



WP/08/94

IMF Working Paper

Informality and Bank Credit: Evidence from Firm-Level Data

Era Dabla-Norris and Junko Koeda

IMF Working Paper

Middle East and Central Asia

Informality and Bank Credit: Evidence from Firm-Level Data

Prepared by Era Dabla-Norris and Junko Koeda¹

Authorized for distribution by Marta Castello Branco

April 2008

Abstract

This Working Paper should not be reported as representing the views of the IMF.

The views expressed in this Working Paper are those of the author(s) and do not necessarily represent those of the IMF or IMF policy. Working Papers describe research in progress by the author(s) and are published to elicit comments and to further debate.

The paper relies on a firm-level data on transition economies to examine the relationship between informality and bank credit. We find evidence that informality is robustly and significantly associated with lower access to and use of bank credit. We also find that higher tax compliance costs reduce firms' reliance on bank credit, while a stronger quality of the legal environment is associated with higher access to credit even for financially opaque informal firms. An interactive term between a country-wide measure of tax compliance costs and the level of informal activity is negative and significant, suggesting that the negative association between informality and bank credit is stronger in countries with weak tax administration.

JEL Classification Numbers: L25, O17, O43, P26, P37

Keywords: Bank credit, informality, business environment, Transition countries

Author's E-Mail Address: edablanorris@imf.org, jkoeda@imf.org

¹ We would like to thank Marta Castello Branco and Leah Brooks for helpful comments.

Contents

Page

I.	Introduction.....	3
II.	Analytical Framework	5
III.	Empirical Strategy and Results.....	8
	A. Empirical Model	8
	B. Data and Summary Statistics.....	9
	C. Empirical Results	12
	D. Robustness Tests.....	16
IV.	Conclusions.....	18
	References.....	36

Tables

1.	Summary Statistics.....	20
2.	Correlation Matrix	21
3.	Baseline Regression.....	22
4.	Access to Credit and Informality: Impact of Business Environment	23
5.	Informality, Access to Credit, and Business Environment: Interaction Effects	24
6.	Access to Credit and Informality: Impact of Institutional Development.....	25
7.	Informality, Access to Credit, and Business Environment: Interaction Effects	26
8.	Extended Regressions: Firm Transparency and Performance	27
9.	Interaction Regressions: Informality, Firm Transparency, and Firm Performance ...	28
10.	Instrumental Variables Regression	29

Appendices

I.	Solving the Model.....	30
II.	Countries in the Sample	32
III.	Variables and Sources.....	33

I. INTRODUCTION

There is widespread evidence that firms' incentives to operate informally are shaped by the possibility of reducing or eliminating tax payments, and avoiding burdensome and often complex administrative procedures associated with tax and regulatory compliance and bureaucratic corruption (see Dabla-Norris et. al, 2008 and references therein). However, by operating informally, firms may limit their access to bank financing. This is because banks tend to be unwilling to grant credit to enterprises that lack proper documentation (such as government registration and licensing, tax compliance certificates, and audited financial statements); hidden assets generally cannot be used as collateral for bank loans; and inaccurate representation of firms' financial soundness and economic prospects in their financial statements could scare off prospective lenders (World Bank, 2007a).

At the same time, deficiencies in the legal and institutional environment can discourage firms to seek bank financing (Demirgüç-Kunt and Maksimovich, 1998; Beck et. al, 2005, Savafian and Wimpey (2007)). In addition, these deficiencies can make it difficult for banks to enforce contracts as well as to sort and monitor borrowers, resulting in credit rationing by lenders. Recent research shows that access to bank finance has a significant and positive effect on firm performance, by encouraging new firm entry, growth, and innovation (see Klapper et. al, 2006; Claessans and Leavan, 2003; and Aiyagari et. al, 2007).

Understanding the link between informality and firms' access to bank credit is, therefore, important, given its implications for productivity and firm growth.² The goal of this paper is to examine the relationship between informality and bank credit and the role of tax and legal institutions in determining this. To this end, we develop a simple model in which firms can choose to operate informally, and both the extent of informality and a firm's reliance on bank credit are related to policy and institutional constraints. In the model, firms trade off a high tax and regulatory burden against the possibility of retaining more profits at the risk of being caught and fined. However, this makes it more difficult to obtain bank credit because doing so requires official financial documentation, and the process of hiding economic activity involves concealing the true level of profits or sales. This framework also shows that a higher tax and regulatory burden reduces the use of bank finance by encouraging informality and discouraging investment demand. By contrast, a stronger legal environment reduces informality, and encourages bank borrowing.

We test these predictions using a firm-level data set for 26 countries in Eastern Europe and Central Asia. Financial sectors in transition countries have achieved rapid credit growth and diversified in recent years (EBRD, 2006). However, there is evidence that, despite some regional variation, bank loans still play a limited role in enterprise financing. At the same time, high costs of business regulation, weak tax administration, a poor institutional framework, and weak property rights are viewed as major obstacles to doing business in transition countries (World Bank, 2007b). Moreover, there is considerable variation in the

² The decision to operate informally affects the allocation of resources across firms' activities and can distort incentives for capital accumulation and innovation, with negative consequences for productivity and firm growth. This is because in order to avoid detection, firms may remain suboptimally small, adopt fewer productive technologies, and divert resources to mask their activities (Dabla-Norris and Inchauste, 2008).

extent of informal activity across transition countries that is influenced by differences in tax, legal, and regulatory obstacles faced by firms. These are important concerns for policymakers, because creating incentives for formalization and encouraging financial-sector intermediation are viewed as important steps to increase aggregate productivity and sustain growth.³

Our paper provides empirical evidence of a strong negative association between informality and bank credit.⁴ In line with our model, we find that a firm's reliance on bank credit is positively associated with the quality of the legal environment and is negatively associated with weaknesses in tax administration, as proxied by bribes to tax collectors and the severity of tax administration constraints. By contrast, weaknesses in tax administration are positively associated with the use of informal credit and with the probability that firms self-report the availability of financing as a major obstacle to their operations. Moreover, we find a differential impact of the legal environment and tax administration constraints on access to bank and informal credit by formal and informal firms. In particular, we find that an efficient and well-functioning legal system increases access to bank credit even for financially opaque informal firms while lowering reliance on informal credit by formal firms. Finally, we find that weaknesses in tax administration increase reliance on informal credit by informal firms more significantly than for formal firms.

When we look at countrywide institutions, we find that firms tend to use less bank credit in countries with underdeveloped financial systems, and in countries where tax compliance costs are high. An interaction term between tax compliance costs and the level of informal activity is negative and significant, suggesting that the negative association between informality and credit is stronger in countries with a weak tax administration.

The significant negative association between informality and bank credit is robust to the inclusion of other variables that capture the role of firm transparency and performance in obtaining bank credit. Thus, while the correlation between informality and bank credit could still reflect the presence of unobserved firm traits linked to both informality and access to credit, it is also consistent with informality reducing access to formal sector loans. We also find that these results do not appear to be driven by reverse causality. Using instrumental variable techniques to deal with the potential endogeneity between informality and bank credit leaves the results unchanged.

³ See Levine (2005) for a review of the empirical literature on the link between financial development and long-term economic growth. Loayza (1996), Loayza et. al (2005), and Schneider (2006) find that higher informality is associated with lower growth. See World Bank (2007a) for the negative consequences of informality for productivity.

⁴ Gatti and Honoratti (2008) recently find that formality is significantly associated with more access to credit. Our paper differs from theirs in that we examine the role of tax and regulatory constraints and the legal environment, as well as country-specific institutions in determining the impact of informality on access to bank credit.

The remainder of the paper proceeds as follows. The next section lays out the analytical framework and derives its main predictions. Section 3 then describes the data and the empirical model. The results are presented in Section 4, and Section 5 concludes.

II. ANALYTICAL FRAMEWORK

The model is kept as simple as possible to generate empirically testable predictions. Consider a representative firm operating for two periods in a competitive environment. In each period $i=1,2$, a firm produces output Y_i using capital k_i , according to a general production function $y_i = f(k_i)$, with $f'(\cdot) > 0$ and $f''(\cdot) < 0$. In the first period, the firm's initial capital is given by k_1 . In the second period, the firm can self-finance part of its physical capital using its first period profits (retained earnings). The firm can also borrow some capital from a financial intermediary with access to perfect outside capital markets, where a one-period risk-free security earns a net return $r > 0$.⁵ The firm's capital stock in the second period is given by

$$k_2 = L + \pi_1 \quad (1)$$

where k_2 is the firm's capital in period 2, π_1 is its first-period profit, and L is the firm's external borrowing. For simplicity, the rate of capital depreciation is assumed to be 1. The firm gets dissolved in period 2, paying out all of its dividends; the dividend for period 1 is assumed to be zero.

In each period $i=1,2$ the firm can operate fully in the formal sector or hide a fraction α_i of its activity by operating informally, where $\alpha = 0$ denotes full formality or compliance with existing taxes and regulations, and $\alpha = 1$ denotes complete evasion of taxes. If the firm operates formally, its reported revenue is subject to a financial burden at a rate T . This can be interpreted as the cost of complying with taxes, bribes, and burdensome regulations as a result of weaknesses in the tax and regulatory environment. For instance, Dabla-Norris et al. (2008), Dabla-Norris and Inchauste (2008), and Freidman et al. (2000) find that higher tax and regulatory constraints and corruption are all significant determinants of informality. Similarly, Johnson et al. (2000) using firm-level data for five Eastern European countries find that bureaucratic corruption and burdensome regulations, rather than high tax rates, create incentives for firms to operate informally.

To avoid the tax and regulatory burden, the firm can hide a fraction of its activities or assets by operating informally. However, it faces the prospect of a fine with some probability. For simplicity, we do not distinguish between the role of the probability of being caught from the size of the fine. We assume that the expected penalty of being caught, P , is increasing in α and the firm's output y , such that $P = C(\alpha)y$, where $C(\cdot)$ is assumed to be a convex function. The underlying idea is that tax penalties usually depend on the size of tax evasion, and it is easy to divert a smaller amount of resources, but as the level of informality increases it becomes more difficult for a registered firm to operate without being observed by the government and courts (see, for example, Loayza, 1996).

⁵ Therefore, one should think of our firm as operating in a small open economy.

The firm derives profits from its formal and informal operations in both periods. The income of a firm after incurring the tax and regulatory burden is given by $(1 - \alpha_i)(1 - T)y_i$, while the income generated informally is $\alpha_i y_i$. The firm's profits in period 1 and 2 can then be written as:

$$\pi_1 = (1 - (1 - \alpha_1)T)y_1 - C(\alpha_1)y_1 \quad (2)$$

$$\pi_2 = (1 - (1 - \alpha_2)T)y_2 - C(\alpha_2)y_2 - (1 + r)L \quad (3)$$

We assume that the firm faces a credit ceiling \bar{L} , where the credit ceiling constraint given by

$$L \leq \bar{L}(\alpha_1; k_1, q), \quad \text{where } \bar{L}'(\cdot) < 0, \bar{L}''(\cdot) < 0, \partial \bar{L} / \partial q > 0, \partial \bar{L}' / \partial q > 0 \quad (4)$$

is a function of firm's reported sales, the level of its fixed assets, k_1 , and the quality of legal and financial institutions, q . Specifically, we assume that the credit ceiling is decreasing in the firm's level of informality α_1 . This assumption captures the idea that a bank loan typically requires official documentation or accounting data, so that a firm's revenue is at least partially verifiable, and it can engage in legal contractual relationships. This enables it access to bank credit.⁶ Hiding profits or sales from tax authorities, and the associated lack of transparency, increases information asymmetries in the borrower-lending relationship, reducing incentives for banks to lend.

In reality, a firm may still be able to finance its investment needs by borrowing from informal sources. Informal creditors can screen and monitor borrowers and enforce contracts without having to rely on evidence of cash flow and profitability, and without recourse to the legal system. This is because these relationships are largely based on personal interaction between the borrower and lender based on an understanding of the borrower's business, and not just on collateral or credit scoring systems (McMillan and Woodruff, 1999). Firms in transition economies may have another reason to prefer informal financing in addition to borrower/lender information asymmetries. Bank financing may make it difficult for firms to hide their activities from tax collectors. While we do not model this explicitly, in the empirical section we examine the relationship between firm informality and use of informal credit sources.⁷

⁶ Pagano (2001) and Savafian and Wimpey (2007) note that credit institutions require borrowers to present credible documentation with respect to their sales, profitability, or pledgeable assets, and to make their operations at least partly observable through specific records (books, financial statements, banking operations, information from their suppliers and clients).

⁷ Straub (2005) develops a model in which a dual credit system arises in equilibrium. Gordon and Li (2005) develop a model in which governments rely on the information available from bank records in order to identify taxable entities and measure their tax liabilities.

The credit ceiling is also assumed to increase with the initial level of capital (k_1), which captures the size of the firm's assets that could be used as collateral. Boot and Thakor (1994) and others have shown that collateral can be an instrument to overcome the asymmetric information problem between lender and borrowers. In their framework, collateral serves as a signaling device that offers the lender a signal about the true riskiness of the borrower. Finally, we assume that the credit ceiling is increasing in the quality of the legal and financial system (q). This is in line with La Porta et. al (1997) and Djankov et. al (2007) who find that deficiencies in the legal and institutional environment make it difficult for banks to enforce contracts. Similarly, Demirguc-Kunt and Maksimovic (1998) find that a higher proportion of firms use long-term external financing in countries with a better legal system.

The firm's problem is formally given by (see Appendix 1 for details):

$$\begin{aligned}
 & \max_{k_2, L} \quad \pi_1(\alpha_1) + \frac{1}{1+r} \{ \pi_2(k_2, L) \} \\
 & s.t. \\
 & k_2 = L + \pi_1 \\
 & L \leq \bar{L}(\alpha_1; k_1, q), \quad \bar{L}'(\cdot) < 0, \quad \bar{L}''(\cdot) < 0 \\
 & \pi_1 = (1 - (1 - \alpha_1)T)f(k_1) - C(\alpha_1)f(k_1), \quad C'(\cdot) > 0, \quad C''(\cdot) > 0 \\
 & \pi_2 = (1 - (1 - \alpha_2)T)f(k_2) - C(\alpha_2)f(k_2) - (1+r)L \\
 & k_1 \text{ is given,}
 \end{aligned}$$

We can distinguish between two cases: (i) when the credit ceiling constraint is not binding, i.e. $L < \bar{L}(\alpha_1; k_1, q)$, and (ii) when the credit ceiling constraint is binding, i.e. $L = \bar{L}(\alpha_1; k_1, q)$.

When the credit ceiling is not binding, the firm's share of informal operations is decreasing in the tax and regulatory burden; that is, $d\alpha_i/dT = 1/C''(\alpha_i) > 0$, where $i = 1, 2$. This is because firms weigh the benefits of being formal against the costs; thus, when the tax and regulatory burden increases, more firms choose to operate informally. Furthermore, a larger tax and regulatory burden discourages bank financing.

Proposition 1. *A larger tax burden discourages bank financing when the disincentive for investment and the sensitivity of α with respect to the tax burden are sufficiently large (see Appendix 1 for proof).*

The intuition behind this is as follows. Suppose firm's investment demand (k_2) remains unchanged with a higher tax burden. Then the firm would need to increase not only its hidden profits but also bank financing in order to achieve a desired level of investment. The magnitude of this increase would depend upon the extent to which the firm would want to increase its hidden profits instead of relying on bank financing. However, a higher tax burden would discourage investment. We assume that weaknesses in tax policy and administration and a poor business environment reduce the net profitability of investments, creating sufficient disincentive for investment. As a result, a firm's investment demand is negatively related to the tax burden faced, thereby, reducing its demand for bank financing. This result

is consistent with Johnson et al. (2002), who find that entrepreneurs are unwilling to invest when returns are insecure due to corruption or expropriation.

When the credit ceiling constraint is binding, the model reduces to the following two equations:

$$L = \bar{L}(\alpha_1; k_1, q) \quad (5)$$

$$\alpha_1 = h(T, q, k_1) \quad (6)$$

where $\bar{L}'(\alpha_1; \cdot) < 0$. Differentiating equation (6) with respect to the quality of legal environment, q , while applying the envelope theorem, reveals that $\partial \alpha_1 / \partial q < 0$, implying that a better quality of the legal and financial environment reduces the propensity for a firm to operate informally. Moreover, since by assumption, the credit ceiling \bar{L} is decreasing in α_1 , and $\partial \bar{L}(\alpha_1; k_1, q) / \partial q > 0$, we can show that the amount of bank financing, L , is increasing in the quality of legal and financial institutions. This gives us

Proposition 2: *A better quality of legal and financial institutions increases bank financing.*

In the empirical section of the paper we examine the relationship between informality and bank financing, arguing that higher informality is likely associated with lower reliance on bank financing. This is particularly likely to be the case when evading taxes and hiding sales or profits makes it difficult for banks' to accurately assess a firm's credit worthiness, and effectively restricts firms' access to credit and to external finance (the case where $L = \bar{L}(\alpha_1; k_1, q)$). The issue of reverse causality is addressed in the robustness section.

III. EMPIRICAL STRATEGY AND RESULTS

A. Empirical Model

Based on the theoretical model presented in Section II, we estimate the following reduced form model:

$$Credit_{ij} = f(Inf_{ij}, Z_{ij}) = \beta_0 + \gamma_j + \beta_1 Inf_{ij} + \beta_2 T_{ij} + \beta_3 q_{ij} + \beta_4 X_{ij} + \varepsilon_i \quad (7)$$

where i and j denote firm and country subscripts, respectively. *Credit* is the relevant dependent variable that captures the extent to which firms rely on bank credit for their external financing needs. The explanatory variables consist of the share of a firms' operations conducted informally (*Inf*), as well as of a vector of variables, Z_i , which include the tax burden (T), the quality and efficiency of the legal system (q), and firm-level and country-wide controls (X_i). Our firm-level controls include the firm's age, size, and industry dummies, as well as dummies equal to 1 if the firm is owned by the government, if it is an exporter, and if it is a corporation. Our country-level controls include the log of real GDP per capita, CPI inflation, and real GDP growth.

Our dependent variables are 0–1 indicators (see Section III.B), and thus all regressions are estimated using a Probit model. We use standard maximum likelihood estimation with heteroskedasticity-robust standard errors. The coefficients of the Probit model cannot, however, be interpreted as marginal effects of a one-unit increase in the independent variables on the dependent variable. Since the model is nonlinear, the value of predicted probabilities depends on the values of all other control variables. The economic effects reported in the text are evaluated at the mean value of the control variables.

B. Data and Summary Statistics

We use the 2005 Business Environment and Enterprise Performance Survey (BEEPS) conducted by the World Bank and the EBRD. The data set consists of firm-level survey responses for firms in 26 transition countries in Eastern Europe and Central Asia.⁸ The survey reports detailed information on firm size, employment, age, industry, ownership, legal status, governance, and financing, as well as questions on firm financing from different sources. We only consider firms that have external financing sources.⁹ Table 1 contains sample statistics of the variables we consider.

We construct three dependent variables that capture the extent to which firms rely on bank credit for their external financing needs. The first variable, *Bank Credit*, is a binary variable that takes the value of 1 if a firm relies on bank credit (commercial banks, development and foreign banks) for its external financing of either working capital or new investment, and zero otherwise. We construct this variable based on the survey responses about the proportion of firms' working capital and new investment over the past year that was financed through internal and external funds.

The second dependent variable, *Informal Credit*, is a binary variable which takes the value of 1 if the firm relies on money-lenders or family and friends to finance either working capital or new investment, and zero otherwise. Over 56 percent of firms in our sample use bank credit to meet their external financing needs, while 29 percent of firms use informal credit sources to finance working capital or new investment.

The third dependent variable, *Financing Obstacle*, is a dummy which equals one if firms report the availability of financing as a "major constraint", and zero otherwise. Simply looking at financing patterns of firms does not allow us to distinguish between credit demand and supply effects. Unfortunately, the survey does not contain detailed information on the loan amount requested and received. In the survey, enterprise managers were asked to rate the extent to which access to financing (as determined by collateral requirements and credit availability) constrained the operation of their business. The ratings are quantified from 1 to

⁸ See Appendix 2 for the full list of countries.

⁹ We define external financing sources are those sources other than internal fund (retained earnings). In the survey, these sources consist of equity, borrowing from banks, loans from family/friends, money lenders or other informal sources, trade credit from suppliers or customers, credit cards, leasing arrangement, the government, and other.

4, with 1 denoting no obstacle and 4 a major obstacle.¹⁰ Overall 22 percent of all firms in our sample report availability of financing as a major obstacle.

The key variables of interest, *informality (Inf)*, is retrieved from the answer to the following question in the survey:

- “Recognizing the difficulties many firms face in fully complying with taxes and regulations, what percentage of total *annual sales* would you estimate the typical firm in your area of business reports for tax purposes?”

Firms are considered to be more informal the lower the percentage of sales reported for tax purposes. This variable is only a rough proxy for informality for two reasons. First, the question is phrased in terms of typical behavior by firms in that sector, rather than the behavior of the firm in question, which may introduce a bias towards the average behavior of other firms in that environment. Although firms are understandably reluctant to reveal the extent of their reporting to government, managers presumably most often respond based on their own experiences. Therefore, with caution, the responses can be interpreted as indicating the firms’ own behavior (Johnson and others, 2000). Second, all the firms in the survey are registered firms, which implies they all have at least some operations in the formal economy. Hence, we are ignoring firms that are completely unregistered, particularly very small enterprises. In this respect, our results can be seen as capturing the degree of tax evasion or of tax noncompliance. Sales to tax authorities are not fully reported by 39 percent of firms in our sample, with an average level of informality of 11 percent.

The survey also includes a large number of questions on the firm’s perception of the tax and regulatory burden faced by firms and the quality of the legal environment in which they operate. We use two measures to proxy for the tax and regulatory burden faced by firms. Enterprise managers were asked to rate the extent to which weaknesses in tax administration constrained the operation of their business, quantified from 1 to 4, with 1 denoting no obstacle and 4 a major obstacle. We construct a binary variable which takes the value of 1 if the firm reports weaknesses in tax administration as a “major” obstacle, and zero otherwise. Businesses were also asked how common it was to give bribes to deal with taxes and tax collection, regulations, and customs, rated from 1 (never) to 6 (always). We construct a binary variable which takes the value of 1 if firms report that it is common to give bribes “usually” or “always” (responses 5-6), and zero otherwise. In our sample, 26 percent of firms that report tax administration to be a major constraint to their business use bank credit, while 33 percent use informal credit. Similarly, 15 percent of firms that report that giving bribes to tax collectors is common use bank credit, while 18 percent use informal credit.

To capture the quality of the legal and contractual environment within which firm’s operate, we construct an additive index which combines three main questions about the efficiency of the legal system. Businesses were asked to evaluate whether the country’s courts enforced

¹⁰ We have also used the categorical answers with all 4 relative responses using ordered probit regressions and find results similar to those reported.

decisions, whether the courts were honest, and whether courts were viewed as being fair and impartial. The answers were rated from 1 (never) to 6 (always). The legal effectiveness index we construct ranges from 0 to 2, with 2 indicating that the entrepreneurs said all three dimensions of the legal system were frequently or always true, and 0 indicating an affirmative response to none. A higher value of this index therefore represents a better legal environment.

The survey also contains information on firm size, age, and industry, structure, and legal ownership, all of which are used to control for differences in financing requirements and firms' propensity to be informal. Empirical studies have found that smaller firms are more credit constrained than larger firms, in part due to market imperfections and greater information asymmetries associated with lending to such firms (Beck et al., 2005). At the same time, Dabla-Norris et al. (2008ab) find that small firms tend to have a higher incidence of informality relative to large firms. There may also be an ownership effect of the firm (private or state) in influencing its access to credit. Heterogeneity of firms in terms of access to credit may also arise due to other characteristics, such as firm age, exporting status, and legal structure. Being an older firm should lower informational opacity (Frazer, 2004) and increase their propensity to be formal. Firms that are incorporated are usually subject to more stringent reporting mechanisms (Demirguc-Kunt et al., 2006), which might make getting credit easier and evading taxes harder.

The survey defines firms of different sizes, small, medium, and large, based on the number of full time workers (small = 5-50, medium sized = 51 -500, and large firms > 500) We construct two dummy variables for large and small firms. Over 66 percent of the sample is made up of small firms, while only 12 percent of firms are large. We control for industry effects by including dummy variables for mining, construction, manufacturing, transport, retail, real estate, hotel, and other sectors. State-owned firm is a dummy variable that equals one if the government holds a majority stake in the firm, and zero otherwise. Corporation is a legal status dummy that takes the value of one if the firm is organized as a corporation, and zero otherwise. Exporter is a dummy variable that takes the value of one if some percentage of the firm's sales are exported directly, and zero otherwise. In our sample, 10 percent of firms are state-owned companies and 28 percent are corporations. Over 28 percent of them are exporters, and they are mostly concentrated in the manufacturing (45 percent) and retail (36 percent) sectors. Firms are on average 16 years old, but there are some in the sample that are 180 years old.

In order to address the question of whether the impact of informality on firms' reliance on bank credit varies based on the country's level of institutional development, we complement the firm level data with cross-country level indicators from various sources. We would expect that a better legal environment and lower regulatory costs not only reduce incentives for informality by making market interactions more efficient, but making participation in formal credit markets more attractive.¹¹ We use the index of Rule of Law from Kaufmann, Kraay, and Mastruzzi (2006) as a proxy for the quality of legal institutions and level of legal

¹¹ Dabla-Norris and Inchauste (2008) find that find that a poor legal environment (as proxied by the rule of law) and higher regulatory costs create incentives for firms to operate informally.

enforcement in a country.¹² The index includes perceptions of both violent and non-violent crime, the effectiveness and predictability of the judiciary, and the enforceability of contracts, with higher values denoting a better quality of rule of law. Higher costs of tax compliance resulting from a weak tax system and poor administration can create incentives for informality, reducing firm's reliance on bank credit. We use the hours per year it takes for businesses to pay taxes (corporate, value added, and labor tax) from the World Bank's Doing Business survey.¹³ Finally, we use the ratio of private credit to GDP, which is widely used as an indicator of financial intermediary development (Beck et al., 2000).

We also use country-level controls in some specifications, including real GDP per capita to control for the country's general economic development, and the average growth rate of GDP per capita in the previous three years, since firms in faster growing countries are expected to grow faster and have a higher demand for external financing. We also include the inflation rate to proxy for monetary instability, conjecturing that firms in more stable monetary environments face fewer obstacles to obtaining credit.

Table 2 presents correlations between our measures of access to credit, informality, firm level constraints, and the level of institutional development in the sample countries. As can be seen from the simple correlations of the firm-level variables in Panel A, informality is negatively correlated to the use of bank credit and positively correlated with the use of informal credit and self-reported financing constraints. Bank credit is negatively correlated with tax administration constraints and positively correlated with the index of legal quality. As expected, informality and the use of informal credit is positively correlated with tax constraints and negatively correlated with the index of legal quality. Moreover, the simple correlations indicate that larger firms, exporters, and firms that are incorporated are less likely to be informal and more likely to use bank credit. Panel B shows that firms in poorer countries with higher inflation, lower bank development, and higher tax compliance costs are less likely to use bank credit and more likely to use informal credit or report lack of availability of financing as a major obstacle to the growth of their business.

C. Empirical Results

To study the impact of a firm's propensity for informality on its reliance on formal and informal credit, we proceed in several steps. We first examine this relationship controlling for broad firm characteristics, such as size, age, legal status, ownership, and industry, as well as country dummies. In line with the predictions of our model, we then examine the role of the business environment and country-wide institutions in determining the impact of informality on bank credit. As robustness tests, we introduce variables that enable us to examine this relationship controlling for other features of firm transparency and performance. Finally, we report results of instrumental variables regressions to address concerns of reverse causality.

¹² Available at <http://info.worldbank.org/governance/kkz2005/tables.asp>.

¹³ Available at <http://www.doingbusiness.org/>.

Baseline regressions

We first examine the relationship between informality and firm's reliance on bank credit. Table 3 presents our baseline specification for both dependent variables of interest. Columns 1 and 2 report regressions with the dependent variables *Bank Credit* and *Informal Credit*, measuring a firm's reliance on bank and informal sources of external financing, respectively. Column 3 provides the results with the dummy dependent variable *Financing Obstacle* measuring perceived financing constraints. All columns report coefficient estimates with country dummies to control for unobserved heterogeneity across countries.

Column (1) shows that there is a statistically significant negative relationship between a firm's propensity to be informal and its reliance on bank financing. This holds even after controlling for firm, industry, and country characteristics. The relationship is also economically significant. The marginal effects (not shown in the table) show that the probability of the firm relying on bank credit increases by 2 percentage points for every 10 percent reduction in informality at the sample average of 11 percent. The results also indicate that firms reporting fewer sales for tax purposes are also the one that use more informal sources of external financing. Column (2) shows that informality is positively and significantly associated with higher reliance on informal credit. This suggests that bank and informal credit are substitutes to some degree. We also find that informality is associated with a higher incidence of severe financing constraints (i.e. a higher probability of firms rating the availability of finance as a major obstacle). This tentatively indicates that informal firms are more likely to face greater financing constraints rather than simply having a lower demand for bank credit.

In line with previous studies, the results suggest that individual firm characteristics are an important determinant of a firm's reliance on bank financing. As expected, the probability of the firm relying on bank credit increases with firm size. We also find that smaller firms are more likely to be financially constrained and to rely to a lesser extent on the banking system for credit than large firms. The marginal effects show that the probability of relying on bank credit decreases by 27 percent for small firms compared to large firms. At the same time, the probability of relying on informal sources of financing increases by 13 percent for small firms. This result suggests that reliance on informal external finance decreases with size. Moreover, it suggests that formal and informal credit are only imperfect substitutes since informal sources might fulfill completely the financing needs of smaller firms, but might not satisfy credit demand as scale increases.

With respect to other controls, we find that exporters and foreign-owned firms use significantly greater bank finance and report to be less financially constrained. State-owned firms, on the other hand, rely to lesser extent on bank financing as compared to private firms. Presumably, these firms receive public funding, which reduces their reliance on both bank and informal credit. Firms organized as corporations are also less likely to be financially constrained and to rely less on informal credit as compared to other forms of legal organization.

Informality, access to credit, and the business environment

We extend the baseline regressions by including survey-based indicators of the tax

and regulatory system and the quality of legal institutions in Table 4. The survey-based measures of insitutional quality are introduced one at a time for each of the three dependent variables, and simultaneously in columns 4, 8, and 12.¹⁴ Consistent with the predictions of our model, weaknesses in tax administration have a negative and significant effect on a firm's reliance on bank credit (columns 1 and 4). In particular, the marginal effects (for column 4) show that a firm that reports having to frequently give bribes to deal with taxes and regulations has a 5 percent lower probability of using bank credit than firms that report bribes to be less common. Moreover, a firm's reliance on bank credit is increasing in the quality of the legal environment as expected. For example, the estimates imply that an improvement in the legal quality index from the sample average of 0.91 is associated with a 4-percent increase in the probability of using bank credit.

By contrast, weaknesses in tax administration—as proxied by the frequency of bribes to tax collectors as well as the extent to which tax administration is viewed as a major constraint—are positively and significantly associated with the use of informal credit and with the probability that firms self-report the availability of financing as a major obstacle to their operations. For example, from the estimates in columns 8 and 12, we find that a firm that sees tax administration as a major obstacle has a 6 percent higher probability of using informal credit and a 12 percent higher probability of reporting being financially constrained. We also find that a better legal environment is negatively and significantly associated with both the use of informal credit as well as access to credit as measured by the financing obstacle. The significant association between informality and different measures of access to credit continues to hold in all regressions.

To test whether tax and regulatory constraints and the quality of the legal environment have a differential impact on access to credit by formal and informal firms, we separate the sample and define formal firms as those that report 100 percent of their sales; as before, informal firms are those that report less than 100 percent of their sales. Columns (1–3) and (7–9) in Table 5 present the results for the bank credit variable, while columns (4–6) and (10–12) report results for informal credit. Comparing columns (1–3) and (7–9), we see that informal firms benefit more from an efficient and well-functioning legal systems as compared to formal firms. In particular, an improvement in the legal quality index results in a 7 percent increase in the probability of informal firms using bank credit. This finding suggests that lenders find that a stronger legal environment is more valuable for firms where accounting information is poorer, and therefore adverse selection and incentive problems would otherwise be more severe. Moreover, a higher frequency of bribes to deal with taxes and regulations reduces the use of bank credit by formal firms, while more severe tax administration constraints reduce the use of bank credit by informal firms.

With respect to the use of informal credit, we find that a better legal environment lowers reliance on informal credit by formal firms. By contrast, a stronger legal environment is not

¹⁴ Regressions with clustered standard errors at the country level produce similar results except that the bribes variable becomes insignificant when all variables are considered together as in column 4. These results are available upon request.

significantly associated with reliance on informal credit by informal firms. However, tax and regulatory constraints increase the use of informal credit sources by informal firms more significantly. In particular, weaknesses in tax administration result in an 8 percent increase in the probability that informal firms rely on informal financing and a 4 percent increase in the probability that formal firms rely on informal credit.

Informality, access to credit, and institutional development

Next, we examine the effect of country-specific institutions on access to credit in Table 6 by replacing the survey-based measures of the business environment with country-wide variables. We include three country-wide institutional variables, namely financial sector development, an index of the rule of law, and a measure of the efficiency of the tax system (the number of hours it takes per year to comply with taxes) to the baseline regressions reported in Table 4. Given the high degree of correlation between the country dummies and country-specific institutional variables, we control for country characteristics by including real per capita GDP, GDP growth, and consumer price inflation.

Our model predicts that a more efficient legal system and greater financial-sector development increases the use of bank credit, while higher compliance costs associated with taxes discourage the use of bank credit. Columns (1–4) report results for bank credit as the relevant dependent variable, while columns (4–8) report regressions for the informal credit variable.¹⁵ The results confirm that more developed financial systems and better quality legal institutions are associated with higher use of bank credit even controlling for other country-specific and firm-level characteristics. In contrast, weaknesses in tax administration—as proxied by high costs of tax compliance—are negatively and significantly associated with reliance on bank credit. However, we find that firms tend to use more informal credit in countries with less developed financial systems, and in countries where tax compliance costs are high. The significant association between informality and access to credit continues to hold in all regressions.

In particular, the effect of tax institutions on a firm’s reliance on bank credit are not only statistically significant, but also economically relevant. In order to assess the economic effects, we use the column 4 results to quantify the effect that weaknesses in the tax system have on the probability that a firm uses bank credit. As an example, consider Ukraine and Estonia. Our results indicate that if took the same number of hours per year to comply with taxes in Ukraine as in Estonia (104) instead of its own level (2185), there would be a 4-percentage point increase in the probability that Ukrainian firms rely on bank credit.

In terms of the impact of countrywide controls, we find that firms in richer countries with lower inflation tend to rely on bank credit relative to firms in lower levels of GDP per capita and higher inflation rates. GDP growth is insignificant in all bank credit regressions. In contrast, poorer and faster growing countries tend to rely more on informal sources of

¹⁵ The result for financing obstacles as the dependent variable are omitted for the sake of brevity but are identical to those reported for the informal credit variable. The results are available from the authors upon request.

financing.

Next, we address the issue whether the impact of informality on the use of bank versus other informal sources of credit depends on the country's level of financial and legal development and the quality of its tax institutions. To examine this issue, in Table 7 we interact the informality variable with a variable proxying for institutional development. The coefficient on the interaction term then measures whether, for instance, the financial development of the economy has an effect on the relation between reported informality and reliance on bank and other sources of credit. The results indicate that informal firms' reliance on bank credit is most severely affected by weaknesses in the tax system. While we continue to find that a more developed financial sector and legal system are positively and significantly associated with the use of bank credit, the coefficients of the interaction terms of informality with financial sector development and rule of law are insignificant. These results support the prediction of the model that in countries where the effective tax burden faced by firms is high, in the form of high compliance costs and weak administration, informal firms have an even greater incentive to forego bank credit.

D. Robustness Tests

Firm transparency and performance

Although the negative association between informality and bank credit holds when controlling for an array of firm-specific and country-specific characteristics, there may exist a concern that the informality variable is proxying for other unobservable omitted firm-level characteristics. To address this concern, we extend the baseline regressions reported in Table 3, adding variables that capture the role of firm transparency and performance in obtaining bank credit.¹⁶

We control for a wide variety of variables that have been found in the literature to be associated with a firm's access to credit. Firm's transparency and performance could influence its access to bank credit as well as its incentive to operate informally (Brown et al., 2007). We capture firm transparency by an indicator variable of a firm's auditing procedures. The variable takes the value of 1 if the firm's financial statements are checked and certified by an external auditor, and zero otherwise. We also include a variable that captures whether the firm uses international accounting standards (IAS) as opposed to national standards. The variable takes a value of 1 if the firm relies on international standards, and zero otherwise. Past firm performance may be an important determinant of whether firms are likely to obtain credit.¹⁷ We use firm's sales growth over the last 3 years as an indicator of future growth opportunities. To the extent that a firm's fixed assets represent

¹⁶ We also ran all regressions including both proxies of tax administration constraints as well as the index of legal quality. The results for the indicators of firm transparency and performance reported in this section remain unchanged, and are available upon request.

¹⁷ Previous studies have found that higher sales and profits are associated with greater access to credit (see for example, Topalova, 2004).

collateral, they are likely to be an important determinant of access to credit.¹⁸ At the same time, it is an important determinant of a firm's propensity to operate informally because of the visibility associated with tangible assets. As a result, we also include the log value of a firm's assets.

As expected, Table 8 shows that firm transparency and performance have a positive and significant effect on firm's use of bank credit (Columns 1–4).¹⁹ We find that information transparency—defined as reliance on an external auditor—is significantly and positively associated with firm's reliance on bank credit. However, we find no significant association between bank credit and the adoption of international accounting standards. We also find that past sales growth is a significant predictor of bank financing.²⁰ Moreover, firms with larger fixed assets have a higher probability of using bank finance. The significant negative association between informality and reliance on bank credit is unchanged with the addition of these variables.

We find that the use of international accounting standards or audited financial statements is negatively and significantly associated with a firm's reliance on informal credit (columns 5–6). While past sales growth does not enter significantly in the regressions (column 7), the size of a firm's fixed assets is negatively and significantly associated with reliance on informal credit (column 8). These results are consistent with previous studies which argue that informal credit mechanisms do not require presenting credible documentation to their pledgeable assets or require keeping transparent records. The significant positive association between informality and reliance on informal credit sources continues to hold in all regressions.

Next, we examine if there are non-linearities in the relation between firm informality and reliance on bank credit by interacting informality with indicators of firm transparency and performance. Table 9 presents the interaction regressions. Column (2) shows that while there is an inverse relationship between informality and use of bank credit, this is less likely when the firm uses international instead of national accounting standards. This result is consistent with anecdotal evidence from many developing and transition countries which suggests that firms resort to double bookkeeping in order to avoid taxes, and that financial reporting for banks frequently differs from that for tax authorities. We also find that the positive relationship between informality and use of informal credit is less likely for firms that use international accounting standards (column 6) and for firms with larger fixed assets (column 8).

¹⁸ Demircuc-Kunt and Maksimovic (1999) find that firms that operate with greater fixed assets have greater borrowing capacity. Similarly, La Porta et. al (2002) for Mexico show that 84 percent of the banks' credit portfolio in their study are backed by collateral.

¹⁹ The results for financing obstacles as the dependent variable are omitted for sake of brevity. However, we find that the use of audited financial statements, past sales performance, and the size of a firm's fixed assets have no effect on self-reported financing constraints. The results are available from the authors upon request.

²⁰ We also included the percent of profits reinvested in the previous year as an alternative indicator of firm profitability and a dummy for whether the loan required collateral. The results are similar to those obtained on the sales growth variables and are available upon request.

While the above results show that informality has a significant impact on firms' use of bank and informal credit, and varies according to firm transparency, we recognize that there could be a self-selection problem in informal firms using external auditors. At the same time, the results confirm that even after we control for a wide range of variables that have been found in the previous literature to be associated with the availability of bank finance, informality is still an important determinant of the use of bank and informal credit.

Instrumental variables regressions

In this section we investigate the relationship between informality and bank financing using instrumental variables regressions to address the potential endogeneity between informality and reliance on bank credit. In line with our model, firms' that are more informal on account of burdensome taxes and regulations may have lower access to bank credit. At the same time, firms that are denied credit may have an incentive to evade taxes in order to use their extra cash flow to finance their activities.

To address this reverse causality, we instrument for the informality variable. In the first stage, we use average informality in firms within the same location as an instrument.²¹ Within each country, location is relevant in determining the firm's propensity to be informal as it captures location-specific incentives to evade taxes and tax enforcement, while simultaneously controlling for access to and use of credit.²² Moreover, while greater usage of bank credit may lead to lower informality for that firm, it is not likely that it would explain the average level of informality across different locations within a country. We find that the instrument is significantly correlated with firm-level informality (a correlation coefficient of 0.42). We also test for weak instruments in the first-stage regressions and find that this is a strong enough instrument as measured by an *F*-test on the excluded variables.

Table 10 reports results for all three dependent variables controlling for baseline firm characteristics, indicators of firm transparency, the instrumented informality variable, and country dummies. The results from the IV-estimations provide support for the hypothesis that informal firms rely to a lesser extent on bank credit. Table 10 shows that the coefficient on the instrumented informality variable is negative and significant for both use of bank credit and perceived financing obstacles. We continue to find evidence of a significant positive relationship between the use of informal credit, self-reported financing constraints, and the propensity of a firm to be informal.

IV. CONCLUSIONS

Tax and regulatory burdens, bureaucratic corruption, and legal ineffectiveness are commonly cited as important determinants of a firm's decision to operate informally. However,

²¹ Using grouped averages as instruments has also been found to mitigate the measurement error in micro-data (Krueger and Angrist, 2001). See also Fissman and Svensson (2007) for a discussion of the benefits of using grouped averages to deal with endogeneity issues in using firm-level subjective data.

²² Location includes 5 dummies for the capital city as well as other cities within the country based on population size.

informality entails important costs associated with the narrower set of formal banking mechanisms available to informal firms. The limited access to formal credit and contract enforcement mechanisms can constrain the expansion of informal firms, with consequences for productivity and firm growth. At the same time, in environments with weak tax and regulatory institutions and low governance, firms may have an incentive to forego the benefits of formal finance if this makes their operations more transparent to tax authorities, thereby reducing their demand for formal credit. Both of these features, in turn, have implications for the functioning of financial markets and its contribution to growth and productivity, particularly in countries with high levels of informality.

This paper relies on a data set on firms in 26 transition economies to examine the relationship between informality and bank credit. We find evidence that informality is robustly and significantly associated with lower access to and use of bank credit and a higher reliance on informal sources of financing. We also find that a firm's reliance on bank credit is positively associated with the quality of the legal environment and is negatively associated with weaknesses in tax administration. Moreover, we find a differential impact of the legal environment and tax administration constraints on access to bank and informal credit by formal and informal firms. In particular, we find that an efficient and well-functioning legal system increases access to bank credit even for financially opaque informal firms, while lowering reliance on informal credit by formal firms. Our results further reveal that the negative relationship between informality and access to credit is stronger in countries with weak tax administrations and high tax compliance costs.

These results provide evidence that high tax compliance costs, and weak legal institutions create barriers to the access and use of bank credit by informal firms. An important policy conclusion is that countries that implement policies to reduce tax and regulatory constraints and improve their legal environment reduce the incentives for firms to operate informally, both by increasing the benefits of accessing formal credit markets and by reducing the costs of doing so. These results underscore the importance of further improving tax policy and strengthening tax administration in order to reduce the size of the informal economy as well as to encourage financial deepening.

Table 1. Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
General Characteristics of Firms					
Bank Credit	4226	0.56	0.50	0	1
Informal Credit	4226	0.29	0.45	0	1
Financing Obstacle	4085	0.22	0.41	0	1
Informality	4226	11.20	19.24	0	98
Government ownership	4226	0.10	0.30	0	1
Exporter	4226	0.28	0.45	0	1
Corporation	4226	0.27	0.45	0	1
Small	4226	0.66	0.47	0	1
Large	4226	0.12	0.32	0	1
Age	4226	16.36	18.50	4	180
Mining	4226	0.01	0.11	0	1
Construction	4226	0.13	0.34	0	1
Manufacturing	4226	0.45	0.50	0	1
Transport	4226	0.10	0.29	0	1
Retail	4226	0.36	0.48	0	1
Real Estate	4226	0.11	0.31	0	1
Hotel	4226	0.06	0.23	0	1
Other industries	4226	0.10	0.30	0	1
Quality of Business Environment					
Bribes - tax collection	4226	0.16	0.36	0	1
Tax administration constraint	4136	0.26	0.44	0	1
Index of legal quality	3626	0.91	0.63	0	2
Institutional Variables					
GDP per capita (log)	4226	7.82	0.86	5.47	9.34
Inflation (annual percent)	4226	5.84	4.31	0.5	17.30
Real GDP growth (percent)	4226	4.99	2.81	0.1	14.55
Rule of law	4226	-0.17	0.71	-1.32	1
Private Credit (percent of GDP)	4226	29.64	15.39	6.19	59
Time to pay taxes (hours per year)	4226	486.82	547.82	96	2185

Table 2. Correlation Matrix

	Bank Credit	Informal Credit	Financing Obstacle	Informality	Government ownership	Exporter	Corporation	Small	Large	Age	Bribes - tax collection	Tax administration constraint	Index of legal quality
Informal Credit	-0.33	1											
Financing Obstacle	-0.04	0.10	1										
Informality	-0.07	0.13	0.08	1									
Government ownership	-0.06	-0.10	0.01	-0.09	1								
Exporter	0.13	-0.13	-0.01	-0.07	0.05	1							
Corporation	0.03	-0.07	-0.07	-0.05	-0.10	0.12	1						
Small	-0.17	0.20	0.07	0.13	-0.28	-0.29	-0.15	1					
Large	0.11	-0.13	-0.06	-0.09	0.32	0.23	0.09	-0.52	1				
Age	0.06	-0.13	0.02	-0.09	0.41	0.18	0.04	-0.35	0.35	1			
Bribes - tax collection	-0.02	0.04	0.04	0.03	0.01	-0.01	-0.03	-0.02	0.00	0.02	1		
Tax administration constraint	-0.01	0.10	0.16	0.07	-0.07	-0.02	-0.02	0.04	-0.05	-0.05	0.12	1	
Index of legal quality	0.07	-0.07	-0.09	-0.12	0.08	0.06	0.03	-0.12	0.08	0.06	-0.10	-0.12	1

Panel B: Country Level variables

	Bank Credit	Informal Credit	Financing Obstacle	Informality	GDP per capita	Inflation	GDP growth	Rule of Law	Private Credit	Time to pay taxes
Informal Credit	-0.33	1								
Financing Obstacle	-0.04	0.10	1							
Informality	-0.08	0.15	0.09	1						
GDP per capita	0.02	-0.08	0.00	-0.03	1					
Inflation	0.04	0.00	-0.07	0.06	-0.52	1				
GDP growth	-0.06	0.10	0.00	-0.03	-0.36	-0.16	1			
Rule of Law	0.03	-0.05	0.05	-0.05	0.88	-0.58	-0.31	1		
Private Credit	0.02	-0.10	-0.06	-0.03	0.63	-0.19	-0.49	0.59	1	
Time to pay taxes	-0.08	0.06	0.00	0.01	-0.27	0.28	-0.02	-0.27	-0.12	1

Table 3. Baseline Regression

$$Credit_{ij} = f(Inf_{ij}, Z_{ij}) = \beta_0 + \gamma_j + \beta_1 Inf_{ij} + \beta_2 X_{ij} + \varepsilon_i$$

Credit is either *Bank Credit*, *Informal Credit*, or *Financing Obstacle*. *Bank Credit* is a dummy variable that takes the value of 1 if the firm uses bank credit to finance either working capital or new investment, and zero otherwise. *Informal Credit* is a dummy variable that takes the value of 1 if the firm uses credit from money-lenders or family and friends to finance either its working capital or new investment, and zero otherwise. *Financing obstacle* is a dummy variable that takes the value of 1 if the firm reports the availability of financing as a “major constraint”, and zero otherwise. *Inf* is the percentage of sales that are not reported for tax purposes. γ are country dummies, X are firm-level controls including firm age, size and industry dummies, as well as dummies equal to 1 if the firm is owned by the government, if it is a corporation, and if it is an exporter. Robust standard errors are in parentheses; significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent.

Dependent variable	Bank credit (1)	Informal Credit (2)	Financing Obstacle (3)
Government ownership	-0.545 (0.081)***	-0.215 (0.088)**	0.137 (0.086)
Exporter	0.203 (0.050)***	-0.179 (0.054)***	-0.059 (0.057)
Small	-0.436 (0.054)***	0.394 (0.058)***	0.212 (0.061)***
Large	0.236 (0.080)***	-0.044 (0.089)	-0.202 (0.090)**
Age	0.001 (0.001)	-0.005 (0.002)***	0.002 (0.001)
Corporation	0.066 (0.055)	-0.133 (0.059)**	-0.146 (0.064)**
Informality	-0.004 (0.001)***	0.008 (0.001)***	0.006 (0.001)***
Constant	0.100 (0.113)	-0.789 (0.119)***	-1.237 (0.132)***
Industry dummies	YES	YES	YES
Country dummies	YES	YES	YES
Observations	4226	4226	4085
Pseudo R ²	0.100	0.080	0.090

Table 4. Access to Credit and Informality: Impact of Business Environment

$$Credit_{ij} = f(Inf_{ij}, Z_{ij}) = \beta_0 + \gamma_j + \beta_1 Inf_{ij} + \beta_2 T_{ij} + \beta_3 q_{ij} + \beta_4 X_{ij} + \varepsilon_i$$

$Credit_{ij}$ is either *Bank Credit*, *Informal Credit*, or *Financing Obstacle*. $Bank\ Credit$ is a dummy variable that takes the value of 1 if the firm uses bank credit to finance either working capital or new investment, and zero otherwise. *Informal Credit* is a dummy variable that takes the value of 1 if the firm uses credit from money-lenders or family and friends to finance either its working capital or new investment, and zero otherwise. *Financing obstacle* is a dummy variable that takes the value of 1 if the firm reports the availability of financing as a “major constraint”, and zero otherwise. Inf_{ij} is the percentage of sales that are not reported for tax purposes. T_{ij} is the tax burden measured by the severity of tax administration constraints faced by individual firms and the frequency with which firms have to give bribes to deal with taxes and tax collection. The quality and efficiency of the legal system, q_{ij} , is proxied by the index of legal effectiveness. γ_j are country dummies, X_{ij} are firm-level controls including firm age, size and industry dummies, as well as dummies equal to 1 if the firm is owned by the government, if it is a corporation, and if it is an exporter. Robust standard errors are in parentheses; significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent.

Dependent variable	Bank Credit				Informal Credit				Financing Obstacle			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Government ownership	-0.550 (0.081)***	-0.550 (0.082)***	-0.574 (0.087)***	-0.576 (0.088)***	-0.213 (0.089)**	-0.179 (0.089)**	-0.271 (0.096)***	-0.245 (0.097)**	0.141 (0.086)	0.171 (0.087)*	0.185 (0.092)**	0.207 (0.094)**
Exporter	0.201 (0.050)***	0.207 (0.051)***	0.206 (0.054)***	0.198 (0.055)***	-0.178 (0.054)***	-0.165 (0.054)***	-0.193 (0.058)***	-0.177 (0.058)***	-0.057 (0.057)	-0.067 (0.057)	-0.042 (0.061)	-0.049 (0.061)
Small	-0.437 (0.054)***	-0.427 (0.054)***	-0.437 (0.058)***	-0.437 (0.058)***	0.397 (0.058)***	0.389 (0.058)***	0.393 (0.062)***	0.392 (0.063)***	0.213 (0.061)***	0.211 (0.062)***	0.141 (0.065)**	0.149 (0.066)**
Large	0.236 (0.080)***	0.246 (0.081)***	0.194 (0.085)**	0.204 (0.086)**	-0.042 (0.089)	-0.062 (0.090)	-0.029 (0.095)	-0.051 (0.096)	-0.201 (0.090)**	-0.198 (0.092)**	-0.216 (0.096)**	-0.210 (0.097)**
Age	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	-0.005 (0.002)***	-0.005 (0.002)***	-0.005 (0.002)***	-0.005 (0.002)***	0.002 (0.001)	0.002 (0.001)	0.002 (0.002)	0.002 (0.002)
Corporation	0.064 (0.055)	0.072 (0.056)	0.040 (0.060)	0.050 (0.060)	-0.132 (0.059)**	-0.132 (0.059)**	-0.160 (0.064)**	-0.164 (0.065)**	-0.144 (0.064)**	-0.126 (0.065)**	-0.139 (0.069)**	-0.111 (0.070)
Informality	-0.004 (0.001)***	-0.004 (0.001)***	-0.004 (0.001)***	-0.003 (0.001)***	0.008 (0.001)***	0.007 (0.001)***	0.007 (0.001)***	0.006 (0.001)***	0.006 (0.001)***	0.005 (0.001)***	0.005 (0.001)***	0.004 (0.001)***
Bribes - tax collection	-0.127 (0.057)**			-0.115 (0.064)*	0.110 (0.059)*			0.086 (0.067)	0.135 (0.063)**			0.071 (0.071)
Tax administration constraint		-0.045 (0.049)		-0.026 (0.052)		0.166 (0.049)***		0.158 (0.053)***		0.428 (0.053)***		0.423 (0.057)***
Legal quality index			0.091 (0.036)**	0.089 (0.037)**			-0.077 (0.038)**	-0.066 (0.038)*			-0.227 (0.040)***	-0.196 (0.041)***
Constant	0.111 (0.113)	0.153 (0.115)	0.077 (0.126)	0.127 (0.118)	-0.798 (0.119)***	-0.837 (0.122)***	-0.766 (0.134)***	-0.819 (0.136)***	-1.246 (0.132)***	-1.299 (0.135)***	-0.953 (0.144)***	-1.045 (0.148)***
Industry dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	4226	4136	3626	3565	4226	4136	3626	3565	4226	4136	3626	3565
Pseudo R ²	0.104	0.102	0.100	0.100	0.081	0.081	0.085	0.086	0.088	0.101	0.093	0.109

Table 5. Informality, Access to Credit, and Business Environment: Interaction Effects

$$Credit_{ij} = \beta_0 + \gamma_j + \beta_1 Inf_{ij} + \beta_2 T_{ij} + \beta_3 q_{ij} + \beta_4 X_{ij} + \beta_5 Inf_{ij} * T_{ij} + \beta_6 Inf_{ij} * q_{ij} + \varepsilon_i$$

Credit is either *Bank Credit*, *Informal Credit*, or *Financing Obstacle*. *Bank Credit* is a dummy variable that takes the value of 1 if the firm uses bank credit to finance either working capital or new investment, and zero otherwise. *Informal Credit* is a dummy variable that takes the value of 1 if the firm uses credit from money-lenders or family and friends to finance either its working capital or new investment, and zero otherwise. *Financing obstacle* is a dummy variable that takes the value of 1 if the firm reports the availability of financing as a “major constraint”, and zero otherwise. *Inf* is the percentage of sales that are not reported for tax purposes. *T* is the tax burden measured by the severity of tax administration constraints faced by individual firms and the frequency with which firms have to give bribes to deal with taxes and tax collection. The quality and efficiency of the legal system, *q*, is proxied by the index of legal effectiveness. *X* are firm-level controls including firm age, size and industry dummies, as well as dummies equal to 1 if the firm is owned by the government, if it is a corporation, and if it is an exporter. Robust standard errors are in parentheses; significant at 10 percent; ** signifi

Dependent variable	Bank Credit			Informal Credit			Financing Obstacle		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Informality	-0.003 (0.002)*	-0.003 (0.002)**	-0.006 (0.002)***	0.004 (0.001)***	0.005 (0.001)***	0.007 (0.002)***	0.004 (0.002)***	0.002 (0.001)	0.009 (0.002)***
Informality*Bribes - tax collection	-0.003 (0.002)*			0.008 (0.002)***			0.003 (0.002)*		
Informality* Tax administration constraint		-0.003 (0.002)*			0.005 (0.002)***			0.009 (0.002)***	
Informality*Legal quality index			0.003 (0.002)*			-0.001 (0.002)			-0.005 (0.002)**
Industry dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	4226	4136	3626	4226	4136	3626	4085	4029	3530
Pseudo R ²	0.115	0.115	0.111	0.082	0.078	0.082	0.087	0.091	0.087

Table 6. Access to Credit and Informality: Impact of Institutional Development

$$Credit_{ij} = f(Inf_{ij}, Z_{ij}) = \beta_0 + \beta_1 Inf_{ij} + \beta_2 T_j + \beta_3 q_j + \beta_4 X_{ij} + \varepsilon_i$$

Credit is either *Bank Credit* or *Informal Credit*. *Bank Credit* is a dummy variable that takes the value of 1 if the firm uses bank credit to finance either working capital or new investment, and zero otherwise. *Informal Credit* is a dummy variable that takes the value of 1 if the firm uses credit from money-lenders or family and friends to finance either its working capital or new investment, and zero otherwise. *Inf* is the percentage of sales that are not reported for tax purposes. *T* is a country-wide measure of tax burden proxied by the time taken to pay taxes per year. The quality and efficiency of the legal system, *q*, is proxied by a country-wide measure of the rule of law and the ratio of private credit to GDP. *X* are firm level and country-wide controls including firm age, size and industry dummies, as well as dummies equal to 1 if the firm is owned by the government, if it is a corporation, and if it is an exporter, the log of GDP per capita, average GDP growth, and CPI inflation. Robust standard errors are in parentheses; significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent.

Dependent variable	Bank Credit				Informal Credit			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
State	-0.570 (0.079)***	-0.568 (0.079)***	-0.586 (0.080)***	-0.574 (0.080)***	-0.210 (0.088)**	-0.202 (0.088)**	-0.201 (0.088)**	-0.202 (0.089)**
Exporter	0.186 (0.049)***	0.199 (0.049)***	0.196 (0.049)***	0.188 (0.050)***	-0.186 (0.053)***	-0.200 (0.053)***	-0.200 (0.053)***	-0.181 (0.053)***
Small	-0.440 (0.053)***	-0.444 (0.053)***	-0.424 (0.053)***	-0.427 (0.053)***	0.400 (0.057)***	0.400 (0.057)***	0.393 (0.057)***	0.389 (0.057)***
Large	0.237 (0.079)***	0.238 (0.079)***	0.245 (0.079)***	0.244 (0.079)***	-0.047 (0.089)	-0.048 (0.088)	-0.051 (0.088)	-0.053 (0.088)
Age	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	-0.005 (0.002)***	-0.005 (0.002)***	-0.005 (0.002)***	-0.005 (0.002)***
Corporation	-0.055 (0.049)	-0.086 (0.048)*	-0.088 (0.048)*	-0.074 (0.049)	-0.120 (0.052)**	-0.091 (0.051)*	-0.084 (0.051)*	-0.127 (0.053)**
GDP per capita	0.086 (0.047)*	0.089 (0.047)*	0.109 (0.046)**	0.051 (0.049)	-0.093 (0.049)*	-0.140 (0.049)***	-0.126 (0.048)***	-0.102 (0.050)**
Inflation	-0.034 (0.007)***	-0.030 (0.007)***	-0.034 (0.007)***	-0.036 (0.007)***	-0.005 (0.008)	-0.007 (0.008)	-0.006 (0.008)	-0.002 (0.008)
Growth	0.004 (0.010)	-0.004 (0.010)	-0.015 (0.010)	-0.016 (0.011)	0.024 (0.011)**	0.029 (0.011)***	0.037 (0.011)***	0.028 (0.011)**
Informality	-0.004 (0.001)***	-0.004 (0.001)***	-0.004 (0.001)***	-0.004 (0.001)***	0.008 (0.001)***	0.008 (0.001)***	0.008 (0.001)***	0.008 (0.001)***
Private Credit	0.005 (0.002)**			0.004 (0.002)**	-0.006 (0.002)***			-0.007 (0.002)***
Rule of Law		0.162 (0.082)**		0.208 (0.085)**		0.083 (0.084)		0.112 (0.089)
Time to Pay Taxes			-0.0002 (0.000)***	-0.0002 (0.000)***			.00009 (0.000)**	0.00009 (0.000)**
Industry dummies	YES	YES	YES	YES	YES	YES	YES	YES
Observations	4226	4226	4226	4226	4226	4226	4226	4226
Pseudo R ²	0.079	0.078	0.081	0.084	0.068	0.067	0.068	0.070

Table 7. Informality, Access to Credit, and Business Environment: Interaction Effects

$$Credit_{ij} = \beta_0 + \gamma_j + \beta_1 Inf_{ij} + \beta_2 T_j + \beta_3 q_j + \beta_4 X_{ij} + \beta_5 Inf_j * T_j + \beta_6 Inf_{ij} * q_j + \varepsilon_i$$

Credit is either *Bank Credit* or *Informal Credit*. *Bank Credit* is a dummy variable that takes the value of 1 if the firm uses bank credit to finance either working capital or new investment, and zero otherwise. *Informal Credit* is a dummy variable that takes the value of 1 if the firm uses credit from money-lenders or family and friends to finance either its working capital or new investment, and zero otherwise. *Inf* is the percentage of sales that are not reported for tax purposes. *T* is a country-wide measure of tax burden proxied by the time taken to pay taxes per year. The quality and efficiency of the legal system, *q*, is proxied by a country-wide measure of the Rule of law and the ratio of private credit to GDP. *X* are firm level and country-wide controls including firm age, size and industry dummies, as well as dummies equal to 1 if the firm is owned by the government, if it is a corporation, and if it is an exporter, the log of GDP per capita, average GDP growth, and CPI inflation. Robust standard errors are in parentheses; significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent.

Dependent variable	Bank Credit			Informal Credit		
	(1)	(2)	(3)	(4)	(5)	(6)
Informality	-0.002 (0.002)	-0.004 (0.001)***	-0.002 (0.001)	0.007 (0.002)***	0.007 (0.001)***	0.007 (0.001)***
Private Credit	0.005 (0.002)**			-0.006 (0.002)***		
Informality*Private credit	-0.000 (0.000)			0.000 (0.000)		
Rule of Law		0.150 (0.085)*			0.115 (0.088)	
Informality*Rule of Law		0.001 (0.001)			-0.002 (0.001)	
Time to pay taxes			-0.0002 (0.000)***			0.000 (0.000)
Informality*Time to pay taxes			-0.000 (0.000)**			0.000 (0.000)
Industry dummies	YES	YES	YES	YES	YES	YES
Observations	4226	4226	4226	4226	4226	4226
Pseudo R ²	0.079	0.078	0.082	0.069	0.067	0.068

Table 8. Extended Regressions: Firm Transparency and Performance

Bank Credit is a dummy variable that takes the value of 1 if the firm uses bank credit to finance either working capital or new investment, and zero otherwise. *Informal Credit* is a dummy variable that takes the value of 1 if the firm uses credit from money-lenders or family and friends to finance either its working capital or new investment, and zero otherwise. *Informality* is the percentage of sales that are not reported for tax purposes. *Audit* is a dummy variable that takes the value of 1 if the firm has an external auditor, and zero otherwise. *Account* is a dummy variable that takes the value of 1 if the firm uses international accounting standards, and zero otherwise. *Sales growth* is the firm's sales growth in the last three years. *Assets* is the log of firm's fixed assets. Other firm-level controls include firm age, size and industry dummies, as well as dummies equal to 1 if the firm is owned by the government, if it is a corporation, and if it is an exporter. Robust standard errors are in parentheses; significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent.

Dependent variable	Bank Credit				Informal Credit			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Government ownership	-0.552 (0.082)***	-0.539 (0.082)***	-0.532 (0.082)***	-0.622 (0.091)***	-0.211 (0.090)**	-0.223 (0.089)**	-0.224 (0.089)**	-0.070 (0.100)
Exporter	0.145 (0.051)***	0.156 (0.051)***	0.151 (0.051)***	0.101 (0.059)*	-0.139 (0.055)**	-0.137 (0.055)**	-0.150 (0.054)***	-0.107 (0.063)*
Small	-0.408 (0.055)***	-0.439 (0.055)***	-0.433 (0.054)***	-0.104 (0.074)	0.369 (0.059)***	0.379 (0.059)***	0.400 (0.058)***	0.203 (0.076)***
Large	0.250 (0.082)***	0.259 (0.082)***	0.258 (0.081)***	0.115 (0.095)	-0.042 (0.090)	-0.038 (0.090)	-0.058 (0.089)	0.023 (0.105)
Age	0.000 (0.001)	0.000 (0.001)	0.001 (0.001)	-0.001 (0.001)	-0.005 (0.002)***	-0.005 (0.002)***	-0.005 (0.002)***	-0.005 (0.002)***
Corporation	0.047 (0.056)	0.062 (0.056)	0.062 (0.055)	0.006 (0.063)	-0.122 (0.059)**	-0.126 (0.059)**	-0.138 (0.059)**	-0.079 (0.066)
Informality	-0.004 (0.001)***	-0.004 (0.001)***	-0.004 (0.001)***	-0.003 (0.001)**	0.007 (0.001)***	0.007 (0.001)***	0.007 (0.001)***	0.006 (0.001)***
Audit	0.142 (0.046)***				-0.135 (0.048)***			
Account		0.017 (0.060)				-0.156 (0.065)**		
Sales growth			0.001 (0.001)**				0.000 (0.001)	
Assets				0.838 (0.096)***				-0.521 (0.087)***
Constant	-0.164 (0.171)	-0.114 (0.171)	-0.117 (0.170)	-1.592 (0.290)***	-0.357 (0.171)**	-0.383 (0.170)**	-0.401 (0.170)**	0.689 (0.277)**
Industry dummies	YES	YES	YES	YES	YES	YES	YES	YES
Country dummies	YES	YES	YES	YES	YES	YES	YES	YES
Observations	4226	4226	4226	3325	4226	4226	4226	3325
Pseudo R ²	0.121	0.120	0.121	0.132	0.091	0.090	0.089	0.095

Table 9. Interaction Regressions: Informality, Firm Transparency, and Firm Performance

Bank Credit is a dummy variable that takes the value of 1 if the firm uses bank credit to finance either working capital or new investment, and zero otherwise. *Informal Credit* is a dummy variable that takes the value of 1 if the firm uses credit from money-lenders or family and friends to finance either its working capital or new investment, and zero otherwise. *Informality* is the percentage of sales that are not reported for tax purposes. *Audit* is a dummy variable that takes the value of 1 if the firm has an external auditor, and zero otherwise. *Account* is a dummy variable that takes the value of 1 if the firm uses international accounting standards, and zero otherwise. *Sales growth* is the firm's sales growth in the last three years. *Assets* is the log of firm's fixed assets. Other firm-level controls include firm age, size and industry dummies, as well as dummies equal to 1 if the firm is owned by the government, if it is a corporation, and if it is an exporter. Robust standard errors are in parentheses; significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent.

Dependent variable	Bank Credit				Informal Credit			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Informality	-0.005 (0.001)***	-0.005 (0.001)***	-0.004 (0.001)***	-0.004 (0.006)	0.008 (0.001)***	0.008 (0.001)***	0.008 (0.001)***	0.021 (0.006)***
Audit	0.118 (0.052)**				-0.104 (0.055)*			
Informality*Audit	0.002 (0.002)				-0.003 (0.002)			
Account		-0.066 (0.066)				-0.092 (0.072)		
Informality*Account		0.009 (0.003)***				-0.006 (0.003)*		
Sales growth			0.001 (0.001)*				0.000 (0.001)	
Informality* Sales growth			0.000 (0.000)				-0.000 (0.000)	
Assets				0.830 (0.105)***				-0.423 (0.093)***
Informality*Assets				0.001 (0.003)				-0.009 (0.003)**
Industry dummies	YES	YES	YES	YES	YES	YES	YES	YES
Country dummies	YES	YES	YES	YES	YES	YES	YES	YES
Observations	4226	4226	4226	3325	4226	4226	4226	3325
Pseudo R ²	0.122	0.121	0.121	0.132	0.091	0.091	0.089	0.097

Table 10. Instrumental Variables Regression

Bank Credit is a dummy variable that takes the value of 1 if the firm uses bank credit to finance either working capital or new investment, and zero otherwise. *Informal Credit* is a dummy variable that takes the value of 1 if the firm uses credit from money-lenders or family and friends to finance either its working capital or new investment, and zero otherwise. *Financing obstacle* is a dummy variable that takes the value of 1 if the firm reports the availability of financing as a “major constraint”, and zero otherwise. *Informality* is the percentage of sales that are not reported for tax purposes. Firm-level controls include firm age, size and industry dummies, as well as dummies equal to 1 if the firm is owned by the government, if it is a corporation, and if it is an exporter. In the first-stage regressions, the instrument (*average informality*) is informality averaged across locations within the country. Robust standard errors are in parentheses; significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent.

	Bank Credit (1)	Informal Credit (2)	First stage (3)	Financing Obstacle (4)	First stage (5)
Informality	-0.005 (0.003)*	0.007 (0.003)***		0.013 (0.003)***	
State	-0.527 (0.079)***	-0.186 (0.087)**	-2.980 (0.879)***	0.159 (0.083)*	-2.993 (0.892)***
Exporter	0.184 (0.048)***	-0.228 (0.052)***	-1.192 (0.590)**	-0.019 (0.054)	-0.954 (0.601)
Small	-0.427 (0.053)***	0.389 (0.057)***	2.716 (0.641)***	0.197 (0.059)***	2.600 (0.654)***
Large	0.232 (0.078)***	-0.051 (0.088)	-0.190 (0.845)	-0.221 (0.087)**	-0.652 (0.842)
Age	0.002 (0.001)	-0.005 (0.002)***	-0.022 (0.015)	0.004 (0.001)***	-0.021 (0.015)
Corporation	-0.068 (0.046)	-0.114 (0.049)**	-0.954 (0.588)	-0.170 (0.053)***	-0.910 (0.596)
Average Informality			1.039 (0.038)***		1.037 (0.040)***
Constant	0.146 (0.079)*	-0.782 (0.084)***	0.155 (0.953)	-1.081 (0.085)***	0.090 (0.984)
Industry Dummies	YES	YES	YES	YES	YES
Country Dummies	YES	YES	YES	YES	YES
Observations	4226	4226	4226	4085	4085
F-test of Instruments	0	0	0	0	0

Robust standard errors in parentheses

*** significant at 1%, ** significant at 5%, * significant at 10%

Appendix I: Solving the Model

Appendix I: Solving the Model

The firm's problem can be rewritten as:

$$\begin{aligned} \max_{\alpha_1, \alpha_2, L} & (1 - (1 - \alpha_1)T)f(k_1) - C(\alpha_1)f(k_1) \\ & + \frac{1}{1+r} \left((1 - (1 - \alpha_2)T)f(L + \pi_1(\alpha_1)) \right. \\ & \left. - C(\alpha_2)f(L + \pi_1(\alpha_1)) - (1+r)L \right) \\ \text{s.t. } & L \leq \bar{L}(\alpha_1; k_1, q), \quad \bar{L}'(\cdot) < 0, \quad \bar{L}''(\cdot) < 0 \end{aligned}$$

The Lagrangian is given by

$$\begin{aligned} L = & (1 - (1 - \alpha_1)T)f(k_1) - C(\alpha_1)f(k_1) \\ & + \frac{1}{1+r} \left((1 - (1 - \alpha_2)T)f(L + \pi_1(\alpha_1)) \right. \\ & \left. - C(\alpha_2)f(L + \pi_1(\alpha_1)) - (1+r)L \right) + \gamma(\bar{L}(\alpha_1; k_1, q) - L) \end{aligned}$$

The FOC with respect to α_1 is given by

$$f(k_1)(T - C'(\alpha_1))(1 + r + (1 - (1 - \alpha_2)T)f'(k_2) - C(\alpha_2)f'(k_2)) + (1 + r)\gamma\bar{L}'(\alpha_1; k_1, q) = 0 \quad (\text{A1})$$

The FOC with respect to α_2 is given by

$$T - C'(\alpha_2) = 0 \quad (\text{A2})$$

Thus α_2 is a function of T , $\alpha_2 = g(T)$.

The FOC with respect to L is given by

$$(1 - (1 - \alpha_2)T)f'(k_2) - C(\alpha_2)f'(k_2) - r - (1 + r)\gamma = 0 \quad (\text{A3})$$

Case1: The credit constraint ceiling is not binding, i.e. $L < \bar{L}(\alpha_1; k_1, q)$

The Lagrangian multiplier (γ) is equal to zero because the credit limit constraint is not binding. Combining equations (1) and (2) in the text, and solving out the first-order conditions (A1)-(A3), we get the following 4 equations in 4 unknowns ($\alpha_1, \alpha_2, k_2, L$):

$$T - C'(\alpha_i) = 0, \text{ for } i = 1, 2 \quad (\text{A4})$$

$$(1 - (1 - \alpha_2)T) - C(\alpha_2) = 0 \quad (\text{A5})$$

$$k_2 - (1 - (1 - \alpha_1)T)f(k_1) + C(\alpha_1)f(k_1) - L = 0 \quad (\text{A6})$$

where α_1 and α_2 are determined by (A4), and k_2 and L are jointly determined by (A5) and (A6). Using the Envelope theorem, the derivatives of (A5) and (A6) with respect to T are $-(1 - \alpha_2)f'(k_2) < 0$ and $(1 - \alpha_1)f(k_1) > 0$ respectively. The derivatives of k_2 with respect to T for (A5) and (A6) are given by:

$$\frac{\partial k_2}{\partial T} = \frac{(1-\alpha_2)f'(k_2)}{(1-(1-\alpha_2)T-C(\alpha_2))f''(k_2)}, \text{ and } \frac{\partial k_2}{\partial T} = -(1-\alpha_1)f(k_1).$$

L falls as T increases when the following inequality holds:

$$-\frac{(1-\alpha_2)f'(k_2)}{(1-(1-\alpha_2)T-C(\alpha_2))f''(k_2)} > (1-\alpha_1)f(k_1),$$

i.e. when the curvature of the production function is sufficiently small.

Case 2: The credit constraint ceiling is binding, i.e. $L = \bar{L}(\alpha_1; k_1, q)$

Substituting out γ by combining (A-1) and (A-3), we get

$$\begin{aligned} & f'(k_2) (1-(1-g(T))T-C(g(T))) (\bar{L}'(\alpha_1; k_1, q) + f(k_1)(T-C'(\alpha_1))) \\ & + f(k_1)(T-C'(\alpha_1))(1+r) - \bar{L}'(\alpha_1; k_1, q)(r) = 0 \end{aligned} \quad (A7)$$

From equation (1) we have,

$$k_2 = \bar{L}(\alpha_1; k_1, q) + (1-(1-\alpha_1)T-C(\alpha_1))f(k_1) \quad (A8)$$

Solving for α_1 by substituting k_2 out from (A-7) and (A-8) gives us α_1 as a function of the following variables: $\alpha_1 = h(T, q, k_1)$.

The derivation of L with respect to q when $L = \bar{L}(\alpha_1; k_1, q)$

Define F_1 and F_2 as the following:

$$\begin{aligned} F_1 &= f'(k_2) (1-(1-g(T))T-C(g(T))) (\bar{L}'(\alpha_1; k_1, q) + f(k_1)(T-C'(\alpha_1))) \\ &+ f(k_1)(T-C'(\alpha_1))(1+r) - \bar{L}'(\alpha_1; k_1, q)(r) = 0 \\ F_2 &= k_2 - \bar{L}(\alpha_1; k_1, q) - ((1-(1-\alpha_1)T)-C(\alpha_1))f(k_1), \end{aligned}$$

Then the Jacobian determinant²³ would be positive and the determinant of a 2x2 matrix where the (1,1), (1,2), (2,1), and (2,2) elements are given by $\partial F_1/\partial k_2$, $\partial F_1/\partial q$, $\partial F_2/\partial k_2$, and $\partial F_2/\partial q$ would be negative respectively.²⁴ This implies that the derivative of α_1 with respect to q is negative. Since \bar{L} decreases with α_1 and $\partial \bar{L}(\alpha_1; k_1, q)/\partial q > 0$, it must be the case that L increases with q .

²³ The determinant of matrix where the (1,1), (1,2), (2,1), (2,2) elements are given by $\partial F_1/\partial k_2$, $\partial F_1/\partial \alpha_1$, $\partial F_2/\partial k_2$, and $\partial F_2/\partial \alpha_1$.

²⁴ Note that γ is positive when the credit ceiling constraint is binding. Also by assumption, $\bar{L}'(\alpha_1; k_1, q) < 0$ and $\partial \bar{L}'(\alpha_1; k_1, q)/\partial q < 0$. Then, by (A1) $T - C'(\alpha_1) < 0$ because the second and third terms in (A1) are positive; by (A-3) $(1-(1-\alpha_2)T)f'(k_2) - C(\alpha_2)f''(k_2) - r > 0$; and by (A7) $\bar{L}'(\alpha_1; k_1, q) + f(k_1)(T - C'(\alpha_1)) < 0$.

Appendix II. Countries in the Sample

	Country	Number of Firms	Percent	Cumulative
1	Albania	86	2.04	2.04
2	Armenia	204	4.83	6.86
3	Azerbaijan, Rep. of	51	1.21	8.07
4	Belarus	152	3.6	11.67
5	Bosnia & Herzegovina	106	2.51	14.17
6	Bulgaria	172	4.07	18.24
7	Croatia	139	3.29	21.53
8	Czech Republic	208	4.92	26.46
9	Estonia	102	2.41	28.87
10	Georgia	57	1.35	30.22
11	Hungary	391	9.25	39.47
12	Kazakhstan	224	5.3	44.77
13	Kyrgyz Republic	85	2.01	46.78
14	Latvia	147	3.48	50.26
15	Lithuania	123	2.91	53.17
16	Macedonia, FYR	141	3.34	56.51
17	Moldova	153	3.62	60.13
18	Poland	465	11	71.13
19	Romania	311	7.36	78.49
20	Russia	214	5.06	83.55
21	Serbia & Montenegro	75	1.77	85.33
22	Slovak Republic	115	2.72	88.05
23	Slovenia	126	2.98	91.03
24	Tajikistan	52	1.23	92.26
25	Ukraine	280	6.63	98.89
26	Uzbekistan	47	1.11	100
	Total	4,226	100	

Appendix III. Variables and Sources

Variable	Definition	Original Source
Bank Credit	Dummy variable that takes on the value 1 if the firm relies on external sources (local and foreign banks) to finance either working capital or new investment, zero otherwise.	Business Environment and Enterprise Performance Survey (BEEPS, 2005)
Informal Credit	Dummy variable that takes on the value 1 if the firm relies on informal sources (money-lenders or family and friends) to finance either working capital or new investment, zero otherwise.	BEEPS, 2005
Financing obstacle	Dummy variable constructed on the basis of the question: how problematic is access to financing (e.g., collateral required or financing not available) for the operation and growth of your business: no obstacle (1), a minor obstacle (2), a moderate obstacle (3), or a major obstacle (4)?	BEEPS, 2005
Informality (percentage of sales not declared to tax authorities)	Recognizing the difficulties many firms face in fully complying with taxes and regulations, what percentage of total annual sales would you estimate the typical firm in your area of business reports for tax purposes?	BEEPS, 2005
Tax administration constraint	Dummy variable constructed on the basis of the question: how problematic is tax administration for the operation and growth of your business: no obstacle (1), a minor obstacle (2), a moderate obstacle (3), or a major obstacle (4)?	BEEPS, 2005
Bribes- taxes and tax collection	Dummy variable constructed on the basis of the question: how often would a firm like yours make unofficial payments/gifts to deal with taxes and tax collection in a given year: never(1), seldom(2), sometimes(3),	BEEPS, 2005

frequently(4), usually (5), always(6)?

Legal quality index	Additive index based on questions: how often do you associate the description “fair and impartial”, “honest”, and “able to enforce its decisions” with the court system in resolving business disputes: always (1), usually (2), frequently (3), sometimes (4), seldom (5), never (6)?	BEEPS, 2005
Government ownership	Dummy variable that takes on the value 1 if any government agency or state body has a financial stake in the ownership of the firm, zero otherwise.	BEEPS, 2005
Corporation	Dummy variable that takes on the value 1 if the firm is organized as a corporation, and zero if the firm is organized as a cooperative, sole proprietorship, partnership, or some other legal form.	BEEPS, 2005
Exporter	Dummy variable that takes on the value 1 if firm exports, zero otherwise.	BEEPS, 2005
Age	Business age calculated as the difference between the year of the survey minus the year when the firm started operations.	BEEPS, 2005
Firm-size dummies	A firm is defined as small if it has between 2 and 49 employees, medium if it has between 50 and 249 employees, and large if it has more than 250 employees.	BEEPS, 2005
Audit	Dummy variable that takes on the value 1 if the firm has an external auditor, zero otherwise.	BEEPS, 2005
Account	Dummy variable that takes on the value 1 if the firm uses international accounting standards, zero otherwise.	BEEPS, 2005

Assets	Logarithm of the book value of the physical production assets owned and used by the firm (land, buildings, equipment).	BEEPS, 2005
Sales growth	Estimate of the firm's sales growth over the past three years.	BEEPS, 2005
Private credit	Private credit by deposit money banks over GDP.	Beck, Demirgüç-Kunt, and Levine(2000), updated (2007)
Rule of law	Principal component indicator of survey indicators measuring the quality of contract enforcement, the police and the courts, as well as the likelihood of crime and violence.	Kaufmann, Kraay, and Mastruzzi (2006)
Time to pay taxes	Time taken to prepare, file and pay (or withhold) three major types of taxes: corporate income tax, value added or sales tax and labor tax, including payroll and social security contributions.	World Bank Doing Business Survey (2005)
GDP per capita	Log of per capita GDP in constant 2000 U.S. dollars.	World Development Indicators (WDI)
GDP growth	Growth rate of real GDP, average 2002-2005.	WDI
Inflation	Log difference of Consumer Price Index.	IFS, line 64

References

- Aiyagari, M., A. Demircug-Kunt, and V. Maksimovic, 2007, "Firm Innovation in Emerging Markets," World Bank Policy Research Working Paper 4157.
- Beck, T., A. Demircug-Kunt, and V. Maksimovic, 2005, "Financial and Legal Constraints to Growth: Does Firm Size Matter?" *Journal of Finance*, Vol. 60, pp. 137–177.
- Brown, M., T. Jappelli, and M. Pagano, 2007, "Information Sharing and Credit: Firm-Level Evidence from Transition Countries," Swiss National Bank Working Paper 15.
- Claessens, S. and L. Laevan, 2003, "Financial Development, Property Rights, and Growth," *Journal of Finance*, Vol. 58, pp. 2401-2436.
- Cull, R., D. McKenzie, and C. Woodruff, 2007, "Experimental Evidence on Returns to Capital and Access to Finance in Mexico," World Bank Working Paper.
- Dabla-Norris, E., M. Gradstein, and G. Inchauste, 2008a, "What causes firms to hide output? The Determinants of Informality," *Journal of Development Economics*, Vol. 85, pp. 1–27.
- Dabla-Norris, E., and Inchauste, G., 2008b, "Informality and Regulations: What Drives the Growth of Firms" *IMF Staff Papers*, forthcoming.
- Demircug-Kunt, A., I. Love, and V. Maksimovic, 2006, "Business Environment and the Incorporation Decision," *Journal of Banking and Finance*, Vol. 30, pp. 2967-93.
- Demircug-Kunt, A., and V. Maksimovic, 1998, "Law, Finance, and Economic Growth," *Journal of Finance*, Vol. 53, pp. 2107-37.
- Djankov S., C. McLeish, and A. Shliefer, 2007, "Private Credit in 129 Countries," *Journal of Financial Economics*, forthcoming.
- European Bank for Reconstruction and Development, 2007, *Finance in Transition* (London: EBRD).
- Friedman, E., S. Johnson, D. Kaufman, and P. Zoido-Lobaton, 2000, "Dodging the Grabbing Hand: the Determinants of Unofficial Activity in 69 Countries," *Journal of Public Economics*, Vol. 76, pp. 459–92.
- Fajnzylber, P., F. Maloney, and G. Montes Rojas, 2006, "Releasing Constraints to Growth or Pushing on a String? The Impact of Credit, Training, Business Associations, and Taxes on the Performance of Mexican Micro-firms," World Bank Policy Research Working Paper No. 3807.
- Gatti, R., and M. Honoratti, 2008, "Informality among Formal Firms: Firm-Level, Cross-Country Evidence on Tax Compliance and Access to Credit," World Bank Policy Research Working Paper 4476.

- Gordon, R., and W. Li, 2005, "Tax Structure in Developing Countries: Many Puzzles and a Possible Explanation," NBER Working Paper 11267.
- Johnson, S., D. Kaufman, J. McMillan, and C. Woodruff, 2000, "What Do Firms Hide? Bribes and Unofficial Activity After Communism," *Journal of Public Economics*, Vol. 76, pp. 495–520.
- Johnson, S., McMillan, J., and C. Woodruff, 2002, "Property Rights and Finance," *American Economic Review*, Vol. 92, pp. 1335–56.
- Kaufmann, D., A. Kraay, and M. Mastruzzi, 2006, "Governance Matters V: Governance Indicators for 1996–2005." Available at the internet:
<http://info.worldbank.org/governance/kkz2005/tables.asp>
- Klapper, L., L. Laevan, and R. Rajan, 2006, "Entry Regulation as a Barrier to Entrepreneurship," *Journal of Financial Economics*, Vol. 82, pp. 591–629.
- La Porta, R., F. Lopez-de-Silanes, A. Shleifer, and R. Vishny, 1997, "Legal Determinants of External Finance," *Journal of Finance* Vol. 52, pp. 1131–1150.
- Loayza, N., 1996, "The Economics of the Informal Sector: A Simple Model and Some Empirical Evidence from Latin America," *Carnegie-Rochester Conference Series on Public Policy*, Vol. 45, pp.129–62.
- Levine, R., 2005, "Finance and Growth: Theory and Evidence," *Handbook of Economic Growth*, Eds. Aghion, P. and S. Durlauf, Chapter 12, pp. 865–934 (Amsterdam: North Holland Elsevier).
- McMillan, J., and C. Woodruff, 1999, "Interenterprise Relationships and Informal Credit in Vietnam," *Quarterly Journal of Economics*, Vol. 114, pp. 1285–1320.
- Savafian, M., and J. Wimpey, 2007, "When do Enterprises Prefer Informal Credit?" World Bank Policy Research Working Paper 4435.
- Schneider, F., 2006, "Shadow Economies and Corruption All Over The World: What Do We Really Know?" CESifo Working Paper No. 1806.
- Straub, S., 2005, "Informal Sector: The Credit Market Channel," *Journal of Development Economics*, Vol. 78, 299–321.
- World Bank, 2007a, *Informality: Exit and Exclusion* (Washington, D.C.).
- World Bank, 2007b, *Doing Business* (Washington, D.C.).
- World Bank, 2007c, *Finance For All? Policies and Pitfalls in Expanding Access* (Washington, DC.).