	0.81	1.24	1.52	0.93
state-year	0.31	0.43	0.45	0.41	0.32	0.50	0.55	0.39
state-industry	0.61	0.80	0.99	0.58	0.55	0.81	1.04	0.57
year-industry	0.36	0.48	0.51	0.42	0.36	0.52	0.55	0.40
state-year-industry	0.30	0.41	0.45	0.39	0.30	0.46	0.52	0.36

Table 3.B: correlation table. Number of firms is applied as weights.

	Reg	Treg	Vreg	Vtreg	Ereg	Etreg	Credit to SDP (log)	Branch per capita	Enf. exp. per firm (log)	SDP per capita (log)	Gov. exp. / SDP	RZ index
Treg	0.600***											
Vreg	0.460***	0.301***										
Vtreg	0.314***	0.291***	0.850***									
Ereg	0.667***	0.399***	0.803***	0.597***								
Etreg	0.512***	0.428***	0.826***	0.850***	0.849***							
Credit to SDP (log)	0.293***	0.213***	0.370***	0.324***	0.377***	0.366***						
Branch per capita	0.314***	0.240***	0.267***	0.205***	0.333***	0.312***	0.575***					
Enf. exp. per firm (log)	0.291***	0.188***	0.219***	0.119***	0.310***	0.231***	0.619***	0.583***				
SDP per capita (log)	-0.07***	-0.08***	-0.17***	-0.17***	-0.14***	-0.156***	-0.16***	0.0383**	-0.0397**			
Gov. exp. / SDP	0.178***	0.122***	0.189***	0.110***	0.219***	0.160***	0.161***	0.161***	0.0626***	0.0404**		
RZ index	0.244***	0.231***	-0.06***	-0.09***	0.142***	0.0795***	-0.11***	-0.00353	-0.062***	0.0218	0.0163	
Forward linkages	0.0285*	0.173***	-0.11***	-0.12***	-0.04**	-0.0446**	-0.05***	-0.0103	-0.0307*	0.0052	0.0088	0.500***

Table 4- Financial depth vs. breadth and barriers to formality. state, year, and industry fixed effects are included in all regressions. Number of firms is applied as weight in all regressions and standard errors are clustered at state level.

	All firms				Fixed assets < 25th percentile			
	proportion of registered under any act		proportion of registered under tax		proportion of registered under any act		proportion of registered under tax	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Branches per capita	21.365		9.088***		17.274***		16.278***	
	(13.905)		(2.433)		(5.647)		(4.334)	
Log (Credit/SDP)	0.388	0.986	-0.179*	0.158		3.969		2.459***
	(1.250)	(1.221)	(0.102)	(0.151)		(2.929)		(0.882)
Log (SDP pc)	16.608	8.437	-1.406	-3.287	0.330	0.471	-0.436***	-0.197
	(20.047)	(18.826)	(5.224)	(5.092)	(0.535)	(0.525)	(0.143)	(0.120)
Government exp. / SDP	-0.591	-0.404	0.155	0.293*	-11.148	-16.447	5.375	0.602
	(0.919)	(0.874)	(0.201)	(0.155)	(10.275)	(10.174)	(10.221)	(9.798)
Enforcement exp. / No. firms		2.046		0.038	1.085***	0.782**	0.003	-0.091
		(3.959)		(0.909)	(0.357)	(0.304)	(0.311)	(0.391)
Constant	6.391	26.943	26.015**	31.673***	14.862	36.932***	10.629	27.808**
	(17.722)	(19.940)	(9.665)	(9.357)	(8.827)	(10.166)	(10.986)	(10.768)
Observations	3024	3024	2717	2717	2673	2673	2384	2384
R-squared	0.577	0.574	0.456	0.451	0.301	0.299	0.214	0.209

Table 5- The effect of financial dependence and forward linkages on registration. Difference-in-differences estimation: State × year, and industry fixed effects are included in all regressions. Number of firms is applied as weight in all regressions and standard errors are clustered at state level.

	proportion of registered under any act				proportion of registered under tax			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
RZ × branches per capita	22.707***		22.714***		7.550***		6.913***	
	(8.149)		(8.200)		(2.371)		(2.485)	
RZ × log(Credit/SDP)		11.927***		12.636***		2.383***		2.379***
		(3.046)		(3.427)		(0.536)		(0.494)
RZ × log(SDP pc)	-1.871*	0.198	-1.702	0.454	-0.238	0.426	-0.129	0.494*
	(1.069)	(1.022)	(1.058)	(0.967)	(0.338)	(0.290)	(0.342)	(0.281)
RZ × Government exp./SDP	-38.106	19.786	-37.198	24.102	-5.135	5.347	-5.219	5.509
	(37.479)	(44.733)	(38.896)	(47.623)	(13.400)	(11.109)	(12.656)	(10.665)
FL × Enforcement exp./No. firms			-1.079	-1.370			0.502*	0.484**
			(0.799)	(0.876)			(0.269)	(0.224)
FL × log(SDP pc)			0.046	0.089			0.111**	0.123**
			(0.100)	(0.118)			(0.046)	(0.045)
Constant	30.849***	30.858***	43.168***	40.184***	30.751***	30.539***	31.150***	29.936**
	(8.773)	(8.272)	(10.474)	(10.687)	(10.977)	(10.951)	(11.211)	(11.229)
Observations	2526	2526	2366	2366	2189	2189	2125	2125
R-squared	0.638	0.645	0.643	0.652	0.484	0.484	0.487	0.488

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Table 6- The effect of financial dependence on formal value-added and employment: Difference-in-differences estimation:state × year, and industry fixed effects are included in all regressions. Number of firms is applied as weight in all regressions and standard errors are clustered at state level. All dependent variables are in logarithmic form.

	VA share of registered under any act		VA share of registered under tax		employment share of registered under any act		employment share of registered under tax	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
RZ × branches per capita	-0.046		0.126		-0.161		-0.327	
	(0.589)		(0.693)		(0.939)		(1.128)	
RZ × log(Credit/SDP)		0.372**		0.613***		0.441*		0.887***
		(0.148)		(0.219)		(0.218)		(0.155)
RZ × log(SDP pc)	-0.079	-0.074	-0.049	-0.032	-0.127	-0.130**	-0.036	-0.055
	(0.083)	(0.064)	(0.098)	(0.094)	(0.083)	(0.047)	(0.141)	(0.097)
FL × Enforcement exp./No. firms	-0.070	-0.085	-0.050	-0.069	-0.006	-0.024	-0.027	-0.060
	(0.053)	(0.059)	(0.086)	(0.094)	(0.063)	(0.075)	(0.102)	(0.119)
FL × log(SDP pc)	0.008	0.008	0.017	0.018	0.008	0.008	0.007	0.008
	(0.006)	(0.005)	(0.011)	(0.011)	(0.006)	(0.005)	(0.011)	(0.010)
RZ × Government exp./SDP	-1.370	0.627	-1.121	2.541	-0.803	1.593	-3.732	1.768
	(2.269)	(2.286)	(3.303)	(2.776)	(1.976)	(2.796)	(4.640)	(3.497)
Constant	3.752***	3.592***	2.709***	2.351***	3.396***	3.205***	3.000***	2.473***
	(0.520)	(0.546)	(0.463)	(0.558)	(0.418)	(0.419)	(0.438)	(0.424)
Observations	2307	2307	1927	1927	2306	2306	1925	1925
R-squared	0.697	0.701	0.646	0.652	0.747	0.750	0.691	0.698

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Table 7- Financial depth vs. breadth and Productivity: Difference-in-differences estimation: state × year, and industry fixed effects are included in all regressions. Number of firms is applied as weight in all regressions and standard errors are clustered at state level. All dependent variables are in logarithmic form.

Panel A: Production

	Production		Production of registered		Production of tax registered		Production of unregistered	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
RZ × log(Credit/SDP)	0.530***		0.901***		1.046***		0.042	
	(0.175)		(0.202)		(0.251)		(0.130)	
RZ × branches per capita		0.348		0.455		0.876		0.258
		(0.832)		(1.076)		(1.205)		(0.728)
RZ × log(SDP pc)	-0.053	-0.091	-0.130	-0.184	-0.104	-0.184	-0.099	-0.120
	(0.078)	(0.100)	(0.107)	(0.129)	(0.131)	(0.145)	(0.064)	(0.085)
RZ × Government exp./SDP	4.109	1.359	4.799	0.086	6.685	0.688	2.941	2.789
	(2.773)	(3.278)	(3.620)	(4.375)	(4.623)	(5.443)	(2.752)	(2.499)
Constant	9.761***	9.809***	9.025***	9.114***	9.458***	10.128***	7.795***	7.784***
	(0.583)	(0.578)	(0.643)	(0.685)	(0.754)	(0.680)	(0.506)	(0.516)
Observations	2520	2520	2459	2459	1978	1978	2128	2128
R-squared	0.829	0.826	0.834	0.830	0.794	0.789	0.790	0.790

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Panel B: Value added

	Value-Added		Value-Added of registered		Value-Added of tax registered		Value-Added of unregistered	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
RZ × log (Credit/SDP)	0.272		0.641**		0.995**		-0.082	
	(0.195)		(0.292)		(0.365)		(0.146)	
RZ × branches per capita		0.397		0.493		0.942		0.300
		(0.833)		(1.223)		(1.446)		(0.855)
RZ × log(SDP pc)	0.004	-0.033	-0.089	-0.141	-0.028	-0.114	-0.060	-0.083
	(0.068)	(0.100)	(0.103)	(0.140)	(0.143)	(0.163)	(0.062)	(0.086)
RZ × Government exp./SDP	2.776	1.424	3.396	0.070	6.061	0.411	2.882	3.410
	(2.588)	(2.908)	(3.896)	(4.420)	(5.087)	(6.056)	(2.761)	(2.526)
Constant	8.546***	8.555***	7.353***	7.397***	7.387***	7.997***	7.489***	7.455***
	(0.442)	(0.439)	(0.315)	(0.367)	(0.717)	(0.816)	(0.538)	(0.567)
Observations	2476	2476	2403	2403	1912	1912	2125	2125
R-squared	0.767	0.766	0.796	0.793	0.759	0.754	0.758	0.758

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Table A1 – summary statistic of each industry

NIC	Description	Obs.	%	Reg	Treg	Vreg	Vtreg	Ereg	Etreg	RZ	FL
1	relating activities to agriculture	5,228	0.55	30.80	32.69	97.90	91.25	88.64	75.38	-0.09	1.80
14	relating activities to mining and quarrying	110	0.01	100	100	100	100	100	100		
15	food products and beverages	152,950	15.98	20.09	2.03	80.12	62.90	36.86	17.62	0.14	0.53
16	tobacco products	49,885	5.21	3.13	0.48	66.63	58.02	16.25	11.62	-0.45	0.27
17	Textiles	130,084	13.59	7.78	1.45	79.72	61.28	30.26	16.55	0.11	0.84
18	wearing apparel, dressing and dyeing of fur	103,045	10.76	7.77	0.50	52.84	38.72	22.55	11.30	-0.14	0.39
19	leather and related products	15,001	1.57	10.34	2.94	69.40	58.95	37.41	25.31	-0.09	0.87
20	wood and wood products	85,478	8.93	3.37	0.72	31.02	16.37	7.84	2.35	0.28	1.51
21	paper and paper products	9,812	1.03	12.91	5.94	95.46	82.78	54.81	39.88	0.18	1.51
22	publishing, printing and reproduction of recorded media	14,595	1.52	50.58	8.89	90.83	67.95	69.90	29.04	0.20	1.02
23	coke and refined petroleum	2,273	0.24	56.11	40.63	99.87	96.19	91.48	76.12	0.31	1.61
24	chemical and chemical products	29,452	3.08	13.01	7.71	99.23	91.92	68.59	54.96	0.26	1.19
25	rubber and plastic products	13,401	1.4	34.17	13.40	95.53	83.87	72.19	50.19	0.97	1.78
26	other non-metallic mineral products	62,550	6.53	9.10	4.54	88.98	77.16	41.11	25.53	-0.08	0.81
27	basic metals	16,239	1.7	43.51	21.38	99.52	96.00	91.06	79.80	0.03	2.07
28	fabricated metal	46,821	4.89	23.28	4.60	83.27	65.03	48.17	22.82	0.24	1.21
29	machinery and equipment	31,093	3.25	26.51	8.44	95.86	82.51	68.12	44.65	0.46	0.76
30	office and computing machinery	676	0.07	70.10	39.44	99.85	87.80	97.86	74.72	1.06	
31	electrical machinery	12,092	1.26	38.73	12.58	98.17	85.33	83.01	59.84	0.77	0.74
32	radio, television and communication	4,467	0.47	50.72	25.61	99.03	86.97	91.43	69.72	1.04	0.56
33	medical, precision and optical instruments	3,789	0.4	50.68	19.52	97.98	86.02	86.79	63.52	0.96	0.68
34	motor vehicles	6,513	0.68	61.73	26.26	99.44	92.48	94.60	79.78	0.39	0.44
35	other transport equipments	6,373	0.67	46.69	14.65	98.61	85.52	90.08	61.80	0.35	1.18
36	Furniture	89,795	9.38	15.36	1.72	56.35	33.50	24.86	6.02	0.35	0.82
37	Recycling	561	0.06	26.62	2.51	82.17	56.35	52.05	16.84		
40	electricity gas and water supply	1,029	0.11	100	100	100	70.68	100	51.53		1.41
41	purification of water	459	0.05	100	100	100	58.73	100	66.80		
50	repair of motor vehicles	16,384	1.71	23.62	3.94	86.84	74.45	49.26	26.84		0.53
52	repair of household goods	42,463	4.44	10.67	0.16	25.64	5.38	15.03	0.65		0.76
63	supporting transport activities	1,923	0.2	100	100	100	97.41	100.00	94.24		1.52
72	repair of computer and related activities	1,731	0.18	33.85	2.16	90.26	86.18	69.04	52.21		1.14
90	sewage and refuse disposal	225	0.02	100	100	100	100	100	100		
93	other activities	371	0.04	100	100	100	100	100	100		

Table A2– summary statistic for each state

Code	State name	Est. no. enterprises	Reg	Treg	Vreg	Vtreg	Ereg	Etreg	Credit to SDP	Branches per capita	SDP per capita	Gov. exp. / GDP	Enf. exp. per firm
1	Jammu & Kashmir	874,055	14.20	1.04	69.69	52.30	27.61	9.25	0.36	0.91	12727	0.563	0.113
2	Himachal Pradesh	556,354	19.01	2.60	96.12	90.67	48.42	28.40	0.24	1.40	19553	0.381	0.232
3	Punjab	1,578,964	16.20	4.74	88.89	75.45	56.79	37.86	0.34	1.17	32530	0.183	0.160
4	Chandigarh	24,927	37.10	14.98	94.82	73.97	77.95	45.78	1.35	2.61	80935		
5	Uttaranchal	492,602	18.89	2.05	96.18	93.33	49.48	32.75	0.35	1.15	32898	0.285	0.293
6	Haryana	967,794	13.24	4.67	92.97	83.49	59.49	44.87	0.26	0.83	32811	0.174	0.168
7	Delhi	807,522	18.71	4.83	63.08	45.01	34.40	17.48	1.27	1.28	55218	0.071	4.803
8	Rajasthan	3,014,103	7.27	1.89	82.92	71.64	30.93	19.13	0.28	0.65	13933	0.222	0.207
9	Uttar Pradesh	11,700,000	6.74	1.06	77.89	61.80	23.11	12.62	0.19	0.53	12925	0.184	0.139
10	Bihar	3,889,572	5.30	0.36	58.21	37.33	15.96	6.42	0.12	0.42	8677	0.178	0.121
11	Sikkim	10,164	23.56	2.46	98.97	97.14	59.00	36.63	0.20	0.97	25125	1.119	1.364
12	Arunachal Pradesh	8,168	28.21	1.41	63.34	11.00	61.65	6.14	0.12	0.70	16663	0.538	0.658
13	Nagaland	36,948	14.94	1.67	65.63	38.36	39.53	17.19	0.11	0.44	17167	0.574	0.919
14	Manipur	241,327	1.68	0.30	26.34	18.19	7.04	3.24	0.11	0.34	11599	0.508	0.114
15	Mizoram	23,176	22.47	0.35	53.14	1.13	34.53	0.57	0.16	0.90	17605	0.787	1.279
16	Tripura	246,742	7.81	1.09	59.31	42.05	22.61	12.27	0.16	0.62	15087	0.476	0.111
17	Meghalaya	122,637	9.36	0.77	69.86	58.36	22.51	8.22	0.27	0.80	14593	0.391	0.288
18	Assam	1,342,032	9.51	0.95	77.91	62.35	30.24	17.23	0.16	0.49	12547	0.240	0.149
19	West Bengal	13,000,000	8.16	1.24	73.63	55.46	23.71	10.59	0.32	0.61	18285	0.168	0.053
20	Jharkhand	2,061,750	2.47	0.54	87.02	85.81	15.09	12.12	0.25	0.55	17261	0.278	0.114
21	Orissa	4,935,742	1.33	0.32	80.66	69.43	9.01	6.23	0.23	0.65	10787	0.226	0.071
22	Chhattisgarh	970,077	8.89	1.44	93.22	90.00	28.14	16.88	0.27	0.52	23710	0.216	0.290
23	Madhya Pradesh	3,493,148	9.72	1.31	88.75	74.24	29.21	16.09	0.23	0.57	17610	0.174	0.366
24	Gujrat	3,792,198	25.79	5.07	93.50	81.69	56.42	31.44	0.33	0.82	35153	0.169	0.091
25	Daman & Diu	13,512	62.70	47.06	99.85	98.83	97.19	91.87					
26	Dadra & Nagar Haveli	11,481	48.32	42.11	99.77	98.12	95.98	92.21					
27	Maharastra	5,690,878	27.18	4.49	94.72	79.82	59.11	31.24	0.66	0.79	35062	0.144	0.462
28	Andhra Pardesh	7,648,296	9.21	2.00	85.20	75.00	34.05	23.28	0.36	0.76	22080	0.180	0.090
29	Karnataka	4,554,846	13.55	2.02	90.30	77.81	40.24	23.20	0.49	0.98	20221	0.195	0.105
30	Goa	67,314	42.35	18.52	98.97	92.81	77.22	56.15	0.29	3.26	59411	0.239	0.273
31	Lakshadweep	1,292	18.75	1.00	51.27	7.99	38.20	6.20					
32	Kerala	2,565,822	21.94	3.49	87.28	62.73	52.18	25.12	0.42	1.14	21569	0.220	0.178
33	Tamil Nadu	7,258,991	13.50	2.75	89.48	74.52	46.26	27.85	0.55	0.85	24449	0.189	0.085
34	Pondicheri	58,558	20.92	7.22	97.82	92.74	71.36	51.93	0.28	1.15	42335	0.358	0.448
35	Andaman & Nicober	11,058	21.78	1.85	74.62	40.84	59.82	26.04	0.22	1.01	26588		

Table A3- The effect of financial dependence and forward linkages on registration; sample splits according to size. State × year, and industry fixed effects are included in all regressions. Number of firms is applied as weight in all regressions and standard errors are clustered at state level.

Panel A: Fixed asset < 25th percentile of respective industry and year

	proportion of registered under any act				proportion of registered under tax			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
RZ × branches per capita	16.746*		15.428*		4.624*		3.518	
	(8.978)		(8.478)		(2.349)		(2.321)	
RZ × log(Credit/SDP)		5.492		5.946		1.826***		1.916***
		(3.894)		(3.752)		(0.627)		(0.671)
RZ × log(SDP pc)	-1.256	0.217	-0.971	0.472	0.004	0.436***	0.171	0.538***
	(1.194)	(0.520)	(1.153)	(0.507)	(0.236)	(0.134)	(0.238)	(0.143)
RZ × Government exp./SDP	-3.078	26.169	-4.032	27.394	-1.697	7.675	-1.545	8.480
	(21.821)	(30.784)	(22.493)	(32.545)	(6.190)	(6.183)	(5.512)	(5.900)
FL × Enforcement exp./No. firms			-0.436	-0.459			0.461**	0.453**
			(0.270)	(0.301)			(0.204)	(0.199)
FL × log(SDP pc)			0.168***	0.202***			0.060*	0.071*
			(0.053)	(0.072)			(0.032)	(0.038)
Constant	16.890**	17.114**	26.057**	22.450*	20.418**	20.139**	22.312**	20.867**
	(6.940)	(6.882)	(11.799)	(12.843)	(9.283)	(9.307)	(9.942)	(10.019)
Observations	2306	2306	2174	2174	1983	1983	1941	1941
R-squared	0.360	0.359	0.363	0.364	0.228	0.229	0.232	0.233

Panel B: Fixed asset > 25th percentile of respective industry and year

	proportion of registered under any act				proportion of registered under tax			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
RZ × branches per capita	10.112		10.312		5.349		5.029	
	(10.263)		(10.474)		(3.489)		(3.611)	
RZ × log(Credit/SDP)		11.127***		11.447***		1.869**		1.892**
		(3.683)		(3.947)		(0.813)		(0.808)
RZ × log(SDP pc)	-0.841	-0.137	-0.758	0.003	-0.051	0.385	0.021	0.434
	(1.106)	(1.125)	(1.050)	(1.043)	(0.461)	(0.373)	(0.443)	(0.359)
RZ × Government exp./SDP	-38.003	12.075	-34.083	16.343	-1.205	5.705	-1.641	5.497
	(43.262)	(51.721)	(43.245)	(51.963)	(16.145)	(14.484)	(15.806)	(14.321)
FL × Enforcement exp./No. firms			-0.213	-0.351			0.595*	0.582*
			(0.826)	(1.036)			(0.348)	(0.336)
FL × log(SDP pc)			0.017	0.053			0.083	0.092
			(0.163)	(0.176)			(0.056)	(0.057)
Constant	62.814***	62.670***	72.274***	69.238***	58.524***	57.773***	55.502***	55.144***
	(10.147)	(10.220)	(11.056)	(11.127)	(12.507)	(12.543)	(12.238)	(12.300)
Observations	2458	2458	2306	2306	2127	2127	2065	2065
R-squared	0.698	0.704	0.703	0.709	0.504	0.504	0.505	0.506

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Table A4- The effect of financial dependence and forward linkages on registration; sample of small industries. The sample includes industries below median of total production in each state and year (the biggest half of industries in each state and year is excluded). State × year, and industry fixed effects are included in all regressions. Number of firms is applied as weight in all regressions and standard errors are clustered at state level.

	proportion of registered under any act				proportion of registered under tax			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
RZ × branches per capita	10.642		14.505**		7.478**		8.581**	
	(7.115)		(6.165)		(3.487)		(3.155)	
RZ × log(Credit/SDP)		13.123**		13.254**		1.560*		1.750*
		(4.955)		(4.950)		(0.871)		(0.857)
RZ × log(SDP pc)	-0.808	-1.376	-0.964	-1.186	-0.395	0.228	-0.584	0.128
	(1.237)	(1.240)	(1.229)	(1.312)	(0.416)	(0.213)	(0.397)	(0.261)
RZ × Government exp./SDP	-16.706	59.110	-25.143	54.854	-9.183	3.265	-11.510	2.878
	(34.424)	(38.472)	(28.689)	(36.305)	(10.758)	(12.028)	(10.288)	(11.567)
FL × Enforcement exp./No. firms			2.551***	2.358***			0.584**	0.429
			(0.789)	(0.737)			(0.260)	(0.259)
FL × log(SDP pc)			-0.101	-0.064			0.136***	0.134***
			(0.104)	(0.107)			(0.044)	(0.040)
Constant	9.983*	8.693	63.374***	59.002***	20.782*	20.413	18.804	18.323
	(4.910)	(5.249)	(16.518)	(16.130)	(12.159)	(12.090)	(11.991)	(11.952)
Observations	1045	1045	940	940	893	893	837	837
R-squared	0.754	0.768	0.765	0.778	0.482	0.479	0.487	0.483