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Informal Sector: The Credit Market Channel

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INFORMAL SECTOR: THE CREDIT MARKET CHANNEL*

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Abstract

We build a model of firms' choice between formality and informality. Complying with costly registration procedures allows the firms to benefit from key public goods, enforcement of property rights and contracts, that make the participation in the formal credit market possible. In a moral hazard framework with credit rationing, their decision is shaped by the interaction between the cost of entry into formality, and the relative efficiency of formal versus informal credit mechanisms and their related institutional arrangements. The model is consistent with existing stylized facts on the determinants of informality.

JEL Codes: O17, D2, G2.

Keywords: Formal and Informal Sectors, Credit Markets, Institutional Arrangements.

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1   Introduction

Informality is a pervasive phenomenon around the world, and indeed one that represents a major challenge to economic and social policies in developing countries. Although some progress has been made toward the empirical measurement of informal activities, the theoretical understanding of their causes and consequences is still lagging (see Schneider and Enste, 2000, for a comprehensive survey).[1]

Being formal entails costs. For established economic units, these include taxes, compliance with the whole array of regulations (related among others to labor and environment), and possibly exposure to bribe taking by government officials. Moreover, as first shown by de Soto (1987) in the case of Peru, and further documented by Djankov, La Porta, Lopez-de-Silanes and Shleifer (2002) for 85 countries, firms support significant "entry costs", in the form of registration and license fees, to be able to operate formally. These are both direct monetary costs and the opportunity cost of the time spent complying with legal requirements. According to Djankov et al. (2002), they range from a low of 2 procedures, taking two days and generating a cost equivalent to 2.3% of per capita GDP in Canada, to a high of 21 procedures, 80 days and 463% of per capita GDP in the Dominican Republic. Moreover, in 30 out of the 85 countries they consider, the estimated cost exceeds 50% of per capita GDP.

On the other hand, the benefits of being formal consist in the access to public goods and services, which we classify in two categories. First, those making production possible (as, for example, police and judicial protection against crime) and/or enhancing productivity (public infrastructure). Second, the public goods which, by ensuring the enforcement of property rights and contracts, secure access to specific markets, where they make interactions between private agents possible and more efficient.

Depending on the nature of the public goods, informal agents may be incompletely excluded from their use, so they have an incentive to free ride, i.e. use them at least partly while not participating in their financing. Moreover, there exist informal substitutes for these public goods and the specific markets they give access to. These are either produced by the agents themselves (reputation is a prominent example in the case of contracting), or by specific

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[1] A common definition, focusing on legal activities, considers the informal economy to be made of "all economic activities that contribute to the officially calculated (or observed) gross national product but are currently unregistered" (Schneider and Enste, 2000).

institutions (Mafia protection, neighbor associations for the establishment of informal property rights on land, informal credit by money lenders, etc.).

Most of the literature adopts a simple formalization of the benefits, assuming that formality gives access to a productivity enhancing public good, while informal agents must invest in an imperfect substitute[2]. While this fits well the infrastructure interpretation of public goods, it is less satisfactory when talking about property rights and contract enforceability, the primary effect of which is to allow entrepreneurs to participate in efficient markets. Moreover, there appears to be an interaction between the cost of formality and the relative efficiency of specific formal markets vs. their informal counterparts that is crucial in explaining the formality decision.

The effect of the second category of public goods is of particular importance in the credit market. Financial markets are at the heart of productive activities, both by sustaining medium and long term investment and by smoothing exchanges through short term credit. As shown for example in Pagano (2001), their efficiency depends crucially on a number of supporting institutions, which allow lenders to secure a reasonable rate of repayment by ensuring a steady flow of information from borrowers to lenders, reducing strategic default, and facilitating judicial recovery of loans or guarantees. In turn, these institutions function through the imposition of certain procedures, which among others require borrowers to present credible documentation relative to their physical location and 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).

These requirements de facto exclude most informal producers, who lack the incentive to incur these additional costs. Most of them do not register their operations in books, they do not use banking accounts or traceable means of payment, and they generally mix cash operations corresponding to their business with their personal activity. For these reasons, monitoring their business is difficult, and most loans are made possible only because of the strong enforcement techniques used by informal lenders, such as physical threat, violent seizure of assets, etc. As an example, Straub and Sosa (2001) report the following story, told by the president of the Paraguayan association

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[2]See for example Loayza (1995), Marcouiller and Young (1995), Johnson, Kaufmann and Shleifer (1997), Friedman, Johnson, Kaufmann and Zoido-Lobatón (2000), Choi and Thum (2002) and Azuma and Grossman (2002).

of finance companies: "One of our clients was heavily indebted with several creditors, including us and a usurer. As a way to remind him of his obligation, the usurer sent him a bullet in an envelope. The client paid the usurer first and then filed a reorganization procedure. We recovered only a small fraction of the formal loans".

We analyze the formality decision in a continuous investment model with moral hazard *à la* Holmstrom and Tirole (1997). The model builds on a dual credit market structure, in which the basic assumption is that ex post income is verifiable for formal lenders but not for informal ones, so these rely instead on coercion to get repaid. By introducing a cost of entry into formality, it then gives simple predictions linking the decision of each entrepreneur to become formal or not to the amount of available initial capital, the relative efficiency of credit markets and the cost of registering formally. Moreover, it is extended to see how the trade-off is affected by the possibility to attach collateral, a more or less efficient judicial recovery of loans, the volatility of the economic environment and the existence of labor rigidities like minimum wage requirements or dismissal costs[3].

The contribution of this paper is twofold. First, it opens the black box of formality versus informality benefits by modeling explicitly the underlying credit mechanisms in each sector, as well as the related institutional arrangements. Second, it offers an explanation of the formality choice that does not rely on a fixed employment or asset threshold, linked to some exogenous institutional feature. Instead, taking entrepreneurs' initial endowment as given, the model exhibits a decision rule with an endogenous asset threshold above which formalization is beneficial. Finally, the effect of different types of environmental characteristics on this threshold is analyzed.

In the next Section 2, we motivate the model by presenting an overview of the existing empirical evidence on the determinants of the size of the informal sector. Section 3 develops the model, Section 4 introduces a production function in this basic setting to study the impact of labor market rigidities and the possibility of different levels of formality, and Section 5 concludes.

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[3]Note, finally, that the choice between formality and informality is not an "all or nothing" alternative, as stressed for example by Levenson and Maloney (1998). Rather, there exist different degrees of formality, given by the set of institutions and rules that each firm decides to follow. Straub (2003) presents an extension of the model along this line.

2   Empirical Motivation: Stylized Facts

Recent cross-country evidence emphasizes the negative correlation between informality and different aspects of the quality of institutions like corruption, rule of law and regulatory burden[4]. Johnson, Kaufmann, McMillan and Woodruff (2000) present similar results at the firm-level for five Eastern European countries. The general picture is one in which countries with lower quality institutions or heavier burden of regulation also have a larger informal sector. There is less clear-cut evidence, however, regarding the direction of causality and the mechanisms linking institutional outcomes and the extent of informality. Although Friedman et al. (2000) present instrumental regressions using the set of instruments suggested by La Porta, Lopez-de-Silanes, Shleifer and Vishny (1997, 1999), which includes ethnolinguistic fragmentation, origin of the legal system, religious composition and latitude, some recent works suggest that at least part of these instruments may be associated with informality through other channels than the quality of institutions. This is the case for legal origin, which Botero, Djankov, La Porta, Lopez-de-Silanes and Shleifer (2003) show to be associated with the level of labor regulation, itself correlated with the extent of informality; it is also true of the degree of ethnic divisions, which Lassen (2003) find related to informality, arguing that higher fractionalization decreases tax compliance because of an unwillingness to contribute to public goods benefiting other ethnic groups.

Concerning the costs of entry, Djankov et al. (2002) provide preliminary evidence that countries with heavier regulation of entry have larger informal sectors, in a sample of 85 countries. They argue that their results support the view of politicians deliberately creating extractable rents by restricting entry into formal markets. After presenting a model along this line, Auriol and Warlters (2004) build on this data and argue that informality is best explained by a combination of level of development, population size, and cost of entry.

The available evidence on the effect of taxes is ambiguous. Loayza (1996) reports a positive correlation between the level of a country's highest corporate income tax rate and the size of its informal sector, in a sample of 14 Latin American countries. Johnson et al. (1998) show that countries with a higher "tax burden", an index based both on rates and the quality

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[4]See Loayza (1996), Johnson et al. (1997), Johnson, Kaufmann and Zoido-Lobatón (1998), and Friedman et al. (2000).

of tax administration and meant to measure how business friendly the tax system is, have a larger share of unofficial economy. On the other hand, they show that this is also the case of countries with lower marginal tax rates, which is not surprising as the lowest rates are found in places like Bolivia or Uruguay, while the highest one correspond mostly to European OECD countries. These results are not supported by firm-level evidence, however, as Johnson et al. (2000) find no effects of taxes on firms' hidden sales. Finally, Friedman et al. (2000) find that both higher tax rates and a higher tax burden index correlate with smaller unofficial activity and conclude that, for their sample, "the incentive to go underground to dodge higher tax rates is outweighed by the benefits of remaining official when tax rates are higher".

Labor market rigidities, including minimum wage, firing costs and other employment laws meant to protect workers, are also potential determinants of informality. Loayza(1996) shows a positive correlation between labor-market restrictions and informality. Recently, Botero et al. (2003), find that heavier regulation of labor is associated with a larger unofficial economy in a cross country sample of 85 countries. However, they are unable to assess causation as the instrumental regressions using legal origins as instruments are not significant. Evidence based on country level microeconomic data is less conclusive, as discussed for example in Heckman and Pages (2003). They find that the impact of the level of job security protection in Latin American on the formal/informal composition of employment remains ambiguous, despite some preliminary indications that the decline in employment may be greater in the covered, formal sector. In a different context, Lemieux, Fortin and Fréchette (1994) use micro data from a randomized survey to analyze the individual decision to work underground in Quebec City, finding for example significant elasticities with respect to wage differentials, number of hours worked and taxes for some groups of the population.

Batra, Kaufmann and Stone (2003), use the cross-country enterprise-based data of the 1999-2000 World Bank's World Business Environment Survey (WBES) to test the constraints facing firms' development[5]. In the section devoted to the determinants of "unofficialdom" (pages 75 to 83), they present results on the determinants of firms' decision to hide part or the totality of

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[5]On top of detailed information concerning the characteristics of the firms surveyed, one question refers particularly to informal activities: "Recognizing the difficulties many enterprises face in fully complying with taxes and regulations, what percentage of total sales would you estimate the typical firm in your area of activity reports for tax purposes?". The data are available at http://info.worldbank.org/governance/wbes/.

their output. They first find that more policy instability, higher regulatory and tax constraints, more corruption and lower protection of property rights are all significantly related to more informality. Moreover, firms that are smaller, produce only for the domestic market and are privately and locally owned are also more likely to be informal[6].

To conclude this section and motivate the model, we build on Batra et al. (2003) and use the WBES dataset to present some additional illustrative evidence by running simple bivariate probit estimations (see Greene, 1997) of the joint likelihood that a particular firm belongs to the category in which tax compliance is less than 25% and that it lacks access to formal credit mechanisms. To this end, we build an additional dummy variable capturing the fact that a firm does not rely on any type of formal finance and we complete the firm-level data with several country-level indicators, including the cost of entry, rule of law, stability of the environment and labor regulation (social security laws)[7].

Table 1 presents the results. The two upper panels show the results from the probits, while the lower panel gives the marginal effects of each variable for the joint probability that a firm pays less than 25% taxes and does not have access to any type of formal finance.

(Table 1 here)

First of all, a Wald test generally rejects the hypothesis that the two equations are independent, giving some credit to the idea that becoming at least partially formal and accessing the formal credit market is a joint decision. Moreover, we again find standard results with respect to the regulation of entry (represented by the cost in columns 1 to 3 or by the number of procedures in columns 4 to 6) and the rule of law, which appears to be effective through its impact on the access to financing. A more stable environment appears to favor formality, while the effect of labor regulations is less clear in this

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[6]In the original survey, answers vary from 1 to 8, corresponding to decreasing percentages of hidden output being reported, from 100% in category 1 to 0-25% in category 8. This last category is the more interesting from our point of view since firms declaring less than 25% of their sales are likely to be real informal units, while those declaring a higher fraction of their sales would rather be formal firms evading taxes. Moreover, at the country level the selection of firms for the survey is likely to imply under-representation of informal units, as only firms with 5 or more employees are included, so Batra et al. results must rather be seen as a test of the degree of informality or of tax evasion.

[7]All definitions and sources are in Appendix.

context. The most significant index is that capturing social security laws, shown in columns 3 and 6, and its effect is significant through the financing access part of the model. Finally, as firm level aspects are concerned, smaller firms appear to be more likely to remain informal.

As for marginal effects, being small implies a 3 to 4% increase in the probability to be informal (which is slightly above 3% for the sample means of the explanatory variables), one additional registration procedure increases the probability of being informal by 0.2 to 0.3% (the corresponding figure is close to 0.2% for an additional 10% of GDP cost of entry), while an increase of two points in the rule of law index (i.e. a worsening), from the level of Portugal to that of Uruguay for example, corresponds to an approximately 2.4% higher probability to be informal. As the volatility of the growth rate is concerned, going from the level of countries like Germany, Spain, the United States or Canada, to that of the more volatile countries (Armenia or Georgia), would imply an increase of 8 to 11% in the probability to be informal.

We now present a simple model that captures the main stylized facts presented in this section.

3   The Basic Model: Entry Costs vs. Access to Formal Credit Market

Consider as a starting point the following continuous investment model (Holmstrom and Tirole, 1997). Firms (or individuals) have initial capital A, which can be cash or some kind of productive assets pledgeable as collateral. Assets in the economy have an initial distribution characterized by a cumulative distribution function $F(A)$, over a range $\left[0, \overline{A}\right]$

By accessing the credit market, firms intend to borrow an amount $I - A$ and undertake productive projects of variable size I, yielding RI in case of success and 0 in case of failure. Note that income is assumed to be fully verifiable. Moreover, the probability of success depends on the firm's effort, which is not observable by the lender. Moral hazard is here formalized by assuming that the firm can either work, in which case the probability of success is p_H, or shirk, in which case it is only $p_L < p_H$, but it enjoys a private benefit BI (or equivalently saves on the cost of effort).

The credit contract implies an agreement on a level of financing I and a sharing rule $RI = R_b + R_l$ where R_b and R_l are the shares corresponding to

the borrower and the lender respectively.

Making the standard assumptions that the net present value (NPV) per unit of investment is positive if effort is exerted:

$$p_H R > 1, \tag{1}$$

and negative if not:

$$p_L R + B < 1, \tag{2}$$

the problem is solved under the incentive constraint of the borrower:

$$p_H R_b \geq p_L R_b + BI \Leftrightarrow R_b \geq \frac{BI}{\Delta p}, \tag{3}$$

and the break-even constraint of the lender:

$$p_H R_l \geq I - A. \tag{4}$$

Equation (3) defines the maximum pledgeable income $R_l = RI - \frac{BI}{\Delta p}$. Assuming that the credit market is competitive, so profits are null and (4) is binding, and substituting, we obtain:

$$I \leq kA, \tag{5}$$

where:

$$k = \frac{1}{1 + \frac{p_H B}{\Delta p} - p_H R}. \tag{6}$$

Moreover, the competitive nature of the credit market ensures that borrowers get all the surplus, so that:

$$U_b(A) = (p_H R - 1) I = (p_H R - 1) kA, \tag{7}$$

making it optimal for them to invest as much as possible[8].

Building on this basic model, firms have the choice between two different operating modes: they can operate as a legally registered firm or decide to stay informal.

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[8]Assumptions (1) and (2) on the NPV ensures that $k > 1$. We further assume that $p_H R < 1 + \frac{p_H B}{\Delta p}$, as in the Holmstrom and Tirole setting, so that the optimal size of the firm is not infinite.

3.1 Operating Formally

If the firm decides to operate formally, it must first take the steps to register. As discussed in the introduction, there are a variety of requirements involved in formalizing a firm, which cost is not negligible. We simply formalize these costs by assuming that the firm has to pay a fixed[9] "entry cost" C.

As discussed in the introduction, being formal means that the firm has accounting data, so its revenue is at least partially verifiable, and that it can engage in legal contractual relationships. This enables it to access the formal credit market. Straightforwardly, we are in the standard model described above, with the firm now disposing of an initial capital $A - C$. Accordingly, the amount invested is given by:

$$I^F = k(A - C),$$

where the superscript F denotes "formal", and the firm gets utility:

$$U_b^F(A) = (p_H R - 1) k(A - C). \tag{8}$$

3.2 Operating Informally

On the other hand, the firm might decide to stay informal, avoiding the registration expenses C, in which case it lacks the credentials to borrow from the formal credit market and has to rely on informal lenders. As noted above, we assume that informal lenders, who are generally not able to verify the outcome of the borrowers' projects, ensure repayment of their loans through the threat of possible violent enforcement techniques.

The literature on financial markets in developing countries generally holds that the formal financial sector has a comparative advantage in fund intermediation over space and in creating scale economies, as well as the technical possibility to attach assets as collateral, while the informal credit market enjoys superiority in solving enforcement and information problems[10] (Besley,

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[9]Djankov et al. (2002) report costs for a "standardized" firm assumed to have a start-up capital of ten times per capita GDP, so their data do not account for an eventual variation linked to the initial endowment's size. Considering an entry cost with both a fixed and a variable part would not affect significantly the results of the model.

[10]Assuming that informal lenders enjoy both informational and enforcement advantages leaves however a puzzle as to why they don't extend their operations to clients of the formal credit market, and why they charge interest rates that are so much higher than their formal counterpart.

1995). In a framework of imperfect information and imperfect enforcement (see for example Hoff and Stiglitz, 1993), lending activity entails addressing the three following problems: Information acquisition (screening) on the characteristics of loan applicants, creation of proper incentives to increase the likelihood that borrowers will be able to repay the loans, adequate enforcement of this repayment to ensure they will be willing to repay. Our moral hazard framework deals only with the last two issues (incentives and enforcement), but does not address formally the problem of borrowers' screening. One way to do so would be to add an adverse selection dimension to the model, and then examine how costs and incentives to acquire information differ between formal and informal lenders, as well as the repartition of borrowers in the sense of what type of lender finances the riskier projects[11].

From a more practical point of view, one must consider that there are many types of informal credit mechanisms. These include informal loans extended by moneylenders, family members, non-profit organizations, rotating saving and credit associations (ROSCAs) also known as tontines, etc. The institutional setting in which they operate varies greatly, depending in particular of their geographical characteristics, and may range from cases where there is indeed a nearly free flow of information between lenders and borrowers (see for example Udry, 1993, in the case of rural credit in Northern Nigeria), to others in which there is little information gathering and much more reliance on strong enforcement (see the case of Paraguay mentioned above). We focus on this last type of credit mechanism, representative for example of loans made by moneylenders to small entrepreneurs in urban environments characterized by the relative anonymity of contractual relationships.

We thus formalize informal lending by assuming non verifiability of income, alongside with the possibility for the lender to impose a loss K on the borrower in case of non repayment (thus K can be either a pecuniary cost due to the seizure of assets or, consistently with a limited liability assumption, a non pecuniary one in case of "Mafia-style" enforcement)[12]. Moreover, due to the nature of the cost, the lender only recovers a fraction γK, where $\gamma \in [0, 1]$. The parameter γ has an interpretation close to the transaction

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[11]It is not excluded that such a framework would lead to a situation in which informal lenders have higher incentives to invest in information acquisition or face overall a less severe adverse selection problem. However, we leave these extensions for future research.

[12]The mechanisms C and K can be viewed as alternative versions of an imperfect costly state verification model, with the cost borne by the borrower ex ante and ex post in the formal and the informal credit markets respectively.

cost of collusion in the principal-agent literature on regulatory capture and corruption. It summarizes the fact that this kind of side transactions are by nature imperfect because they involve in-kind payments, inefficient liquidation of assets (including personal belongings for which the borrower has specific benefits from ownership, for example sentimental value), as well as the need to hide or the fear of being caught. Note also that, although the cost K is supposed to be a punishment in case of shirking, it is in fact imposed also when the project fails because of bad luck (probability $1 - p_H$) thus inflicting a higher cost to the borrower than solving the moral hazard problem would require.

Under these assumptions, the constraints of the previous model are modified in the following way: there are now two incentive constraints for the borrower, the standard one ensuring effort is exerted and a second one to induce truthful declaration of income.

$$
\begin{aligned}
p_H R_b - (1 - p_H)K & \geq & p_L R_b - (1 - p_L)K + BI \\
& \Leftrightarrow & R_b \geq \frac{BI}{\Delta p} - K,
\end{aligned}
\tag{9}
$$

and

$$
\begin{aligned}
p_H R_b - (1 - p_H)K & \geq & p_H RI - K \\
& \Leftrightarrow & R_b \geq RI - K.
\end{aligned}
\tag{10}
$$

From (1) and (2), $RI > \frac{BI}{\Delta p}$, so that (10) implies (9) and only (10) will be binding[13], implying $R_b = RI - K$. The participation constraint of the lender is then:

$$
p_H R_l + (1 - p_H)\gamma K \geq I - A.
\tag{11}
$$

By substitution, we get:

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[13] This solution dominates the one in which there are no incentive constraints and the lender imposes the cost K with probability one. In this case he would recoup γK instead of $[p_H + (1 - p_H)\gamma] K$ here. The difference comes from the fact that when the project succeeds and truthful declaration of income is induced (probability p_H), the lender avoids the loss γ. When $\gamma = 1$, both solutions become equivalent (note that $R_l = K$ for all γ).

$$p_H(RI - R_b) + (1 - p_H)\gamma K \geq I - A$$
$$\Leftrightarrow p_H K + (1 - p_H)\gamma K \geq I - A.$$

Assuming competition in the informal credit market yields the feasible level of investment (the superscript I denotes "informal"):

$$I^I = A + \Phi K, \tag{12}$$

where $\Phi = p_H + (1 - p_H)\gamma$, so that $\Phi \in [p_H, 1]$.[14]
The utility of the borrower is given by:

$$U_b^I(A) = p_H R_b - (1 - p_H)K - A.$$

Noting that $R_b = RI^I - K$, and substituting from (12), it follows:

$$U_b^I(A) = (p_H R - 1)A + (p_H R\Phi - 1)K. \tag{13}$$

Note that depending on the value of γ, the second term on the right hand side might be positive or negative. Obviously, if it is negative (which happens for low values of γ), the firm is better off renouncing to the loan and investing with its own funds, in which case it gets a surplus $(p_H R - 1)A$. Thus, a better enforcement technology for the repayment of informal loans, in the sense of a higher γ, is to the advantage of both parties.

3.3   Optimal Choice of the Firm

We can now compare the benefits from becoming formal or staying informal at different levels of wealth A. From the expressions of $U_b^F(A)$ and $U_b^I(A)$, we can draw figure 1.

(Figure 1 here)

In Figure 1, we see that, because the fixed cost of formality C shifts the $U_b^F(A)$ line to the right, there is a cutoff level A^*, below which staying

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[14]Note also that if $K > RI$, $R_b = 0$ and the lender rips off all the surplus. In this case, the borrower would not take the loan, because the threat in case of failure is too strong.

informal dominates. There is forced informality for any A lower than C, and voluntary informality between C and A^*.

The model implies that firms holding lower initial assets remain informal because the combination of costly registration costs and credit rationing makes the formal credit market unattractive to them. This provides an alternative and complementary mechanism to the one proposed for example in Rauch (1991) and Choi and Thum (2002), where smaller firms are less likely to be audited and penalized for evading taxes, or to see labor market regulation enforced upon them.

Basic comparative statics show that the prevalence of informality responds to the relative efficiency of credit markets in an intuitive way. A more efficient formal credit market (in the sense of a higher k) favors formality, while a more efficient technology in the informal lending market (both in the sense of a higher enforcement technology K, and lower transaction costs captured by a higher γ) favors informality.

This efficiency differential can be related to the effective rate of interest paid by borrowers (denoted by r_b^F in the formal credit market and r_b^I in the informal one). Simple computations show that[15]:

$$r_b^F = 0,$$

and

$$r_b^I = \frac{1}{\Phi} - 1 > 0.$$

So the model yields the prediction that the interest rate differential between informal and formal loans, given by $\frac{1}{\Phi} - 1$, is inversely related to the size of the informal sector.

3.4 Collateral

Loans backed by some sort of collateral are the most common formal credit contracts (see Besley, 1995, and Pagano, 2001), with real estate and fiduciary

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[15]In the formal sector, borrowers receive $I - (A - C) = (k - 1)(A - C)$ and pay back $R_l = (R - \frac{B}{\Delta p})I = (R - \frac{B}{\Delta p})k(A - C)$ in case of success (p_H) and 0 in case of failure $(1 - p_H)$. Simple computations show that $p_H(R - \frac{B}{\Delta p})k = k - 1$, so that $1 + r_b^F = 1$.

In the informal sector, borrowers receive ΦK and pay back K in case of success (p_H) and K in case of failure $(1 - p_H)$, so the effective interest rate they pay is given by: $1 + r_b^I = \frac{1}{\Phi} > 1$.

collateral being the main form used. For example, La Porta, López-de-Silanes and Zamarripa (2002) for Mexico, and Monje-Naranjo, Cascante and Hall (2001) for Costa Rica show that 84% and 89% of the banks' credit portfolio in their respective studies are backed by collateral. Moreover, such loans are generally over-collateralized, with guarantees to loan ratios of 2.89 and between 1.28 and 2.94 respectively[16].

In the model presented above, the borrower makes an initial contribution A to the investment. From the point of view of the lender, this reduces the agency rent to be left to the borrower in order to preserve his incentive to exert effort to a level where this rent is less than the monetary payoff of the project and the lender is able to break even. In this sense, A shares the incentive characteristics of a collateral, although it is not stricto sensu equivalent, as it is consumed in the realization of the project. In what follows, we modify the model to allow for collateral, and show that the basic insights are preserved.

Consider the case where the asset A is used to support production but still retains its value after the realization of the project. Moreover, to obtain a loan, the borrower has to give the lender a contingent right to seize the asset in case of non-repayment. Redefining the project's surplus, to be shared between the parties, as $RI + A = R_b + R_l$, and considering that the borrower receives R_b in case of success and 0 if failure, it is easy to see that its incentive constraint (equation 3) is not modified. As for the break-even constraint of the lender, it becomes:

$$p_H R_l + (1 - p_H)A \geq I - A. \tag{14}$$

Solving as before, we see that the size of the project is now $I = k_C A$, where $k_C = \frac{2}{1 + \frac{p_H B}{\Delta p} - p_H R} = 2k$. The immediate conclusion is thus that collateral increases the amount of outside financing available to borrowers. Their utility is then given by:

$$U_b^{F,C}(A) = (p_H R - 1) k_C(A - C) + (A - C).$$

As for the informal sector, the analysis is unchanged. Asset A appears on both side of the two borrowers' incentive constraints, while lenders are not able to attach the asset as collateral and ensure its eventual judicial recovery

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[16]These figures are for loans to unrelated parties and to firms respectively.

due to the lack of formal documentation. Simple computations show the amount loaned is unaltered. Therefore, the final utility of borrowers is:

$$U_b^{I,C}(A) = (p_H R - 1) A + (p_H R \Phi - 1)K + A.$$

With the possibility of asset collateralization, the shape of Figure 1 remains the same. The line for $U_b^{F,C}(A)$ still crosses the horizontal axes at C and, given assumption (1), has a higher slope than that of $U_b^{I,C}(A)$. We thus obtain that the main comparative statics of the basic model are unchanged, as would be the extensions considered below.

Finally, several refinements are possible. First, it could be assumed that only a fraction of asset A is owned in the form of real estate and can be collateralized, giving rise to a mixed case between the basic results and those of the present section. Also, a natural assumption would be that the residual value of the collateral for the lender is lower than A, explaining why losses are sometimes observed even when collateral appears to cover more than the value of the loan[17]. Indeed, assuming that lenders receive only a fraction of the collateral A, allows to match the stylized facts mentioned at the beginning of this section that suggest routine over-collateralization, as there would then exist values of the parameters for which $k_C - 1 < 1$, so the amount lent $I - A = (k_C - 1) A$ can be lower than the value of the available collateral A.

3.5   Imperfect Enforcement in the Formal Sector

The efficiency of credit markets depends both on the quality of the norms defining creditor's rights and on how well these norms are enforced. As documented for example in Pagano (2001) for several Latin American countries, formal loans suffer from non negligible default rates, and enforcement of the rules ensuring their recovery is often slow and costly[18]. In turn, this has a direct effect on the amounts available for borrowers and on the interest rates they pay. La Porta et al. (1997) show that countries with a poorer quality of law enforcement have narrower debt markets. Micro-level evidence can be found in Monje-Naranjo et al. (2001) for Costa Rica, in Castelar Pinheiro and Cabral (2001) for Brazil, and in Cristini et al. (2001) for Argentina.

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[17]Such a gap in value can be traced back to the cost of enforcing and executing guarantees through an inefficient judicial system, as addressed in the next section.

[18]For Argentina, Cristini, Moya and Powell (2001) report court costs of enforcement that vary between 4.10 and 8.83% of total claims. For Paraguay, Straub and Sosa [2001] give estimates of between 9.4 and 25.4%.

We introduce this idea in the model, modifying the break-even constraint of the lender in the following way:

$$\theta p_H R_l \geq I - A, \tag{15}$$

where $\theta \in [0, 1]$ is an index of the quality of institutions (norms defining creditor's rights, legal system, etc.) and of the enforcement of these rules. As θ decreases, lenders know that on average they will bear a higher cost to recover their loans. As the incentive constraint of the borrower is unchanged, we obtain $I \leq k^\theta A$, where:

$$k^\theta = \frac{1}{1 + \frac{\theta p_H B}{\Delta p} - \theta p_H R}. \tag{16}$$

Differentiating this expression with respect to θ and using (1) and (2), we see that:

$$\frac{\partial k^\theta}{\partial \theta} > 0, \tag{17}$$

so that a better institutional framework and better enforcement make the formal credit market more efficient in terms of amounts loaned[19], and imply that formality becomes attractive at lower levels of capital A.

3.6 Taxes

Tax avoidance is often put forward as a motive to escape the formal sector. The incentive to avoid costly tax payments is reinforced by the fact that, although informal, firms are not fully excluded from all public goods and may free ride. While they may for example be unable to benefit from legal enforcement of property rights and contracts, they may still benefit from general infrastructure and security. Furthermore, informal substitutes for some public goods may be available. Depending on the relative cost and efficiency of formal public goods and their informal substitutes, and on the

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[19]θ affects the lenders' rate of return, equal now to $\frac{1}{\theta p_H}$ in order to allow them to break even despite the cost of enforcement, but leaves the interest rate faced by borrowers unchanged. This effect on the amounts loaned rather than on the interest rates is consistent with evidence from the empirical literature on small firms finance (see for example Petersen and Rajan, 1994, and Straub and Sosa, 2001).

extent to which free-riding is possible, there may be equilibria, in which some producers are better off staying informal.

In our simple framework, a tax τ on benefits may for example affect the borrower incentive constraint in the following way:

$$p_H (1 - \tau) R_b \geq p_L (1 - \tau) R_b + BI \Leftrightarrow R_b \geq \frac{BI}{\Delta p (1 - \tau)}. \qquad (18)$$

The lender's break-even constraint is now of the form:

$$\theta (\tau) p_H R_l \geq I - A, \qquad (19)$$

where $\theta (\tau)$ indicates the dependence of the judicial enforcement system on the funds made available through taxation.

Additionally, following the discussion above, consider the possibility that taxes also finance general infrastructure that makes production more efficient, and from which informal producers are only partially excluded. On way to formalize this is to assume that a level of taxation τ implies a productivity level $R(1 + \varepsilon(\tau))$ in the formal sector, and $R(1 + \nu \varepsilon(\tau))$ in the informal sector, with $\nu < 1$, $\varepsilon(0) = 0$, $\varepsilon_\tau > 0$, $\varepsilon_{\tau\tau} < 0$.

By substitution, we get that
$I \leq k^{\theta,\tau} A$, where

$$k^{\theta,\tau} = \frac{1}{1 + \frac{\theta(\tau) p_H B}{\Delta p (1 - \tau)} - \theta (\tau) p_H R(1 + \varepsilon(\tau))}. \qquad (20)$$

The effect of taxes on the efficiency of the formal credit market is thus given by:

$$\frac{dk^{\theta,\tau}}{d\tau} = \frac{\partial k^{\theta,\tau}}{\partial \tau} + \frac{\partial k^{\theta,\tau}}{\partial \theta} \frac{d\theta}{d\tau} + \frac{\partial k^{\theta,\tau}}{\partial \varepsilon} \frac{d\varepsilon}{d\tau}. \qquad (21)$$

The first term on the right hand side is the direct effect of taxes, which is negative ($\frac{\partial k^{\theta,\tau}}{\partial \tau} < 0$). The second term is the indirect enforcement enhancing effect, which goes in the opposite direction if we assume that higher taxation improves the institutional framework because it makes more funds available to finance it[20], i.e. $\frac{d\theta}{d\tau} > 0$. The third term is the indirect productivity enhancing effect, which is also positive. Clearly, the effect of the level of

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[20]This might not be true if congestion effects exist. For example, for very high level of spending, bureaucratic complications may hinder rather than facilitate the judicial recovery of loans.

taxes on $k^{\theta,\tau}$ is ambiguous and depends on the magnitude of the partial effects.

Finally, to assess simply the net effect of taxes in this framework, it suffices to rewrite the utility of both types of borrowers:

$$U_b^F(A) = (p_H R(1 + \varepsilon(\tau)) - 1) k^{\theta,\tau}(A - C),$$

and

$$U_b^I(A) = (p_H R(1 + \nu\varepsilon(\tau)) - 1) A + (p_H R(1 + \nu\varepsilon(\tau))\Phi - 1)K.$$

In addition to the ambiguous effect on $k^{\theta,\tau}$, it can also be shown that the direct productivity enhancing effect of taxes on the relative benefits of formality and informality through the function $\varepsilon(\tau)$ can be both positive or negative[21].

Overall the effect of higher taxes on the relative benefits of formality is thus ambiguous. It must indeed be noted that tax policy decisions take into account a variety of objectives, and may or may not be optimal with respect to their specific impacts on the financial and productive spheres. This probably explains why the empirical evidence reviewed in Section 2 concerning the effect of taxes on informality is not clear-cut.

3.7 Stability of the Environment

The productive project yields (in per unit terms) R with probability p_H and 0 with probability $1 - p_H$. The variance of output is therefore equal to $(1 - p_H) p_H R^2$. Assuming $p_H \geq \frac{1}{2}$, this variance is thus decreasing in p_H, so we will consider that higher values of p_H correspond to more stable (less risky) environments[22]. The question is then to determine how the relative stability of the economic environment, defined in this way, affects the trade-off between formality and informality.

This question can be answered directly by noting that the threshold level A^* such that $U_b^F(A^*) = U_b^I(A^*)$ is given by:

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[21]The proof is omitted. Note that even if the direct effect of $\varepsilon(\tau)$ were systematically in favor of formality, the overall effect would still be ambiguous because of the result on $k^{\theta,\tau}$.

[22]The variance is strictly increasing over $\left[0, \frac{1}{2}\right]$, maximum at $\frac{1}{2}$, and decreasing over $\left[\frac{1}{2}, 1\right]$.

$$A^* = \frac{kC}{k-1} + \frac{(p_H R \Phi - 1)}{(p_H R - 1)} \frac{K}{k-1}. \tag{22}$$

Tedious but straightforward computations show that[23]:

$$\frac{\partial A^*}{\partial p_H} < 0. \tag{23}$$

A shift toward a more stable economic environment, in which the risk of failure is lower, makes it more valuable to sink the cost C in order to become formal. It thus favors formal activities more than informal ones and should reduce the fraction of firms operating informally.

To be more rigorous still, and noting that when p_H varies, the mean $p_H R$ also changes along with the variance, we need to look at a mean-preserving spread. This can be obtained by compensating an increase from p_H to $p_H + \varepsilon$, with a decrease in the value of the project from R to $\frac{Rp_H}{p_H + \varepsilon}$. For an unchanged mean, the variance is now easily computed as:

$$\sigma^2 = \left(\frac{1 - p_H - \varepsilon}{p_H + \varepsilon} \right) p_H^2 R^2.$$

A higher value of ε, i.e. a bigger increase in the probability of success of the project, corresponds to a lower variance, at all levels of p_H. Moreover, note that k is now given by $k = \frac{1}{1 + \frac{(p_H + \varepsilon) p_L B}{(p_L + \varepsilon) \Delta p} - p_H R}$, so that $\frac{\partial k}{\partial \varepsilon} > 0$ holds[24]. The rest of the proof is unchanged, and we again conclude that with a mean-preserving spread, a lower variance implies less informality.

We summarize the main results of previous sections in the following proposition:

Proposition 1 *The minimum level of initial assets A^* above which the firm finds it profitable to sink the entry cost in order to access the formal credit market is:*
- Increasing in the entry cost;

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[23]The terms $\frac{kC}{k-1}$ and $\frac{K}{k-1}$ are both decreasing in p_H since $\frac{\partial k}{\partial p_H} > 0$. As for the term $\frac{(p_H R \Phi - 1)}{(p_H R - 1)}$, it can be shown that it is also decreasing in p_H for values of γ such that $p_H R \Phi > 1$, i.e. such that informal lending actually takes place.

[24]We maintain Δp constant. To ensure comparability, we need to modify also the level of private benefit, from B to $\frac{p_L B}{(p_L + \varepsilon)}$, so that in case of shirking the unit expected private benefit is still $p_L B$.

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- Decreasing in the interest rates differential between the formal and the informal credit markets;
- Decreasing in the quality of legal enforcement of creditors' rights;
- Decreasing in the stability of the environment;
- Ambiguously related to the level of taxation.

4 Labor Market Rigidities

We now enrich the model by explicitly introducing a production function in the realization of the project. Consider that the output $\widetilde{R}(I)$ is such that:

$$\widetilde{R}(I) = F\left[I, L(I)\right] - wL(I), \tag{24}$$

where w is the market wage rate and $F\left[I, L(I)\right]$ is a function relating output to the amount of labor $L(I)$ and the amount of capital I employed. Note that for most small and medium size enterprises, I would consist of their initial capital A and a fraction $I - A$ of "working capital", i.e. cash to acquire the necessary inputs or commodities in the case of commercial projects. In what follows, we use for simplicity a constant return to scale Cobb-Douglas functional form such that $F\left[I, L(I)\right] = I^{\alpha}L(I)^{1-\alpha}$.

Consider first a competitive labor market, so that the equilibrium wage w^{E} is equal to the marginal productivity of labor. Firms determine the amount of labor they are going to hire by maximizing:

$$\max_{L}\widetilde{R}(I) = F\left[I, L(I)\right] - w^{E}L(I), \tag{25}$$

so they choose $L_{w^E}^{F}(I) = \left(\frac{1-\alpha}{w^E}\right)^{\frac{1}{\alpha}} I$.

Denoting by $\overline{L}$ the total labor supply in the economy, in the absence of wage regulation, the market clearing condition is simply[25]:

$$\int_{0}^{A^*} L^{I}(A, w^{E})dF(A) + \int_{A^*}^{\overline{A}} L^{F}(A, w^{E})dF(A) = L_{w^E}^{I} + L_{w^E}^{F} = \overline{L}. \tag{26}$$

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[25]In addition, note that substituting for $L_{w^E}^{F}(I)$ in the Cobb-Douglas production function, we get: $\widetilde{R}(I) = \alpha I^{\alpha}\left[I\left(\frac{1-\alpha}{w^E}\right)^{\frac{1}{\alpha}}\right]^{1-\alpha} = RI$,where $R = \alpha\left(\frac{1-\alpha}{w^E}\right)^{\frac{1-\alpha}{\alpha}}$, so that the introduction of this production function is fully compatible with our previous framework. This follows of course from the functional form used. Although it is not necessary to derive the following results, it makes the model more tractable.

Several studies document the existence of a labor market segmentation, with informal employees earning lower wages than their formal sector counterparts[26]. The causes of such a segmentation might be found in labor market rigidities, as for example high firing costs and constraining minimum wage legislations.

To formalize this idea in a simple way, we assume that there exists a mandatory minimum wage $\underline{w}$, which is strictly greater than the market clearing wage w^E. More broadly, this higher cost of labor can be related to other factors, such as high payroll taxes and dismissal costs (see Freije, 2001, and Heckman and Pages, 2003). By definition, as in Rauch (1991), this minimum wage is only enforced in the formal sector.

When the formal sector wage is set at $\underline{w} > w^E$, the market clearing condition becomes:

$$\int_0^{A^*} L^I(A, w^I) dF(A) + \int_{A^*}^{\overline{A}} L^F(A, \underline{w}) dF(A) = L_{w^I}^I + L_{\underline{w}}^F = \overline{L}. \qquad (27)$$

Firms again determine their demand of labor in order to maximize the return of their projects. In the formal sector, they now face a higher wage $\underline{w}$ and choose:

$$L_{\underline{w}}^F(I) = \left(\frac{1-\alpha}{\underline{w}}\right)^{\frac{1}{\alpha}} I. \qquad (28)$$

As $\underline{w}$ grows, firms demand less labor relative to their initial level of capital. In turn this reduces the return from their projects, as $R^F = \alpha \left(\frac{1-\alpha}{\underline{w}}\right)^{\frac{1-\alpha}{\alpha}}$. This also has an impact on the informal sector: as $L_{\underline{w}}^F$ decreases, the supply of labor in this sector rises, implying a lower equilibrium wage w^I in order to clear the market, and a higher return R^I in this sector.

To sum up, a binding wage constraint in the formal sector has two complementary effects. First it shifts the allocation of labor in the economy, with less employment available in the formal sector (technologies become more capital intensive) and more informal employees at a lower wage in the

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[26]There is however a debate about the validity of this segmentation hypothesis (see Freije, 2001, for a summary). A more complete picture should take into account differences between informal employees and self-employed, as well as mobility between the formal and the informal sector.

informal fringe. Moreover, as it also affects the returns in both sector (negatively in the formal sector, positively in the informal one), the cutoff level A^* above which formality dominates actually goes up, which reinforces the first effect by further reducing formal employment opportunities (see Figure 2). This result is summarized in proposition 2:

Proposition 2 *Labor market rigidities, in the form of a minimum wage requirement above the market clearing level, push firms to remain informal at higher level of initial capital and reduce employment in the formal sector.*

(Figure 2 here)

5   Conclusion

At the firm level, costs of being formal include significant fixed expenses in terms of registration fees. As for benefits, they are generally considered as resulting from enhanced access to public goods. We have argued that key public goods, such as property rights protection and contract enforcement, are important not only because they improve firms' productivity directly, but because they secure access to important markets, where they make interactions more efficient.

The model, in which costly registration facilitates the access to the formal credit market, provides theoretical predictions about the effect of several variables (initial assets, efficiency of credit markets, rule of law, volatility of the environment, taxes, labor regulation) on the incidence of informality, which are consistent with the existing stylized facts.

From a policy point of view, this suggests that one important channel through which better rule of law and judicial enforcement may reduce informality is by making market interactions more efficient, therefore rendering the participation in formal credit markets more attractive. Moreover, by reducing the need for agents to rely on informal credit mechanisms, it may have important welfare consequences, since one major drawback of informal lending is the generalized lack of project screening that probably leads to a lower average social value of the projects being financed. Finally, our

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framework also points out to the potential benefits of micro-credit programs that make better credit mechanisms available to small entrepreneurs, while in some sense bypassing some of the costs of formality.

As for potential lines of research, from an empirical viewpoint, it would be interesting to develop more precise measures of the relative efficiency of formal and informal credit markets in and across countries. From a theoretical point of view, an open question is to examine how formal and informal lenders' incentives to acquire information on loan applicants may differ, and how these select different types of credit mechanisms. Finally, in a dynamic perspective, two questions emerge. The first one is to assess the impact of a dual credit market structure and of the costs of entry into formality on industries' dynamics. The second is to determine how the factors considered here would shape the growth potential of an economy.

6 Appendix: List of Variables and Sources

WBES data.

Informal: Dummy variable taking value 1 if percentage of sales declared to tax authorities is between 0 and 25%, and 0 otherwise.

Informal finance: Dummy variable taking value 1 if a firm declares not having received financing from any of the following source: local commercial bank, development bank, foreign bank, leasing, equity issuing, and public sector, and 0 otherwise.

Small/Medium/Large: Dummy variables corresponding to firms with 5-50, 51-500, and more than 500 employees respectively.

Private: Dummy variable taking value 1 if full private ownership, 0 otherwise.

Agriculture/construction/Manufacture/Service: Sectors dummies.

Other data.

LnpcGDP 99: Log of the 1999 per capita GDP in current US dollars. Source: World Development Indicators.

Cost of entry/number of procedures: Cost, as a share of 1999 per capita GDP, and number of procedures involved in carrying out the steps a start-up entrepreneur has to comply with in order to obtain a legal status. Coverage: 85 countries. Source: Djankov et al. (2002).

Growth volatility: variance of the annual GDP growth rate over the period 1990-99. Source: Global Development Finance and World Development Indicators.

Rule of law: Synthetic Index, scaled from 0 (better rule of law) to 10 (worst rule of law). Source: Kaufmann et al. (1999).

Labor regulation: 1997 index on the regulation of labor describing the legal protection of workers. The specific index used in the estimations relates to social security laws. Coverage: 85 countries. Source: Botero et al. (2003)

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Table 1: Bivariate probit estimates

	(1)	(2)	(3)	(4)	(5)	(6)
Informal						
Small	0.23^b (2.18)	0.17^c (1.78)	0.16^c (1.91)	0.21^c (1.86)	0.13 (1.26)	0.13 (1.34)
Medium	0.07 (0.99)	0.03 (0.35)	0.02 (0.32)	0.05 (0.74)	0.01 (0.09)	0.005 (0.07)
Ln GDP 99	0.12 (2.68)	0.16^a (2.91)	0.27^a (3.24)	0.11^b (2.49)	0.20^c (1.77)	0.19^c (1.73)
Cost	0.09 (1.01)	0.19^c (1.84)	0.19^c (1.87)			
Number of procedures				0.01 (0.52)	0.01 (0.44)	0.01 (0.42)
Rule of law		0.08 (1.16)	0.08 (1.23)		0.03 (0.35)	0.03 (0.34)
Growth volatiliy		0.003^a (3.85)	0.003^a (3.99)		0.003^a (3.65)	0.003^a (3.78)
Social sec. laws			0.05 (0.25)			0.03 (0.13)
Informal financing						
Small	0.67^a (6.60)	0.68^a (7.32)	0.63^a (6.35)	0.70^a (6.99)	0.64^a (6.25)	0.60^a (5.62)
Medium	0.29^a (4.67)	0.24^a (3.56)	0.20^a (2.66)	0.27^a (3.95)	0.20^a (2.78)	0.17^b (2.25)
Ln GDP 99	-0.001 (-0.01)	0.37^a (3.20)	0.23^b (2.14)	0.06 (0.85)	0.27^a (2.99)	0.15 (1.53)
Cost	-0.05 (-0.42)	0.16 (1.07)	0.18 (1.63)			
Number of procedures				0.06^a (3.85)	0.04^b (2.28)	0.03 (1.57)
Rule of law		-0.27^a (4.12)	0.23^a (3.54)		0.18^a (2.61)	0.16^b (2.26)
Growth volatiliy		0.004^a (2.64)	0.004^a (3.70)		0.004^a (2.79)	0.003^a (3.82)
Social sec. laws			0.48^a (2.77)			0.42^b (2.42)
N	6564	6564	6564	6564	6564	6564
Log likelihood	-6066.13	-5771.33	-5669.74	-5950.98	-5759.75	-5685.81
Wald test of $\rho=0$: p-value	0.02	0.08	0.13	0.01	0.08	0.11
Marginal Effects (dy/dx)*						
y = Pr(inf.=1; inf. finan.=1)*	0.037	0.032	0.031	0.036	0.032	0.032
Small	0.042^a (2.80)	0.035^a (3.02)	0.032^a (3.04)	0.041^a (2.60)	0.03^b (2.49)	0.029^b (2.53)
Medium	0.015^b (2.40)	0.010^c (1.73)	0.008 (1.48)	0.013^b (2.01)	0.007 (1.29)	0.006 (1.12)
Ln GDP 99	0.008^c (1.79)	0.028^a (4.06)	0.02^a (3.45)	0.009^b (2.23)	0.020^b (2.49)	0.015^c (1.93)
Cost	0.004 (0.44)	0.016 (1.61)	0.016^b (2.02)			
Number of procedures				0.003^c (1.90)	0.002 (1.06)	0.002 (0.82)
Rule of law		0.014^a (2.96)	0.012^a (2.60)		0.008 (1.18)	0.007 (1.10)
Growth volatiliy		0.0003^a (3.51)	0.0003^a (4.05)		0.0003^a (3.66)	0.0003^a (4.10)
Social sec. laws			0.019 (1.40)			0.016 (1.18)

* For dummy variables, dy/dx is for discrete change from 0 to 1. For continuous variables, it corresponds to an increase by 1 unit.
y = Pr(inf.=1; inf. finan.=1) is the bivariate predicted probability at the sample means of the explanatory variables.
Dependent Variables are *Informal*: Dummy Variable indicating whether the Percentage of Sales Declared to Tax Authorities is below 25% (1) or above (0); *Informal financing*: Dummy variable taking value 1 if a firm declares having received investment finance from no formal credit source, and 0 otherwise. Additional firm-level controls not shown in table include dummy variable for full private ownership and sector dummies (agriculture, construction, services, manufacture). Robust z statistics, corrected for clustering at the country level, in parenthesis.
a: significant at the 1% level. b: significant at the 5% level. c: significant at the 10% level.

U_b

Forced
Informality

Voluntary
Informality

Formality

$U_b{}^I$

$U_b{}^F$

$(p_HR\Phi-1)K$

C

A^*

A