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Informality and corruption

Ajit Mishra and Ranjan Ray

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INFORMALITY AND CORRUPTION

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Abstract

The paper considers several determinants of the size of the informal sector and explores the implications of corruption. It focuses attention on an issue that has not received much attention before, namely, the link between informality and corruption. We show that corruption affects both the size and composition of the informal sector in a significant manner. While small firms locate in the informal sector to avoid the fixed costs associated with the formal sector, we find that even larger firms might prefer informality because of their superior access to corruption. The paper shows that there is a U shaped relationship between a firm's share of its sales in the informal sector and the scale of its operations. We also show that imperfections in the credit market and wealth inequality are likely to be associated with a larger informal sector. We use a large cross-country firm level survey data to provide supporting evidence. The results of our exercise have considerable policy implications that extend beyond the micro level framework of this study to the wider macro economy.

Key words: Informal Sector; Shadow economy; Corruption; Inequality

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1 Introduction

The informal sector, which has also been referred to as the “shadow or underground economy” [Schneider and Enste (2000)], and “unofficial activity” [Friedman, et al. (2000)], plays a significant role in developing economies. The precise definition of the informal sector varies considerably but it generally refers to economic activity that is neither taxed nor monitored by a government.¹ While by the very nature of the concept of informality any measure of the informal sector is likely to be tentative, the available evidence suggests that the size of the informal sector is quite significant. Consequently, there have been several interesting attempts to explain the existence and size of the informal sector.²

Our main objective is to analyse the role and implication of corruption in this context. Consider a small roadside garage owner reviewing its decision to stay informal.³ It loses out benefits like insurance and government work, various credit and benefit schemes designed to help small firms. On the other hand, it is subject to various inspections and threats of closure for engaging in different illegal activities. But in the presence of corruption both benefits and costs are diluted. The firm in question is able to avoid penalties or closure by bribing inspectors and it is also able to get some formal sector work using its corruption network. Clearly, corruption is an important determinant of the costs and benefits of informality and greater corruption is likely to be associated with a larger informal sector. More importantly, corruption affects not just the size but also the composition of the informal sector.

Firm's choice to be in the informal sector (or to keep part of its business in the informal sector) has been studied under different approaches. Operation in the formal sector entails certain fixed costs like costs of obtaining license (including extortion payments to license issuing bureaucrats), taxes of several kinds and other costs of meeting various regulatory standards. In addition to these fixed costs, other factors like complexity of the tax system and high degrees of regulatory burden are also cited as barriers to entry to the formal sector.⁴ This view, often termed as the exclusion view [Perry et al. (2007)], highlights the role of reduction in bureaucratic costs and tax simplifications as a way of reducing informality.⁵ Depending on the nature and size of the fixed costs, one would expect small (often poor) firms to benefit from being in the informal sector.

Informality can also be treated as an enforcement problem not very different from the classical tax evasion problem [Rauch 1991, Dabla-Norris et al. 2008]. A firm's choice boils down to evaluating the various costs and benefits associated with informality. By choosing to be in the informal sector a firm forgoes the benefits of formality but avoids the costs mentioned earlier, but it runs the risk of apprehension and penalties. If small firms are more likely to avoid detection, then the informal sector is likely to comprise of small firms.

¹ In many definitions the shadowy nature of this sector is not raised at all (see for example the Report on Definitional and Statistical Issues relating Informal Economy (Government of India). In our paper, the focus is more on the illegal shadowy side of the informal sector. This is partly because the actual data used in the paper identifies informality with ‘percentage of undeclared sales’.

² See Straub (2005), Dabla-Norris et al. (2008), Johnson et al. (2000), Friedman et al. (2000), and Perry et al. (2007) among others. See Gerxhani (2004) for a survey of the literature.

³ It is based on unstructured interviews with some unregistered garage and restaurant owners in Pune, India.

⁴ Various authors have emphasized different aspects of these costs. See Loyaza (1996), Johnson et al. (2000), Friedman et al. (2000).

⁵ The evidence on this is quite mixed. While Bruhn (2010) finds that such reforms had negligible impact in Mexico, Fajnzylber et al. (2011) note a significant rise in registration under the SIMPLES program in Brazil. Russo (2010) finds start-up costs to be a significant entry barrier to formality.

However, as mentioned earlier, the costs and benefits of informality will change drastically in the presence of corruption. Firms that can bribe better are more likely to find informality less costly. This is where the nature and the exact form of corruption assume importance. As is well known, corruption can take different forms; the two dominant forms being extortion and collusion. Cases of government officials extorting bribes for licenses and permits have featured prominently.⁶ To the extent these payments are non-discriminatory they act as taxes on all firms. Collusion, on the other hand, depends on the joint profitability of the bribing firm and corrupt officials and raises the possibility that wealthier firms are more likely to succeed in bribery and find corruption more beneficial. This aspect of corruption creates an interesting trade off, which is explored in the present paper. Suppose potential firms have different wealth or assets to start with and credit imperfections imply that firm size is determined by available wealth. Then following the arguments in the previous two paragraphs we are likely to see small wealth constrained firms in the informal sector because of all the fixed costs. For firms with greater initial wealth, the benefits of formality will outweigh the costs. However, greater initial wealth also implies ability to bribe and greater corruption benefits. If these corruption benefits dominate, wealthier firms will also find informality more profitable. In fact we show the existence of a U shaped relation between informality and firm size when corruption benefits are strong. This has serious implications for designing policies to reduce informality as there is a need to go beyond simply targeting small and poor entrepreneurs. If a sizeable number of firms prefer informality due to corruption benefits, policy reforms aimed at reducing cost of doing business or reducing entry costs to the formal sector will not have the desired effect.⁷

The link between corruption and informality has been noted earlier in several empirical exercises.⁸ In a recent empirical study Dreher and Schneider (2010) have found a positive relation between corruption and the shadow economy in the case of low income countries. Our model predicts a similar positive relationship between corruption and informality and we also offer evidence to support this link. The detailed mechanism and implications of this link in the present context are strikingly different and new.⁹ Our paper is also related to previous work by Choi and Thum (2005). They consider both forms of corruption but it is only extortion which plays a strategic role in their model. Firms entering the formal sector are subject to extortion demands and this is limited by the firm's option of locating in the informal sector. Hence corruption leads to some sort of complementarity between the formal and the informal sector. Our model differs in a number of ways. We consider uniform extortion but focus on the collusion aspect in an imperfect credit market environment. More importantly, unlike the positive relationship that our model predicts, corruption and informality are likely to be negatively related in their model.¹⁰

Moreover, corruption can be affected by the size of the informal sector in the sense that a large informal sector has the potential to reduce the tax revenue and dilute the anti-corruption efforts making bribery more attractive. From a policy viewpoint, this is an important issue to investigate since if, the interaction between the two is mutual, positive and significant, with informality and corruption feeding off one another, an integrated strategy in dealing with both is

⁶ See Mishra (2005) for a comprehensive survey and for some of the important contributions in the corruption literature.

⁷ Note that our analysis does not apply to *all* large firms since operation in the informal sector is not a serious option for very large firms because of their visibility, reliance on formal contracting etc.

⁸ See Johnson et al. (1998), Friedman et al. (2000), and Dreher and Schneider (2010).

⁹ The possibility of firms enjoying informality at the two ends of size or wealth distribution has recently been noticed by McKenzie and Sakho (2010). Our paper is consistent with this evidence and offers an alternative explanation.

¹⁰ Recently we came across Samuel and Alger (2011) which models corruption and informality but in an entirely different context (foreign aid).

likely to be more effective. We discuss how our basic model can be extended to incorporate this aspect.

The interplay between fixed costs of being in the formal sector and wealth dependent corruption benefits also implies that the size of the informal sector is related to the distribution of income or initial wealth. We show that greater inequality will be associated with a larger informal sector and this association is quite evident in the cross-country regressions. The issue of increasing inequality leading to a bigger informal sector is related to earlier contributions by Rosser et al. (2000), Chong and Gradstein (2007). But our analytical framework and the data sets are quite different. The existing explanations rely on the argument that inequality can affect informality by increasing the number of wealth constrained entrepreneurs who are likely to be in the informal sector, especially with lack of access to formal credit. In our model, inequality affects informality even when the number of wealth constrained entrepreneurs stays same but the number of richer entrepreneurs preferring informality is higher.

The rest of this paper is organized as follows. Section 2 presents a simple model that is used to study the link between corruption and informality. We discuss the conditions which lead to informality at the two opposite ends of the wealth distribution and consequently a U-shaped relation between informality (percentage of undeclared sales) and firm size (size of customer base). In Section 3 the basic model is extended in several directions. We show that inequality and informality are positively related and this result is robust to alternative specifications in our empirical analysis. Our analysis is suggestive of a positive relation between informality and the degree of imperfection in the credit market [Straub (2005)], though it is likely to be weaker in the presence of strong corruption benefits. The possibility of feedback from informality to corruption can be used to show why lower taxes need not necessarily be associated with a larger formal sector. Section 4 discusses the data and reports the empirical evidence. We use the World Business Enterprise Survey (WBES) data from the two main rounds to gather information about the extent of informal sales by a firm. Section 5 concludes.

2 A Simple Model

Consider a set of potential entrepreneurs (also referred to as firms) differing in asset (income) A , distributed according to $G(A)$, $\underline{A} \leq A \leq \bar{A}$.¹¹ Production can take place either in the formal sector (F) or in the informal sector (I). A potential entrepreneur can get a fixed payoff by not undertaking production at all. Should it choose to produce, it makes an investment K and produces output $R_j K$, $j=F, I$; $K \leq A$, $R_F \geq R_I$.¹² Operation in the formal sector involves fixed non-production cost C which has several components including the costs of obtaining various licenses and permits to undertake production, costs of compliance with government stipulated rules and regulations. It could also include bribe payments (extortion) that the entrepreneur might have to make to obtain the permits and licenses. Formal sector profits are taxed at a constant rate t . However, by locating in the informal sector an entrepreneur avoids incurring these costs C and payment of taxes. But entrepreneurs in the informal sector always run the risk of being apprehended by an inspector and losing their entire profit.

¹¹The corresponding density is denoted by $g(A)$, the upper bound on A allows us to consider simple constant returns technology. $G(A)$ satisfies the usual properties, $G(\bar{A}) = 1$, $G' \geq 0$.

¹² R refers to the productivity parameter. In the absence of any credit market, if a firm chooses to produce then $K = A$ for any $R > 0$. We introduce credit market and further restrictions on R later in Section 3.

2.1 Informality

Each firm is inspected with probability ϑ by an inspector. An honest officer would report the non-compliant firm. Assuming risk neutrality, payoffs (expected payoffs) in the formal (V_F) and informal (V_I) sectors can be easily derived.

$$\begin{aligned} V_F(A) &= R_F(A - C)(1 - t) \\ V_I(A) &= (1 - \theta)R_I A \end{aligned} \quad (1)$$

Since $V_I(C) > 0$ for $\theta < 1$, there will always be firms in the informal sector. Note that entrepreneurs with $A \leq C$ will never be in the formal sector, the question is why some entrepreneurs who are *able* to join the formal sector ($A > C$) prefer to stay out. We shall assume that $(1 - t)R_F > (1 - \vartheta)R_I$. It can be shown that entrepreneurs with $A \geq A^*$ will choose to be in the formal sector where A^* is given by

$$A^* = \frac{R_F(1 - t)C}{(1 - t)R_F - (1 - \theta)R_I} > C \quad (2)$$

The above expression captures the well-known exclusion and enforcement approaches to the determinants of the informal sector. Factors like regulatory burden, license fees, extortion payments, other lump sum taxes determine the size of the informal sector by affecting C . Higher taxes raise A^* and consequently leads to a smaller formal sector. Similarly, better enforcement efforts would lead to a higher θ and consequently smaller informal sector.¹³

Let V_0 be the payoff to an entrepreneur who chooses not to undertake production. We shall assume that V_0 is independent of A and there exists A_0 such that $V_I(A_0) = V_0$. Hence all entrepreneurs with $A_0 \leq A < A^*$ will choose to be in the informal sector.

2.2 Corruption and the Informal Sector

Suppose inspectors are corruptible and can be bribed by the firms to hide non-compliance. This obviously dilutes the enforcement efforts and increases the profitability of the informal sector. However, access to corruption is likely to differ across entrepreneurs and we explore the implications of this unequal corruption benefits in the following paragraphs.

2.2.1 The Institutional Setting

The regulator employs some risk-neutral inspectors to inspect the firms and each inspector receives a fixed wage W . We assume that each inspector inspects only one firm and can detect whether the firm has complied or not. The inspector can (truthfully) report non-compliance by the informal sector entrepreneur or suppress this information in exchange for a bribe.¹⁴ Bribery gets exposed with some probability δ and following exposure the corrupt inspector is fired and loses its wage income.¹⁵

2.2.2 Bribery

As is evident from the corruption literature, the exact amount of bribe will depend on several factors including the distribution of bargaining powers between inspector and the entrepreneur,

¹³ See Perry et al.(2007). Here θ can be interpreted as 'the rule of law' which is highlighted as a key determinant (i.e. Dabla-Norris et al. (2008)). The informality-taxes link is not so straightforward; a large informal sector can co-exist with lower taxes. We discuss this issue later in Section 3.

¹⁴ To keep things simple we do not consider the possibility of extortion where the inspector could extort from the formal sector firms by threatening to report.

¹⁵ It can be generalized to a case where the inspector gets an additional reward while reporting truthfully and incurs an additional cost/fine in addition to losing wage income when caught having taken a bribe. See Besley and McLaren (1993), Mookherjee and Png (1995), Mishra (2005) for various anti-corruption regimes and mechanisms.

the disagreement payoffs and the total benefit from collusion. We assume that bribe is determined using the Generalized Nash Bargaining Solution, inspector's bargaining power being α , $0 < \alpha < 1$. Agreement implies that the firm is not reported and the inspector receives a bribe B . Failure to agree leads to the firm being reported for non-compliance and forfeiting all its profit ($R_i A$). Collusion is feasible if the joint surplus from agreement is greater than the sum of disagreement payoffs. This implies that bribery will take place when

$$R_i A \geq \delta W, \text{ or } A \geq A^c \text{ where } A^c = \delta W / R_i \quad (3)$$

This implies that the smaller and less wealthy entrepreneurs will not be able to bribe their way out.¹⁶

2.2.3 Corruption and Scale Benefits

Given risk neutrality and the assumption of Nash Bargaining Solution, bribe B will be given by

$$B(A) = \alpha R_i A + (1 - \alpha) \delta W \quad (4)$$

Now, the expected payoff in the informal sector can be shown to be

$$V_i(A) = \begin{cases} (1 - \theta) R_i A + \theta((1 - \alpha)(R_i A - \delta W)) & \forall A > A^c \\ (1 - \theta) R_i A & \forall A \leq A^c \end{cases} \quad (5)$$

Like before, an entrepreneur with $V_i > V_f$, $V_i \geq V_0$ will choose to be in the informal sector, where V_i and V_f are given by (5) and (1). Figure 1 below plots V_f and V_i . The slope of V_i changes at $A = A^c$, reflecting the fact that corruption increases the attractiveness of the informal sector beyond this point. If corruption benefits are strong leading to a steeper V_i , then as shown in Figure 1 there will be two intersection points A_1 and A_2 with $V_i(\bar{A}) > V_f(\bar{A})$. However, even with a steeper V_i (for $A \geq A^c$), it is not always the case that V_i intersects V_f from below (as shown by the dotted line). The following two conditions regarding the slope of the V_i and the location of A^c will determine the size and the composition of the informal sector.

D1: The formal sector has low productivity advantage over the informal sector if

$$R_i \leq R_f \leq R_i \frac{1 - \theta \alpha}{1 - t}. \text{ This will be the case when formal sector productivity is not very high and}$$

the firm's bargaining power ($1 - \alpha$) is not small.¹⁷ Note that this productivity difference is likely to be sector specific and in our model it is independent of the firm.

D2: Anti-corruption regime is moderate if $A^c > A^$ where A^c and A^* are given by (3) and (2) respectively. This condition implies that the marginal entrepreneur indifferent between the two sectors is not going to benefit from corruption because collusion is not feasible. Entrepreneurs who are in the formal sector in the absence of corruption are the likely beneficiaries of corruption should they choose to be in the informal sector. The condition is going to be satisfied if bribery is likely to be discovered with a higher probability (δ) and the efficiency wage of the inspector (W) is high. The complementary case $A^c \leq A^*$ will be realized when anti-corruption*

¹⁶ Note that probability of agreement is zero for $A < A^c$ and one otherwise. An earlier version considered heterogeneous inspectors (with private moral cost) where probability of agreement increases with A in a continuous fashion. The qualitative results remain the same. The feature that wealthier entrepreneurs have better access to corruption has implications in more general contexts. See Glaeser et al. (2003) for an example where the rich uses its wealth to subvert the judicial system and appropriate benefits. In addition to access, the bribe amounts also differ- we recognize this but we are unable to verify it in our dataset.

¹⁷ Note that for $\alpha = 1$, the inspector has all the bargaining power and the presence of corruption does not make any difference to the incentives of the firms. We have taken α to be a constant but one can argue that wealthier entrepreneurs are likely to have higher bargaining powers which will reinforce the point that corruption benefits are higher for the wealthy.

regime is weak. We can also consider a third case, strong anti-corruption regime with $A^c \geq \bar{A}$, but corruption does not make a difference in this case.

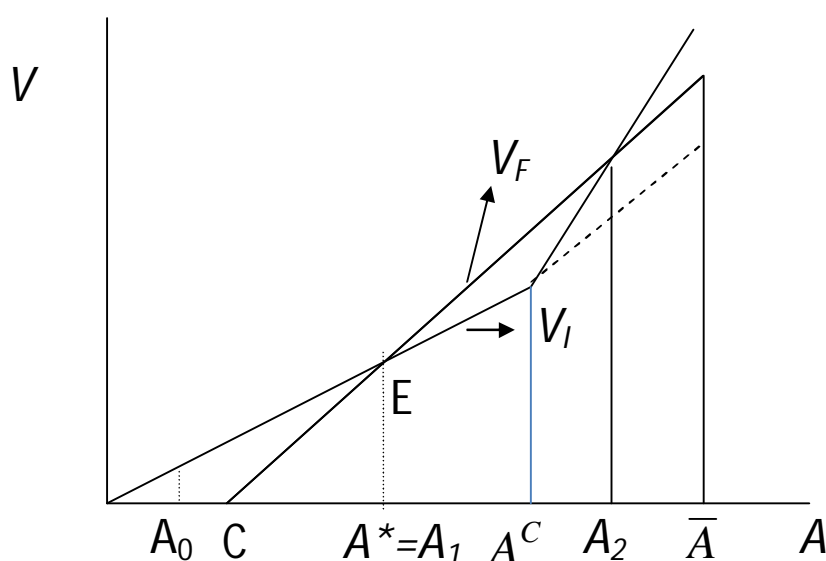


Figure 1

Figure 1 depicts the case where both conditions D1 and D2 are satisfied. Denoting the formal and informal sectors as F and I respectively, it is clear that the informal sector (I) will have two segments (as given in (6)).

$$I = \int_{A_0}^{A_1} g(A)dA + \int_{A_2}^{\bar{A}} g(A)dA, \quad F = \int_{A_1}^{A_2} g(A)dA, \quad (6)$$

Entrepreneurs with $A_0 \leq A < A_1$ and $A_2 < A \leq \bar{A}$ will choose to be in the informal sector where A_1 and A_2 are given by the following.

$$A_1 = A^* \quad C < A^* \leq A^c, \quad (7)$$

$$A_2 = A^* + \frac{(1-\alpha)\theta R_I}{(1-\theta\alpha)R_I - R_f(1-t)}(A^c - A^*)$$

$$V'(A_0) = V_0 \text{ and } A_2 \leq \bar{A}.$$

These two segments correspond to the following two effects.

(1) Scale benefits (presence of C) imply that V_I is likely to be higher at lower values of A and V_F will dominate for higher values of A . This aspect is present in most explanations of the informal sector and these benefits are captured by the relative position of A^* .¹⁸

(2) Corruption benefits imply that the informal sector becomes more attractive at higher values of A because of the ease of bribery. The extent of corruption benefits depend on the strength of the anti-corruption regime (D2) and the magnitude of the productivity differential (slope of V_I or D1).

¹⁸ There is an additional source of scale effects if we assume that the probability of detection θ depends on size. For example De Paula and Scheinkman (2011) assume that $\theta = 1$ for large firms and $\theta = 0$ for smaller firms.

Depending on these two conditions, four different possible cases obtain and these are summarized in Table 1. As mentioned earlier, equations (6)-(7) and Figure 1 refer to case II in the table. The details regarding other cases are given in the Appendix.

Table 1 (Impact of corruption on the size of I/F), $\gamma = (1-\theta\alpha)/(1-t)$

	$R_F < R_I\gamma$ Productivity difference low	$R_F \geq R_I\gamma$ Productivity difference high
$A^* > A^C$ (Weak Anti-corruption regime)	Formal sector F vanishes with corruption (I)	I is higher with corruption (III)
$A^* \leq A^C$ (Moderate anti-corruption regime)	I is higher and it contains both poor and rich (A) firms (II)	I stays the same with corruption (IV)

It is clear that the informal sector is larger in the presence of corruption except when the productive advantage of the formal sector is substantial and anti-corruption regime is moderate (case IV). This is shown in the Figure with A^C to the right of A^* and the V_I is given by the dotted line. In this case, the scope of corruption exists but it does not make a difference to the firms in the informal sector. The firms who would find it profitable to engage in corruption do not have to do so because they are in the formal sector. At the other extreme, when A^C is to the left of A^* and productivity difference is low, V_I stays above V_F for the whole range and we have no formal sector.

It is also easy to see how the formal sector is affected by the changes to non-production cost C , enforcement effort ϑ and anti-corruption efforts δW . A rise in C (interpreted as regulatory burden), for example, shifts V_F to the right (without any change in V_I) resulting in a smaller formal sector. A rise in ϑ (interpreted as rule of law) shifts V_I to the right (depending on other variables like α and δW) and leads to a rise in the formal sector. Increases in anti-corruption drive (δW) shifts the V_I (beyond A^C) to the right and leads to a bigger formal sector. We summarize these in the following proposition, leaving the algebraic verifications to the Appendix.

Proposition 1:

- (i) *The informal sector is always bigger in the presence of corruption, except when anti-corruption efforts are moderate and the formal sector productive advantage is very large. The formal sector is increasing in δW and ϑ , and decreasing in C and taxes.*
- (ii) *When control of corruption is moderate and formal sector productive advantage is low, entrepreneurs with low as well as high levels of A are likely to prefer informality, leaving entrepreneurs with medium levels of A in the formal sector.*

Interpretations

Whether the informal sector has multiple segments or not (as defined by the various cases in Table 1) is an empirical issue. Given the assumptions of our model, a firm with a higher A will also choose to have a higher K . Hence higher values of A can somewhat be identified with larger firms. Since informality is being captured by the extent of undeclared sales, this implies that small and large firms would tend to hide more compared to medium sized firms.

Corollary 1: Small and large sized firms have a higher proportion of undeclared sales compared to medium sized firms.

There is some evidence to support this U shaped relationship. Using the number of customers served in the previous year as a proxy for customer base the following plot between informal sales and customer base does indeed reveal a distinct U shape. Our regression results (see Section 4, Section 4.4 & Table 5) also lend support to this U shaped relationship between informal sales and customer base.

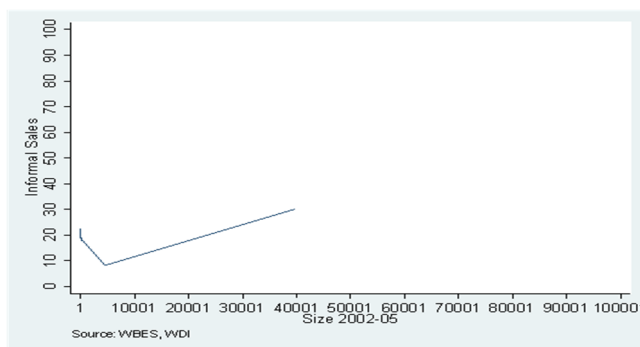


Figure 2: Informal Sales and Size (Customer Base)

Interestingly, a similar non-linearity has been observed by McKenzie and Sakho (2010) in their study of the Bolivian firms. Using survey data they estimate the impact of formality (registering for tax purpose) on firm profits. They find that tax registration increases profitability of medium sized firms but it has no effect on the profitability of small and large firms. It can be argued that registration involves some cost (fixed as well as variable) but the main benefit of registration is the ability to increase the customer base. For small firms with limited capacity the increase in potential customer base does not add to profits and for large firms with already large customer base the potential for further rise is small. Hence only the medium sized firms profit from formalization.

3 Extensions and Discussions

3.1 Inequality

How does the distribution of A affect the size of the informal sector? While some empirical studies have noted a negative link between inequality and the size of informal sector, the mechanism through which asset or income distribution affects informality is far from clear.¹⁹ In our model context, inequality matters to the extent it affects the number of wealth constrained entrepreneurs and the number of rich entrepreneurs with easy access to corruption. Since we want to highlight this issue, we shall focus on case II.

Unequal distribution of A implies that some potential entrepreneurs are likely to join the informal sector because of their inability to raise sufficient capital. This is a simple implication of the scale effects we discussed earlier and the absence of any credit market.²⁰ Using Figure 1 we can get an idea of how changes in inequality will affect the size of the informal sector. Following a redistribution of assets/income, the informal sector is likely to be higher if there are more

¹⁹ See Rosser et.al. (2000), and Chong and Gradstein (2007). Similarly, the level of perceived corruption in an economy has also been shown to be negatively related to income inequality. A more unequal society can lead to more corruption by inducing entry of inefficient but corruption-prone firms (Dutta and Mishra (2011)).

²⁰ As we shall argue in the next section, existence of an imperfect credit market where ability to raise capital depends on existing wealth leads to similar results. It must be noted that Straub (2005) also leads to similar conclusions regarding the effect of inequality.

entrepreneurs at the lower end of the distribution.²¹ However, we have entrepreneurs who are not wealth constrained but still prefer to be in the informal sector because of their ability to bribe and engage in corruption. Hence, redistribution affects informality if there are more entrepreneurs at the other (higher) end of the distribution. The size of the informal sector goes up if there are more entrepreneurs with assets in excess of A_2 .

Definition D3: Consider two distributions G and G' with the same support $[\underline{A}, \bar{A}]$. Distribution G' is considered more unequal if it is derived from G through mean preserving spreads of either or both of the following kinds.

- 1) Consider distribution G and two individuals i & j with $A_i < A_j < A_1 + \delta$, $A_i < A_j$, $\delta < (A_1 - A_0)$. In G' , assets of i & j are given by $A'_i = A_i - \delta$ and $A'_j = A_j + \delta$
- 2) Consider two individuals with $A_2 - \delta < A_j < A_2$, $A_i < A_j$. In G' , assets of i & j are given by $A'_i = A_i - \delta$ and $A'_j = A_j + \delta$

Hence inequality goes up if the ensuing distribution has thicker tails in the sense defined above. Recall that the informal sector comprises up the two tails of the distribution. Our definition of mean preserving spread essentially implies that income/asset is transferred from a poor to a rich in such a way that either the poor enters the tail (lower) or the rich enter the tail (upper). Using the previous arguments and definitions, we have the following proposition.

Proposition 2: Consider two distributions $G(A)$ and $G'(A)$ such that G' is more unequal than G in the sense of D3. The informal sector under G' is larger.

We do find support for the existence of a robust and positive relation between informality (percentage of informal sales) and inequality (GINI coefficient). The plot below indicates a clear positive relation, which is confirmed in the various regressions we report in section 4.

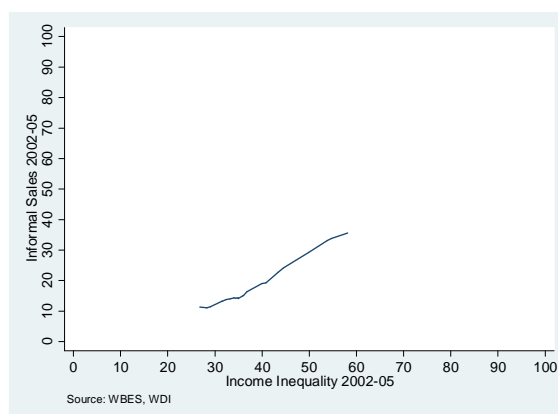


Figure 3: Lowess Plot of Informal Sales to Income Inequality, country average, 2002-2005.

3.2 Credit market

The simple model outlined in Section 2 does not capture the fact that entrepreneurs can use the credit market to choose a suitable level of K . Consider a case where formal sector firms can borrow but informal sector firms do not have access to any form of credit.²² However, credit

²¹ However, informal sector is likely to be unchanged if for distributions G and G' , $G'(A_0) > G(A_0)$ but G' and G coincide over the interval $[A_0, A_1]$. Clearly inequality has increased, but in such a case, inequality will have no effect on informality.

²² This can be extended to a situation where informal sector firm also gets credit but at a higher cost. We allowed for equal access in an earlier version. Although, we do not find strong empirical justification for differentiated and unequal access, equal access is more likely to make informality attractive.

market imperfections imply that credit contracts are not enforced perfectly.²³ Credit market is otherwise competitive where the gross interest rate ρ is taken as given. Suppose the entrepreneur borrows an amount L and invests K . If it defaults the bank can recover only a fraction τ of the total return RK , $0 \leq \tau < 1$. It will default if the cost of default (τRK) is lower than the repayment obligation ($L\rho$). To avoid such default, the bank will choose L (for a project of size K) such that

$$L\rho \leq \tau RK \quad (8)$$

Consider an entrepreneur in the formal sector with asset A . Note that C has to be paid from own income and only $(A-C)$ can be used to invest in the production process. To make a total investment of K , it needs to borrow $(K-A+C)$. Using (8) it is clear that the maximum investment it can undertake will be given by

$$K^F(A) = \rho(A-C)/(\rho-\tau R), \rho > 0 \quad (9)$$

Assuming $R_F > \rho$, entrepreneurs will in fact borrow and invest the maximum amount. For the informal sector entrepreneur, $K^I(A) = A$.

To focus attention on the role of credit market imperfections we shall consider a case where corruption does not affect the size of the informal sector. Consider the basic model of informality with $R_F = R_I = R$ and $t = 0$. Additionally, assume moderate anti-corruption efforts. It is clear that this corresponds to case IV in Table 1. The payoffs will now be given as

$$V_F(A) = RK^F - (K^F + C - A)\rho = \beta R(A - C), \quad \beta = \frac{\rho - \tau\rho}{\rho - \tau R} > 1 \quad (10)$$

$$V_I(A) = \begin{cases} (1-\theta)R_I A + \theta((1-\alpha)(R_I A - \delta W)) & \forall A > A^c \\ (1-\theta)R_I A & \forall A \leq A^c \end{cases} \quad (11)$$

The cut-off value A^* such that entrepreneurs with $A \geq A^*$ will be in the formal sector will now be given by

$$A^* = \frac{C\rho(1-\tau)}{\tau(R-\rho) + \theta(\rho-\tau R)} \quad (12)$$

It is easy to verify that $\frac{\partial A^*}{\partial \tau} < 0$.²⁴ We shall use τ to denote the degree of imperfection, a low value suggesting greater difficulty in raising capital. Hence the size of the informal sector is positively related to the degree of imperfections. An imperfect credit market implies difficulties in obtaining funds and since formal sector involves scale benefits, increased imperfections will lead to a smaller formal sector. It can be verified that this relationship between the informal sector and the degree of imperfections in the credit market holds for other cases I- III as well. A rise in τ shifts the V_I line to the left leading to a fall in A_1 (or A^* depending on the case) and a rise in A_2 leading to a smaller informal sector.

Proposition 3: *A reduction in the degree of credit market imperfection leads to a smaller informal sector.*

We do find support for this relationship. Using the fraction of non-performing loans (npl) as a proxy for τ , we find a positive relation between npl and informal sales.

²³ There are various ways in which credit market imperfections in the presence of wealth constraints can be modeled. The present version follows Matsuyama (2000).

²⁴ The sign of the partial derivative depends on the sign of $C\rho(R-\rho)(\vartheta-1)$. Since $R > \rho$ and $\vartheta < 1$, this term always is negative.

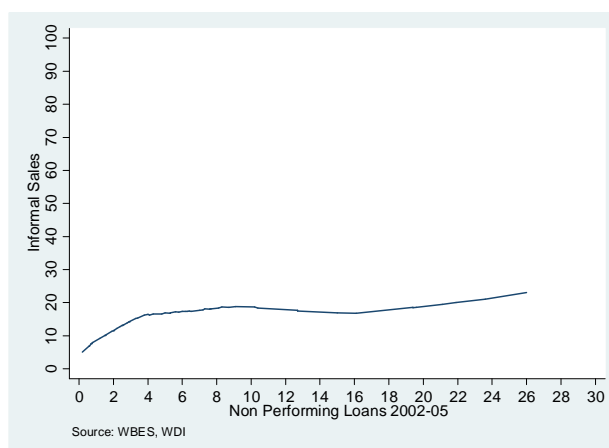


Figure 4: Lowess Plot of Informal Sales to Non-Performing Loans, country average, 2002-2005.

This result can be extended to the case where the informal sector also has access to some form of credit. However, the role of the credit market is less obvious in the case where credit needs differ across potential entrepreneurs. In our model each entrepreneur borrows to the maximum limit, but in a more realistic setting where optimal investment K is finite, there will be some entrepreneurs who will not have to borrow. If the informal sector contains entrepreneurs at both ends of the asset distribution, improvements in the credit market will have a reduced impact on the size of the informal sector. To the extent the informal sector depends on the corruption effect, it will be unaffected by credit market conditions.

3.3 Taxes and Informality

It is clear that the informal sector is likely to be smaller (in most cases) with greater anti-corruption efforts. However, raising either δ or W or both is costly. Suppose spending on corruption control depends on taxes being raised in the formal sector. In such an event, raising taxes have two opposing effects. Consider Figure 1 and the corresponding case II in Table 1. First, a fall in tax rate t will lead to a shift in V_F to the left. This will imply a larger formal sector in the absence of any corruption benefits or for the same level of corruption control. But, lower taxes imply a fall in δW leading to an upward shift of V_I for $A \geq A^C$ (the new A^C will move further to the left). This means that A_2 will fall. The net effect can be a fall in A_1 and a fall in A_2 leading to, depending on the distribution function $G(A)$, an increase in the size of the informal sector.

However, we have to be careful about these comparative static exercises. It is clear that corruption and informality complement each other and in a model where these two are jointly determined in equilibrium, we can have multiple equilibria. We shall use an example to illustrate this point. Let control of corruption (δW) be denoted by CC and the size of the formal sector by F . Then (CC^*, F^*) constitute an equilibrium if entrepreneurs' choice of informality is optimal given CC^* (and F^* is consistent with these choices) and the cost of maintaining the equilibrium level of control of corruption depends on the total taxes T raised from the formal sector, $Z(CC^*) = f(T)$. Total taxes are given by

$$T = \int_{A_1}^{A_2} tR_F (A - C)G(A)dA \quad \text{where} \quad F = \int_{A_1}^{A_2} G(A)dA \quad (13)$$

Example: Let G be a uniform distribution with the support given by $\bar{A} = 60$ & $\underline{A} = 20$, $A_0=20$, $C = 20$, $R_F=R_I = 2$, $\vartheta = .75$, $\alpha = 0$ and total number of entrepreneurs be 80. Let the tax rate $t = \frac{1}{4}$. Clearly these parameter values satisfy the conditions of case II. In addition, let the cost of corruption control be given by $Z(CC) = 171+51(CC-36)$. It is easy to verify that, for the same tax rate, there are two equilibrium outcomes in this case. In one equilibrium outcome the formal

sector is large and there is greater control of corruption: $F=60$ (75% of the entrepreneurs), $CC=40$. Using (7) it can be checked that $A^*=A_1=30$ and $A_2=60$. In this equilibrium, only the small entrepreneurs ($20 \leq A \leq 30$) are in the informal sector. Total revenue raised is consistent with the level of finance required to support the equilibrium level of corruption control. However, there is another equilibrium with $F=36$ and $CC=36$. In the latter case, both poor as well rich entrepreneurs ($20 \leq A < 30$ and $48 < A \leq 60$) are in the informal sector.

Suppose we lower the tax rate to $t=1/5$. Now consider the equilibria with the largest formal sector corresponding to each tax rate. It is easy to verify that with a lower tax rate we can not sustain $CC=40$ and the outcome with $A_2=60$. Some rich entrepreneurs have to leave the formal sector (because of lower corruption control) and this further reduces the total taxes and CC . Lower taxes induce some entrepreneurs at the lower end of the asset distribution to join the formal sector (A^* changes from 30 to 29: implying two more firms in the formal sector). But the formal sector as a whole shrinks. *This shows that lower taxes can co-exist with a smaller informal sector.*²⁵

4 Data and Empirical Analysis

4.1 Data Description

The World Bank Enterprise Surveys (WBES) which provided the data set used in this study collect information (from the firm level surveys) about a host of questions that include the business environment, how it is perceived by individual firms, how it changes over time, and about the various constraints on firm performance and growth. The WBES is a repeated cross section data set covering a range of developing and developed countries at various stages of development.²⁶ The Appendix Table A1 lists the variables from this data set that we have used in this study. The variables that are worth special mention in the present context are *informal sales* (as % age of total sales) and *bribe demand* which is a dummy that takes the value 1 if the firm has been asked to pay a bribe and 0, otherwise. While the WBES data provides information on the characteristics and attitudes of the individual firms surveyed, we supplemented this information by country level indicators obtained from a variety of sources that have been listed in the second half of Appendix Table A1. These include the macro corruption perception and corruption risk indicators, Corruption Perception Index (*CPI*) distributed by Transparency International and corruption component of International Country Risk Guide (*ICRG*) supplied by Political Risk Services, respectively.²⁷ In our empirical work, we arranged the *cpi* and *icrg* variables such that higher values denote increased corruption perception and corruption risk. It is important to note that while the variable, *bribe demand*, is a firm level characteristic that contains information on whether a firm has been asked for a bribe or not, this is distinct from the country level corruption indicators, *cpi* and *icrg*, which measure the overall climate of corruption in the country.

The estimations reported below were based on a pooling of the WBES data sets over the period, 2002-2006. The list of countries by years and showing the number of firms interviewed in each country is presented in Appendix Table A2. Starting from a total of 27,086 observations, as

²⁵ The evidence on taxes and informal sector is quite mixed. In a recent study, Dreher and Schneider (2010) find little evidence to support a positive relation between taxes and the size of the shadow economy predicted by the 'exclusion' theories of the informal sector.

²⁶ Further details are available from the World Bank website, <http://www.enterprisesurveys.org/>. See also Batra et al. (2003) for description of the data and some of its principal features. Dabla-Norris et al. (2008) use this dataset as well to study the determinants of informality.

²⁷ See the following websites on details of these perception indicators: <http://www.prsgroup.com/> and <http://www.transparency.org/>.

recorded in Appendix Table A2, we lost observations with the inclusion of the various determinants dropping down to 17606 observations which dropped further to 10,883 observations with the inclusion of additional country level characteristics.

Let us now turn to the results of estimation. The following discussion is subdivided into three subsections: Section 4.2 reports the results of single equation regression of a firm's share of sales in the informal sector. Section 4.3 extends the estimation framework by taking note of the joint endogeneity of the firm's informal sales and bribe demand to the firm. Section 4.4 explores the robustness of the relationship between the firm's exposure to the informal sector and its scale of operations by adopting an alternative definition of size, namely, the number of its customers.

4.2 The Results of Single Equation Estimation of Informal Sales

Tables 2a and 2b present the OLS and IV estimates of the regression of *informal sales* (as % age of total sales) on a variety of firm characteristics and country level indicators listed in Appendix table A1. The IV estimation is based on the treatment of the corruption perception indicator, *icrg*, for possible endogeneity. Tables 2a and 2b differ because while the former (table 2a) includes the *bribe demand* of the individual firm as a determinant of that firm's informal sales, the latter (Table 2b) excludes this variable. The tables also present the robust standard errors and the p-values showing the significance of the estimates. The estimates are mostly well determined.

Tables 2a and 2b provide strong and robust support to Proposition 1 regarding the positive association between corruption perception and informal sales. In other words, firms operating in countries that are perceived to be more corrupt report, *ceteris paribus*, a higher share of their sales as informal sales. It is worth noting that this result is robust to the instrumentation of corruption perception by freedom of press and CO₂ emissions. The positive, large and statistically significant estimate of the coefficient of the *bribe demand* variable in Table 2a suggests that a firm that has been asked to pay a bribe will increase its undeclared sales as a proportion of its total sales quite substantially.

Tables 2a and 2b also provide some support, though a limited one, to the idea of a U shaped relationship between a firm's exposure to the informal sector and its size, as measured by its number of employees. This takes the form of a negative coefficient estimate of the size variable, and a positive coefficient estimate of the (size)² variable. In each table, the estimated coefficient of the (size)² variable increases in size and significance in case of the IV estimates over the OLS estimates. The weak significance of the (size)² coefficient estimate in Tables 2a, 2b is simply a reflection of the lack of variation in 'size' in the data. As is clear from the definition of firm "size" in Appendix Table A1, we did not have variation on firm size between firms within each group, namely, "small", "middle" and "large". We only had variation in "mean size" between the three groups of firms. In other words, given the information, we could only use inter group variation in firm size not that between the individual firms. As we report later in Table 5, when firm level data on "size" proxied by the number of customers of each firm is available, the evidence in favour of the U shaped relation between size and informality is much stronger and clearer. The U shaped relation suggests that very small and very large firms have a greater exposure to the informal sector than the middle-sized firms (as in Corollary 1). In other words, as a firm expands, the share of informal sales in its total sales initially increases and then declines. This does not of course mean that a very large firm goes completely informal- the result simply suggests that a large firm is more likely to supplement its operations in the formal sector by participating in the informal sector than does a middle-sized firm.

Income inequality, measured by Gini coefficient (*gini*) has a strong and positive effect on informal sales. Consistent with Proposition 2 derived earlier, increasing inequality leads to an

increase in the size of the informal sector.²⁸ Another variable with a positive effect on informal sales and with some policy significance is nonperforming loans (*npl*). This result suggests that in a deteriorating credit environment caused by large default of loans due to their non-performance the informal sector will be larger (Proposition 3). The qualitative results are generally robust between the OLS and the IV estimates, i.e. with respect to the sign and significance of the estimates, though the magnitude often changes. This is in line with the bias in the OLS estimates from the treatment of the corruption perception variable (*icrg*) as an exogenous determinant. These tables also provide evidence on the validity of the instruments used.

Other results from Tables 2a, 2b include the feature that a firm's perception of the country's legal system is a significant determinant of its decision on informal operations. Increased confidence in the country's justice system (*conf_justice*) will encourage a firm to reduce informality and increase the share of formal sales. A firm that considers the functioning of the country's judiciary as not conducive to its business operations (*BClegalsyst*) or, alternatively, views corruption as a business impediment (*BCcorrupt*) will increase the share of its total sales that it chooses not to declare. This is also true of firms that see labour regulations (*BClabregu*) as a constraint on its business operations. Consistent with these results and that of Dabla-Norris, et al. (2008), the large and highly significant coefficient estimate of the rule of law variable (*rol*) suggests that firms operating in countries with superior quality legal systems will declare a larger share of their sales or, alternatively, improved legal systems will reduce informality. In other words, measures aimed at strengthening legal institutions, stricter enforcement of justice and increased confidence in the country's judiciary are some of the most effective means of safeguarding the formal sector and preventing informality.

Foreign owned firms are much less likely to go informal, but higher income firms and those in the export business will have a higher informality. The more literate a country, the higher is the size of the informal sector. Note however that this paradoxical result could be due to the treatment of bribe demand as an exogenous determinant of informal sales. As the following tables show, bribe demand is significantly and negatively affected by the literacy rates. The overall message from tables 2a and 2b is one of robustness of the qualitative picture on the effects of the principal variables of interest on informal share of sales to the treatment of the macro level corruption variable (*icrg*) as an exogenous or endogenous determinant in the econometric specification.

4.3 Joint Estimation of Informal Sales and Bribe demand

As discussed earlier, the positive correlation between bribe demand and informality suggests that firms that are asked to pay bribes will declare a lower share of their sales. However, this relationship can go the other way as well since firms that go informal are more likely to receive bribe demands.²⁹ To allow for this joint dependence, and examine robustness of the results to the possible endogeneity of the bribe demand variable, we performed joint estimation of informal sales and bribe demand. The results are presented in Table 3a with the standard errors clustered by firms. Table 3a allows comparison of the effects of the various determinants of the two forms of illegality. Such a comparison suggests that the direction of the effect of the firm level characteristics and the macro indicators on informal sales and bribe demands is the same in most cases, but the magnitude of such effects is generally much larger for informal sales. The principal result of Table 2a, namely, the positive impact of bribe demand on informality is not

²⁸ Strictly speaking, the proposition relates to wealth inequality but, given the availability of data on wealth inequality for only a limited number of countries, we are using income inequality as a proxy for wealth inequality.

²⁹ This two way causal link has been noticed and discussed earlier by Johnson et al.(2000) in the context of a set of transition countries.

only robust but the effect is actually stronger in Table 3a which allows for two way feedback between the two. Table 3a confirms the reverse causation with informal sales having a positive and significant effect on bribe demands though the effect is much weaker.

Increasing confidence in the country's judicial system acts a brake on both forms of illegality extending the earlier result in Table 2a from informality to corruption. The earlier result that rising inequality increases informality is also robust between the two tables. It is also worth noting that while inequality has a large, positive and significant effect on informal sales, inequality also has a negative and statistically significant effect on bribe demand, though the effect is much weaker. The rule of law variable impacts negatively on the corruption variable and this is passed on to informality through the positive association between corruption and informality. The policy implication is clear- an integrated approach to reducing both informality and corruption rests on a strengthening of legal institutions and measures to increase confidence in the country's judiciary. An interesting point of difference between the two forms of illegality is that, after controlling for the respondents' characteristics and country differences, while there has been an increase in informality there has been a decline in business corruption.

Table 3a excludes several of the country level variables from the informal sales equation that is reported on the left hand side, though they appear as determinants in the bribe demand equation. Prominent examples of such omissions include the rule of law (*rol*) and human development index (*hdi*). In other words, these country characteristics are assumed to have an impact on informal sales only through the bribe demand variable. Table 3b examines robustness of the evidence in table 3a by including all the principal country level variables in the informal sales equation just as they do in the bribe demand equation. In other words, all the country indicators have both a direct effect and indirect effect on informal sales. The standard errors are clustered by firms as in Table 3a. A comparison of Tables 3a and 3b establishes robustness of the principal result of Table 3a, namely, the positive and mutually reinforcing relationship between informal sales and bribe demand. In fact, the impact of bribe demand on informal sales strengthens considerably on the inclusion of the country level variables in the equation for informal sales. The rule of law (*rol*), human development index (*hdi*) and the unemployment rate (*unempl*) variables, which were all excluded from the informal sales equation reported in Table 3a, are seen from the left hand side of Table 3b to have a significantly negative direct impact on informal sales. It is worth noting from the right hand side of Table 3b that the first two country characteristics (*rol*, *hdi*) also have a significantly negative impact on bribe demand, though the size of the coefficients is smaller compared to those in the informal sales equation. Literacy has reverse impacts on informal sales and bribe demand, positive in case of the former, negative in case of the latter. The coefficient estimates in the bribe demand equation in Table 3b are nearly all identical to those in table 3a implying that the results in the bribe demand equation are robust to the expanded list of country level regressors used in the informal sales equation. It is worth noting that the weak support in Table 3a to the idea of a U shaped relationship between informal sales and firm size becomes much stronger in Table 3b with the estimated coefficient of (*firm*)² in Table 3b increasing in size and significance. Table 3 suggests that the turning point occurs for a firm with around 600 employees.

Tables 3a, 3b both suffer from the limitation that while the joint estimations consider the effect of business corruption at micro level in the form of the WBES variable, *bribe demands*, on informal sales, they do not control for the corruption perception of the country at the macro level. To do so, we repeated the joint estimation with the corruption perception variables, *icrg* and *cpi*, introduced as additional regressors, on the right hand side of the informal sales and corruption equations, respectively. The results are reported in Table 4.

The positive association between corruption and informal sales manifests itself through the large and statistically significant impact of *icrg* on informal sales. In other words, and consistent with tables 2a and 2b, firms operating in countries with higher perceived risk of corruption are

likely to experience greater informality. Note, however, that on the introduction of the country wide indicator, *icrg*, the effect of the firm level bribe demand variable in the informal sales equation now weakens to statistical insignificance. This has the policy message that, in countries which are not regarded as being at high risk from corruption, bribe demands on the individual firms do not have any impact on the firm's decision on informality. It is the overall corruption perception of a country that matters in driving informality, not so much the bribe demands made to the individual firms. In contrast, controlling for macro level corruption as measured by the corruption perception indicator (*cpi*) and the other determinants, increased informality does lead to significantly higher bribe demands on the firms. Most of the principal results on informality, for example, rising inequality increases informality, increased confidence in the country's judiciary and an improvement in the credit situation brought about by a reduction in non performing bank loans reduces informality, is seen from Tables 2 and 4 to be robust between the single equation and the simultaneous equation estimates. Note from Table 4 that rising inequality as measured by the *Gini* leads to an increase in both informal sales and bribe demands, but the effect on the latter is much weaker.

Another remarkably robust result is that, *ceteris paribus*, increasing inequality has a large and positive impact on informal sales, consistent with the analytical discussion of this paper. Again, as the earlier discussion suggests, a deteriorating credit situation, as reflected in an increase in nonperforming bank loans (*npl*) will tend to increase informal sales. This result is seen most clearly from the large and statistically significant positive coefficient estimate of *npl* on the left hand side of tables 4 and 4a. The empirical results are subject to the qualification that while they establish association they do not necessarily indicate causation.

4.4 The Relation between Informality and Customer Base

The empirical evidence presented so far has provided strong support to several of the analytical results derived earlier. The weakness in the supporting evidence of the U shaped relationship between firm size and informality was, as noted earlier, a reflection of the lack of information on the number of employees in each firm giving us very limited variation in "size" as defined by the number of employees. To examine whether this is really the case, the informal sales equation was re-estimated with the size of the firm's work force replaced by the number of its customers. The reader will recall the preliminary evidence on this presented in Fig. 2 in the form of a U shaped relationship between informal sales and the size of customer base. This is confirmed in Table 5 that presents the regression results on the subset of firms that provide information on its customer base. The turning point occurs at a firm that has around 20,000 customers, which parallels the turning point at a firm with around 600 employees suggested by table 3b. The drop in the number of observations due to the paucity of information on customer base explains (a) our consideration of a limited set of characteristics, including omission of most of the country level determinants, and (b) the drop in statistical significance in several of the coefficient estimates. However, consistent with the earlier evidence, the right hand side of Table 5 (in the presence of the *icrg* variable) shows that an increase in the share of nonperforming loans to total loans (*npl*) in the economy pushes the firm to greater informality. The coefficient of the *npl* variable is quite large in both size and significance. This table also contains evidence on this smaller data set that suggests that exporting firms and those that are foreign owned are much less exposed to informality than the domestic firms. Once again, the corresponding coefficient estimates are large in both size and significance.

5 Conclusion

The principal objective has been to look at the link between corruption and informality. Large informal sectors are predominant in developing countries and corruption is also pervasive in many of these countries. This is not a simple coincidence; the paper proposes a strong positive

link between corruption and informality. Our empirical exercises using firm level data support this approach.

There are several reasons why this corruption-informality link needs to be looked at closely. It is somewhat expected that corruption will dilute enforcement efforts and distort the incentives associated with being in the formal or informal sector. However, as we have argued, corruption affects not just the average size but also the composition of the informal sector. Since corruption benefits are unlikely to be uniform across the population and wealthier entrepreneurs are likely to have better access to corruption, we can have a situation where informal sector comprises of both wealth constrained poorer firms and wealthier firms. This might seem counter-intuitive at first sight but when we interpret informality as the 'extent of undeclared sales', this result has strong empirical support.

An analytical result of considerable significance is the U shaped relationship between a firm's exposure to informality and the scale of its operations. As a firm starts operations on a very small scale, it is characterized, initially, by near total informality in the nature of its business. This is largely a reflection of its inability to incur the large fixed costs of accessing formal institutions and mechanisms. These obstacles diminish as the firm expands, and so does the scale of its informal operations. However, beyond a point, there is a tendency for the firm to increase the share of its informal sales. This is because once the firm is beyond the turning point its reliance on formal institutions and mechanisms diminishes and the rising cost of compliance induces it towards greater informality. This does not mean, however, that very large firms and businesses are completely informal. This result simply states that very small and very large firms will be more exposed to informality in its operations than medium sized firms. The policy significance of this result stems from the revenue loss to the exchequer from the increasing tendency of the expanding firms to go informal as its scale of operations increases. This result implies that at the macro level as the economy expands, as happened in India during the 1990s and beyond, so did the size of the informal sector. The contribution to this expansion of the informal sector came not only from the newly opened businesses that were operating on a very small scale, such as the tea stalls and the road side traders, but also from the large businesses that were operating increasingly in the informal sector. If the firm level U shaped relation between firm size and informal sales, that our analytical discussion suggests and for which some empirical support is provided, is replicated at the macro level, then we would expect a similar U shaped relationship between the aggregate size of the informal sector in the economy and the per capita GNP of the country. To our knowledge, such a hypothesis has not been explored or tested at the macro level. This clearly has policy implications for taxes and the hidden economy that is best left for future research.

We extend the basic framework to consider the implications for the relation between informality and other factors like inequality, credit market imperfections and taxes. High degree of inequality leads to a bigger informal sector. While the positive link between inequality and informality has been noted earlier, our paper adds a new dimension to this relationship. Suppose we redistribute wealth so that the poorer sections are unaffected, then most models of informality would predict that the size of the informal sector or the shadow economy would remain unchanged.³⁰ However, the upper tail of the wealth distribution also matters in our model and the shadow economy can be larger in such situations if and when the wealthier sections enjoy significant corruption benefits.

Given that wealth or asset distribution plays a central role, we expect credit market imperfections to be positively related to the size of the informal sector. We do find a robust link between the percentage of undeclared sales and the percentage of non-performing loans. The

³⁰ Though not explicitly stated, this is what models by Straub (2005), Chong and Gradstein (2007) would imply. The result can be extended to many other models of informality.

relation between taxes and informality is interesting but more complicated. Higher taxes can lead to more firms leaving the formal sector, but higher taxes can help sustain greater enforcement and anti-corruption efforts resulting in a smaller informal sector. Our analysis in this context is quite preliminary, we use an example to illustrate the point but a more detailed and complete formulation is left for future research.

The possibility that corruption and informality complement each other is also extremely important from a policy perspective. Our analysis is suggestive of this but a proper exploration of this complementarity needs to incorporate political economy considerations. Taxes, enforcement efforts and anti-corruption regimes are political decisions and it would be interesting to see how the formal/informal sectors affect the choice of these variables through political channels.³¹

³¹ In Azuma-Grossman (2008) a large informal sector reflects a policy choice that results from the State's inability to tax-discriminate. There is some interesting work in this area that use electoral competition models to study the informality –policy choice link, See Flochel (2012).

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Table 2a: OLS and IV Estimates of Informal Sales^a (with the bribe demand variable included)

Variables ^b	Coefficient ^c	Robust SE	P> t	Variables ^b	Coefficient ^c	Robust SE	P> t
icrg	2.55*	0.29	0.000	icrg_IV ^d	6.01*	0.61	0.000
Bribe demand	1.79*	0.39	0.000	Bribe demand	2.08*	0.43	0.000
size	-0.01*	0.003	0.002	size	-0.01*	0.003	0.000
size_squared	0.000005	0.000003	0.147	size_squared	0.000006***	0.000003	0.054
firmage	-0.07*	0.01	0.000	firmage	-0.06*	0.01	0.000
conf_justice	-0.80*	0.14	0.000	conf_justice	-0.89*	0.13	0.000
DEffGovt	1.30	1.00	0.193	DEffGovt	0.42	0.76	0.583
BClegalsyst	0.64*	0.22	0.004	BClegalsyst	0.69*	0.20	0.000
BCanticomp	1.21*	0.18	0.000	BCanticomp	1.15*	0.17	0.000
BCcrime	-1.42*	0.21	0.000	BCcrime	-1.29*	0.20	0.000
BCcorrupt	1.88*	0.23	0.000	BCcorrupt	1.59*	0.21	0.000
BCinstable	1.04*	0.21	0.000	BCinstable	1.05*	0.19	0.000
BCpolicy	-1.03*	0.23	0.000	BCpolicy	-1.20*	0.20	0.000
BClic	0.40**	0.20	0.042	BClic	0.34***	0.18	0.061
BClabregu	0.75*	0.20	0.000	BClabregu	0.67*	0.19	0.000
income	1.35*	0.40	0.001	income	0.81***	0.43	0.060
Dexport	0.60	0.49	0.227	Dexport	1.01**	0.48	0.035
Dforeign	-4.35*	0.55	0.000	Dforeign	-4.25*	0.59	0.000
year	0.30***	0.18	0.096	year	0.45**	0.20	0.022
npl	0.15*	0.04	0.001	npl	0.22*	0.05	0.000
gini	0.17*	0.03	0.000	gini	0.10*	0.04	0.006
lgnp	-0.31	0.75	0.684	lgnp	-1.97**	0.78	0.012
rol	-6.31*	0.50	0.000	rol	-7.70*	0.61	0.000
literacy	0.51*	0.05	0.000	literacy	0.49*	0.04	0.000
constant	-585.35	367.18	0.111	constant	-853.58**	392.05	0.029
Number of Obs.			17662	Number of Obs.			17606
F(24, 17637)			135.14	F(24, 17581)			128.36
Prob>F			0.000*	Prob>F			0.000*
R-squared			0.148	Anderson stats: χ^2 (2)	4226.675		0.000*
Root MSE			23.754	Sargan stats: χ^2 (1)	0.227		0.6339*

a. Informal Sales is measured as a proportion of total sales. b. See Appendix Table A1 for meaning of the variable names. c. *, ** and *** imply significance at 1%, 5% and 10% levels respectively. d. icrg_IV implies that icrg is instrumented by Freedom of Press and CO₂ emission.

Table 2b: OLS and IV Estimates of Informal Sales^a [with the bribe demand variable excluded]

Variables ^b	Coefficient ^c	Robust SE	P> t	Variables ^b	Coefficient ^c	Robust SE	P> t
icrg	2.47*	0.29	0.000	icrg_IV ^d	5.74*	0.61	0.000
size	-0.01*	0.003	0.001	size	-0.01*	0.003	0.000
size_squared	0.000005	0.000003	0.141	size_squared	0.000006***	0.000003	0.055
firmage	-0.070035*	0.009487	0.000	firmage	-0.067000*	0.010661	0.000
conf_justice	-0.84*	0.14	0.000	conf_justice	-0.93*	0.13	0.000
DEffGovt	1.19	1.00	0.233	DEffGovt	0.33	0.76	0.667
BClegalsyst	0.63*	0.22	0.005	BClegalsyst	0.68*	0.20	0.001
BCanticomp	1.24*	0.18	0.000	BCanticomp	1.18*	0.17	0.000
BCcrime	-1.43*	0.21	0.000	BCcrime	-1.31*	0.20	0.000
BCcorrupt	1.96*	0.23	0.000	BCcorrupt	1.69*	0.20	0.000
BCinstable	1.03*	0.21	0.000	BCinstable	1.03*	0.19	0.000
BCpolicy	-1.03*	0.23	0.000	BCpolicy	-1.19*	0.20	0.000
BClic	0.46**	0.20	0.019	BClic	0.42**	0.18	0.023
BClabregu	0.77*	0.20	0.000	BClabregu	0.70*	0.19	0.000
income	1.40*	0.40	0.000	income	0.89**	0.43	0.039
Dexport	0.59	0.49	0.232	Dexport	0.98**	0.48	0.040
Dforeign	-4.29*	0.55	0.000	Dforeign	-4.19*	0.59	0.000
year	0.24	0.18	0.195	year	0.37***	0.19	0.053
npl	0.14*	0.05	0.002	npl	0.21*	0.05	0.000
gini	0.15*	0.03	0.000	gini	0.07**	0.04	0.035
lgnp	-0.29	0.75	0.703	lgnp	-1.87**	0.78	0.017
rol	-6.54*	0.50	0.000	rol	-7.88*	0.61	0.000
literacy	0.48*	0.05	0.000	literacy	0.47*	0.04	0.000
constant	-450.19	369.44	0.223	constant	-706.15***	388.65	0.069
Number of Obs.			17662	Number of Obs.			17606
F(23, 17638)			135.79	F(23, 17582)			133.08
Prob>F			0.000*	Prob>F			0.000*
R-squared			0.147	Anderson stats: χ^2 (2)	4275.389		0.000*
Root MSE			23.765	Sargan stats: χ^2 (1)	0.662		0.4159*

a. Informal Sales is measured as a proportion of total sales. b. See Appendix Table A1 for meaning of the variable names. c. *, ** and *** imply significance at 1%, 5% and 10% levels respectively. d. icrg_IV implies that icrg is instrumented by Freedom of Press and CO₂ emission.

Table 3a: Joint Estimates of Informal Sales and Bribe Demand (with country level corruption perception indicators excluded), clustered by firms

Informal Sales ^a				Bribe demand ^a			
Variables ^b	Coefficient ^c	Clustered SE	P> z	Variables ^b	Coefficient ^c	Clustered SE	P> z
Bribe demand	2.95*	0.79	0.000	informal_sales	0.0011*	0.0002	0.000
size	-0.01*	0.003	0.006	size	-0.0001***	0.00005	0.092
size_squared	0.000004	0.000003	0.229	size_squared	0.000000	0.000000	0.470
firmage	-0.076*	0.01	0.000	firmage	-0.00097*	0.0002	0.000
conf_justice	-0.83*	0.14	0.000	conf_justice	-0.02*	0.002	0.000
DEffGovt	3.69*	1.02	0.000	DEffGovt	-0.07*	0.01	0.000
BClegalsyst	0.42***	0.23	0.069	BClegalsyst	-0.01***	0.003	0.067
BCanticomp	1.29*	0.18	0.000	BCanticomp	0.01*	0.003	0.000
BCcrime	-1.07*	0.21	0.000	BCcrime	-0.01**	0.003	0.033
BCcorrupt	2.46*	0.23	0.000	BCcorrupt	0.04*	0.003	0.000
BCinstable	1.10*	0.21	0.000	BCinstable	-0.01**	0.003	0.014
BCpolicy	-0.69*	0.23	0.002	BCpolicy	0.00	0.003	0.452
BClic	0.15	0.20	0.461	BClic	0.03*	0.003	0.000
BClabregu	0.53*	0.20	0.007	BClabregu	0.01*	0.003	0.004
income	1.16*	0.34	0.001	income	0.04*	0.01	0.000
Dexport	0.64	0.48	0.183	Dexport	-0.01	0.01	0.509
Dforeign	-4.98*	0.54	0.000	Dforeign	0.03*	0.01	0.001
year	0.52*	0.19	0.006	year	-0.04*	0.004	0.000
npl	0.21*	0.04	0.000				
gini	0.47*	0.03	0.000	gini	-0.01*	0.001	0.000
lgnp	-3.69*	0.66	0.000	lgnp	0.09*	0.01	0.000
				rol	-0.15*	0.01	0.000
				hdi	-1.12*	0.17	0.000
				unempl	0.001***	0.001	0.085
				literacy	-0.02*	0.001	0.000
				lpop	-0.03*	0.003	0.000
constant	-1014.86*	375.96	0.007	constant	77.55*	7.285	0.000
Number of Obs.			17904	Number of Obs.			17904
Wald test of significance:			2632.51	Wald test of significance:			4713.73
χ^2 (21)				χ^2 (25)			
Prob > χ^2			0.000*	Prob > χ^2			0.000*
R ²			0.126	R ²			0.207
Root MSE			24.01	Root MSE			0.418

a. Informal Sales is measured as a proportion of total sales. Bribe demand is measured by the variable that takes a value of 1 if asked for a bribe, 0 otherwise. b. See Appendix Table A1 for meaning of the variable names. c. *, ** and *** imply significance at 1%, 5% and 10% levels respectively.

Table 3b: Joint Estimates of Informal Sales and Bribe Demand (with country level corruption perception indicators excluded), clustered by firms with all country variables

Informal Sales ^a				Bribe demand ^a			
Variables ^b	Coefficient ^c	Clustered SE	P> z	Variables ^b	Coefficient ^c	Clustered SE	P> z
Bribe demand	4.1794*	0.7841	0.000	informal_sales	0.0013*	0.0002	0.000
size	-0.0119*	0.003	0.000	size	-0.0001	0.00005	0.119
size_squared	0.00001**	0.000003	0.016	size_squared	0.00000004	0.0000001	0.521
firmage	-0.058*	0.009	0.000	firmage	-0.001*	0.0002	0.000
conf_justice	-0.7986*	0.1376	0.000	conf_justice	-0.021*	0.0023	0.000
DEffGovt	1.83***	1.035	0.076	DEffGovt	-0.07*	0.010	0.000
BClegalsyst	0.69*	0.227	0.002	BClegalsyst	-0.01***	0.003	0.053
BCanticomp	1.278*	0.179	0.000	BCanticomp	0.010*	0.003	0.001
BCcrime	-1.35*	0.212	0.000	BCcrime	-0.01**	0.003	0.048
BCcorrupt	1.96*	0.229	0.000	BCcorrupt	0.04*	0.003	0.000
BCinstable	0.80*	0.204	0.000	BCinstable	-0.01**	0.003	0.013
BCpolicy	-0.757*	0.226	0.001	BCpolicy	0.003	0.003	0.407
BClic	0.142	0.202	0.483	BClic	0.035*	0.003	0.000
BClabregu	0.50**	0.194	0.011	BClabregu	0.01*	0.003	0.006
income	1.25*	0.444	0.005	income	0.04*	0.009	0.000
Dexport	0.42	0.47	0.372	Dexport	-0.01	0.008	0.502
Dforeign	-4.11*	0.54	0.000	Dforeign	0.04*	0.010	0.001
year	0.232	0.192	0.227	year	-0.037*	0.004	0.000
npl	-0.08	0.054	0.149	npl	0.001	0.001	0.370
gini	0.142*	0.038	0.000	gini	-0.010*	0.001	0.000
lgnp	0.70	1.15	0.543	lgnp	0.10*	0.021	0.000
rol	-1.72*	0.48	0.000	rol	-0.15*	0.011	0.000
hdi	-41.77*	12.42	0.001	hdi	-1.165*	0.195	0.000
unempl	-0.28*	0.044	0.000	unempl	0.001	0.001	0.170
literacy	0.45*	0.077	0.000	literacy	-0.02*	0.001	0.000
lpop	2.255*	0.166	0.000	lpop	-0.031*	0.004	0.000
constant	-459.33	384.887	0.233	constant	76.08*	7.356	0.000
Number of Obs.			17904	Number of Obs.			17904
Wald test of significance: χ^2 (26)			3357.48	Wald test of significance: χ^2 (26)			4752.13
Prob > χ^2			0.000*	Prob > χ^2			0.000*
R ²			0.154	R ²			0.206
Root MSE			23.63	Root MSE			0.418

a. Informal Sales is measured as a proportion of total sales. Bribe demand is measured by the variable that takes a value of 1 if asked for a bribe, 0 otherwise. b. See Appendix Table A1 for meaning of the variable names. c. *, ** and *** imply significance at 1%, 5% and 10% levels respectively.

Table 4: Joint Estimates of Informal Sales and Bribe demand (with country level corruption perception indicators, icrg and cpi included), clustered by firms

Informal Sales ^a				Bribe demand ^a			
Variables ^b	Coefficient ^c	Clustered SE	P> z	Variables ^b	Coefficient ^c	Clustered SE	P> z
Bribe demand	-0.66	0.52	0.207	informal_sal	0.0006*	0.0002	0.002
icrg	3.54*	0.423	0.000	cpi	0.0145	0.01	0.128
size	0.005	0.003	0.162	size	-0.00003	0.0001	0.601
size_squared	-0.000008***	0.000004	0.054	size_squared	0.000000004	0.00000008	0.957
firmage	-0.08*	0.013	0.000	firmage	-0.0010*	0.0002	0.000
conf_justice	-0.84*	0.17	0.000	conf_justice	-0.02*	0.003	0.000
DEffGovt	3.16*	1.001	0.002	DEffGovt	-0.02	0.018	0.182
BClegalsyst	0.60**	0.258	0.020	BClegalsyst	-0.002	0.005	0.618
BCanticomp	1.62*	0.222	0.000	BCanticomp	0.02*	0.004	0.000
BCcrime	-0.79*	0.254	0.002	BCcrime	-0.01	0.005	0.173
BCcorrupt	1.73*	0.255	0.000	BCcorrupt	0.05*	0.005	0.000
BCinstable	0.96*	0.244	0.000	BCinstable	-0.001	0.004	0.751
BCpolicy	-1.27*	0.249	0.000	BCpolicy	0.002	0.005	0.702
BClic	0.04	0.233	0.868	BClic	0.03*	0.004	0.000
BClabregu	0.35	0.23	0.126	BClabregu	0.02*	0.004	0.000
income	-1.72*	0.48	0.000	income	0.17*	0.01	0.000
Dexport	0.89	0.59	0.131	Dexport	-0.01	0.01	0.183
Dforeign	-4.45*	0.775	0.000	Dforeign	0.001	0.014	0.917
year	14.99*	0.709	0.000	year	-0.06*	0.013	0.000
npl	2.48*	0.11	0.000				
gini	1.68*	0.06	0.000	gini	-0.004*	0.001	0.000
lgnp	2.65**	1.07	0.013	lgnp	0.22*	0.03	0.000
				rol	-0.24*	0.03	0.000
				hdi	-3.023*	0.401	0.000
				unempl	0.01*	0.001	0.000
				literacy	-0.05*	0.003	0.000
				lpop	-0.045*	0.005	0.000
constant	-30144.93*	1424.609	0.000	constant	121.52*	26.576	0.000
Number of Obs.			10883	Number of Obs.			10883
Wald test of significance: χ^2 (22)			3036.67	Wald test of significance: χ^2 (26)			2450.68
Prob > χ^2			0.000*	Prob > χ^2			0.000*
R ²			0.218	R ²			0.184
Root MSE			23.11	Root MSE			0.415

a. Informal Sales is measured as a proportion of total sales. Bribe demand is measured by the variable that takes a value of 1 if asked for a bribe, 0 otherwise. b. See Appendix Table A1 for meaning of the variable names. c. *, ** and *** imply significance at 1%, 5% and 10% levels respectively.

Table 5: OLS Informal Sales^a (with and without the ICRG variable)

Variables ^b	Coefficient ^c	Robust SE	P> t	Variables ^b	Coefficient ^c	Robust SE	P> t
				icrg	3.321**	1.632	0.042
customers	-0.008*	0.003	0.004	customers	-0.0079*	0.00279	0.005
customers_sq	2.2e-07*	7.1e-08	0.002	customers_sq	1.96e-07*	7.05e-08	0.002
firmage	-0.066	0.044	0.128	firmage	-0.062	0.044	0.154
conf_justice	-1.293*	0.465	0.005	conf_justice	-1.333*	0.465	0.004
DEffGovt	2.711	1.680	0.107	DEffGovt	2.456	1.687	0.146
BClegalsyst	-0.650	0.589	0.270	BClegalsyst	-0.677	0.589	0.250
BCanticomp	0.572	0.564	0.311	BCanticomp	0.484	0.569	0.395
BCcrime	0.321	0.653	0.623	BCcrime	0.430	0.657	0.513
BCcorrupt	0.216	0.671	0.748	BCcorrupt	0.268	0.674	0.691
BCinstable	1.219***	0.661	0.065	BCinstable	1.248***	0.659	0.058
BCpolicy	-1.873*	0.700	0.008	BCpolicy	-1.824*	0.699	0.009
BClic	0.271	0.632	0.668	BClic	0.259	0.630	0.682
BClabregu	-1.582*	0.596	0.008	BClabregu	-1.540**	0.595	0.010
income	-7.959*	1.897	0.000	income	-5.720*	2.100	0.007
Dexport	-6.428*	1.614	0.000	Dexport	-6.267*	1.620	0.000
Dforeign	-3.655***	2.188	0.095	Dforeign	-3.738***	2.182	0.087
npl	0.228	0.143	0.109	npl	0.474*	0.176	0.007
constant	45.636*	4.748	0.000	constant	32.469*	7.592	0.000
Number of Obs.			2085	Number of Obs.			2085
F(17, 2067)			9.91	F(18, 2066)			9.84
Prob>F			0.000*	Prob>F			0.000*
R-squared			0.0494	R-squared			0.0510
Root MSE			31.831	Root MSE			31.812

a. Informal Sales is measured as a proportion of total sales. b. See Appendix Table A1 for meaning of the variable names. c. *, ** and *** imply significance at 1%, 5% and 10% levels respectively.

Appendix

First we examine the different cases in Table 1 and then verify the comparative statics reported in Proposition 1.

1. Note that $V_F - V_I$ can be written as

$$V_F - V_I = \begin{cases} [R_F(1-t) - (1-\theta\alpha)R_I]A - [(1-t)R_F C - (1-\alpha)\theta\delta W], \forall A > A^C \\ [R_F(1-t) - (1-\theta)R_I]A - (1-t)R_F C, \forall A \leq A^C \end{cases} \quad (14)$$

Hence $V_F - V_I = 0$ can have at most two roots, A_1 & A_2 .

(i) Suppose $A^* < A^C$. Since $(1-t)R_F C = (1-t)R_F A^* - (1-\theta)R_I A^*$, the smaller of the two roots, A_1 always exists and $A_1 = A^*$. Moreover

$$V_I - V_F = [(1-\theta\alpha)R_I - R_F(1-t)]/[A - A^*] - (1-\alpha)\theta R_I(A^C - A^*) \quad (15)$$

The other root, A_2 , will be given by

$$A_2 = A^* + \frac{(1-\alpha)\theta R_I}{(1-\alpha\theta)R_I - (1-t)R_F} (A^C - A^*), \quad (16)$$

A necessary condition for A_2 to exist will be $R_f \leq R_I \frac{1-\theta\alpha}{1-t}$. However we also need $A_2 < \bar{A}$,

hence we need $(1-\alpha\theta)R_I - (1-t)R_F$ to be sufficiently large or $R_f \leq R_I \beta$. This corresponds to case II in the Table.

On the other hand, if this condition is not satisfied, A_2 does not exist in the relevant zone and $V_I - V_F < 0 \forall A^* < A \leq \bar{A}$.

(ii) Now consider $A^* \geq A^C$. Clearly $V_F - V_I < 0$ for all $A \leq A^C$, hence we can have at most have one root. Denote it as A^{**} . Suppose $R_f > R_I \beta$. This implies that

$$(A^C - A^*) / [(1-\alpha\theta)R_I - (1-t)R_F] > 0. \quad (17)$$

Using (14), we have

$$A^{**} = A^* + \frac{\{(1-\alpha)\theta R_I\}}{(1-\alpha\theta)R_I - (1-t)R_F} (A^C - A^*) \quad (18)$$

Entrepreneurs with $A \geq A^{**}$ will choose to be in the formal sector, this is smaller than the case where there is no corruption. This refers to case III.

However, if $(1-\alpha\theta)R_I - (1-t)R_F > 0$, A^{**} does not exist because $V_F - V_I < 0$ for all values of A . In this case (I), formal sector ceases to exist after the introduction of corruption.

2. Case (II).

Following the definition of F in (6),

$$\frac{\partial F}{\partial X} = g(A_2) \frac{\partial A_2}{\partial X} - g(A_1) \frac{\partial A_1}{\partial X}, \quad X = C, \delta W, \theta \quad (19)$$

Recall that $A_1 = A^*$. It can be verified that $\frac{\partial A_1}{\partial C} > 0$. Moreover, since $(1-\theta)R_I - (1-t)R_F < 0$, it is easy

to show that $\frac{\partial A_2}{\partial C} < 0$.

$$\frac{\partial F}{\partial C} = g(A_2) \frac{\partial A_2}{\partial C} - g(A_1) \frac{\partial A_1}{\partial C} < 0 \quad (20)$$

Hence a rise in C will lead to fall in the size of the formal sector F .

Likewise, a rise in θ will lead to a larger formal sector. From (2), $\frac{\partial A_1}{\partial \theta} < 0$ and $\frac{\partial A_2}{\partial \theta} > 0$. Hence

$$\frac{\partial F}{\partial \theta} = g(A_2) \frac{\partial A_2}{\partial \theta} - g(A_1) \frac{\partial A_1}{\partial \theta} > 0 \quad (21)$$

Similarly, we expect that greater control of corruption will lead to a bigger formal sector. Any rise in W or δ or both will reduce the scope of corruption and raise A^c . Since $\frac{\partial A_2}{\partial W} > 0$ and

$$\frac{\partial A_1}{\partial W} = 0, \text{ it is clear that}$$

$$\frac{\partial F}{\partial W} = g(A_2) \frac{\partial A_2}{\partial W} - g(A_1) \frac{\partial A_1}{\partial W} > 0. \quad (22)$$

Case (III):

$$F = \int_{A^{**}}^{\bar{A}} g(A) dA \quad \frac{\partial F}{\partial X} = -g(A^{**}) \frac{\partial A^{**}}{\partial X} \quad (23)$$

It can be verified that $\frac{\partial A^{**}}{\partial C} > 0, \frac{\partial A^{**}}{\partial W} < 0$.

Case (IV):

This case is similar to the case without corruption and

$$F = \int_{A^*}^{\bar{A}} g(A) dA \quad \frac{\partial F}{\partial X} = -g(A^*) \frac{\partial A^*}{\partial X}. \quad (24)$$

It is easily verified that $\frac{\partial F}{\partial C} < 0, \frac{\partial F}{\partial \theta} > 0$

Table A1: Appendix – Variable Definitions and Data Sources.

WBES Variables	Firm characteristics	Definition (Source: A)
Bribe demand	Bribe	Dummy variable (=1) if the respondent is asked for bribe, 0 otherwise
Informal_sales	Informal Share in Sales	Share of sales not declared, in percentage
Size	Firm size dummies	Size=28 employees for "small", 275 for "medium" and 750 for "large" firms; these were inside the three WBES ranges: 5-50, 51-500; > 500
Customers	Number of customers	Number of customers at the survey year.
Firmage	Age of Firm	Age of Firm at the survey year
Conf_justice	Confidence in Judicial System	Dummy variable (=1) if the respondent answers "tend to agree", "mostly agree", or "fully agree" to the question: Confident judicial system will uphold property rights?, 0 otherwise
DEffGovt	Efficiency of government in delivering services	Dummy variable (=1) if the respondent answers "somewhat efficient", "efficient" or "very efficient" to the question: How would you generally rate the efficiency of central and local government in delivering services, 0 otherwise
BClegalsyst	Business constraint: legal system/conflict resolution	Dummy variable (=1) if the respondent answers "minor", "moderate", "major" or "very severe" to the question: How problematic is functioning of the judiciary for the operation and growth of your business, 0 otherwise
BCanticomp	Business constraint: anti-competitive/informal practices	Dummy variable (=1) if the respondent answers "minor", "moderate", "major" or "very severe" to the question: How problematic is anti-competitive/informal practices for the operation and growth of your business, 0 otherwise
BCcrime	Business constraint: crime, theft, disorder	Dummy variable (=1) if the respondent answers "minor", "moderate", "major" or "very severe" to the question: How problematic is crime, theft, disorder for the operation and growth of your business, 0 otherwise
BCcorrupt	Business constraint: corruption	Dummy variable (=1) if the respondent answers "minor", "moderate", "major" or "very severe" to the question: How problematic is corruption for the operation and growth of your business, 0 otherwise
BCinstable	Business constraint: macroeconomic instability (infl., exch. rate)	Dummy variable (=1) if the respondent answers "minor", "moderate", "major" or "very severe" to the question: How problematic is macroeconomic instability for the operation and growth of your business, 0 otherwise
BCpolicy	Business constraint: economic & regulatory policy uncertainty	Dummy variable (=1) if the respondent answers "minor", "moderate", "major" or "very severe" to the question: How problematic is economic & regulatory policy uncertainty for the operation and growth of your business, 0 otherwise
BClic	Business constraint: licensing and operating permits	Dummy variable (=1) if the respondent answers "minor", "moderate", "major" or "very severe" to the question: How problematic is licensing and operating permits for the operation and growth of your business, 0 otherwise
BClabregu	Business constraint: labour regulations	Dummy variable (=1) if the respondent answers "minor", "moderate", "major" or "very severe" to the question: How problematic is labour regulations for the operation and growth of your business, 0 otherwise

Table A1: Continued

Income	Income grouping for survey year	Firm Income = 1 if "low"; =2 if "lower-middle"; = 3 if "upper-middle" = 4 if "high"; = 5 if "high oecd"
Dexport	Exporter	Dummy variable (=1) if the firm is an exporter, 0 otherwise
Dforeign	Foreign	Dummy variable (=1) if the firm is of foreign ownership, 0 otherwise
time	Year of Survey	Takes the value 0 in base year 2002 and maximum value is 4 in 2006
Country Variables	Country characteristics	Definition (Source)
lpop	Population	Population of the country in millions in the survey year, expressed in Log (B)
unemployment	Unemployment rate	Unemployment, total (% of total labour force) (B)
rol	Rule of law	Synthetic index, rescaled adding 4 points to the index to avoid negative values where a higher indicator denotes a higher quality rule of law (F)
hdi	Human Development Index	Human Development Indicator from UNDP, where higher values denote higher development (C)
press	Freedom of Press	Index of restrictions on media content 1) laws and regulations (0-15 points), 2) political pressures and controls (0-15 points), 3) repressive actions (e.g. killing journalists, censorship) (0-5 points). More point means less freedom. Rated: 1 (free) to 3 (unfree) (Freedom House: Press Freedom Survey) (H)
emission	CO ₂ Emission	Per capita CO ₂ Emission (B)
lgnp	Gross National Income	Log of Gross National Income per capita, PPP, (current international \$) (B)
literacy	Literacy rate	Literacy rate, adult total (% of people ages 15 and above) of the country (B)
npl	Non-Performing Loans	Bank nonperforming loans to total gross loans (%) (B)
gini	Inequality, GINI coefficient	GINI coefficient (B)
cpi	Corruption Perception Index	Takes value of 0 (highly clean) to 10 (highly corrupt) (D)
icrg	International Country Risk Guide	Takes value of 0 (least risky) to 6 (highly risky) (E)

Source:

A	WBES	http://www.worldbank.org/wbi/governance/
B	WDI	www.worldbank.org/data
C	HDR, UNDP	http://hdr.undp.org/en/
D	CPI	http://www.transparency.org/
E	ICRG	International Country Risk Guide, Report by The PRS Group, Inc. (1984-2008)
F	World Governance Indicators 96-07	http://info.worldbank.org/governance/wgi/index.asp
G	Wikipedia	http://en.wikipedia.org/wiki/Landlocked
H	World Database of Happiness	http://worlddatabaseofhappiness.eur.nl/statnat/statnat_fp.htm

Table A2: Appendix- Countries, Years and Number of firms.

Country	Year	Number of firms
Bulgaria	2002	212
China	2002	811
Czech Republic	2002	232
Estonia	2002	136
Croatia	2002	140
Hungary	2002	214
Kazakhstan	2002	215
Lithuania	2002	176
Latvia	2002	158
Moldova	2002	167
Peru	2002	444
Poland	2002	461
Romania	2002	232
Slovenia	2002	151
Russia	2002	427
Turkey	2002	490
Ukraine	2002	427
Brazil	2003	1514
Guatemala	2003	451
Honduras	2003	361
Indonesia	2003	713
Moldova	2003	97
Nicaragua	2003	371
Philippines	2003	598
Poland	2003	101
El Salvador	2003	424
Uganda	2003	189
South Africa	2003	568
Bulgaria	2004	356
Chile	2004	895
Egypt	2004	961
Morocco	2004	834
Sri Lanka	2004	355
Turkey	2004	525
Azarbaijan	2005	349
Bulgaria	2005	290
Costa Rica	2005	287
Czech Republic	2005	333
Germany	2005	1192
Dominican Republic	2005	182
Estonia	2005	170
Spain	2005	600
Georgia	2005	164

Table A2: Continued

Greece	2005	502
Croatia	2005	210
Hungary	2005	592
Ireland	2005	490
Jamaica	2005	73
Kazakhstan	2005	568
Lithuania	2005	172
Latvia	2005	194
Mauritius	2005	171
Moldova	2005	321
Macedonia	2005	182
Poland	2005	969
Portugal	2005	502
Romania	2005	577
Slovenia	2005	205
Slovakia	2005	191
Turkey	2005	1120
Ukraine	2005	573
Argentina	2006	947
El Salvador	2006	554
Total		27086

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