



*Citation for published version:*

Mishra, A & Ray, R 2010 'Informality, Corruption, and Inequality' Bath Economics Research Working Papers, no. 13/10, Department of Economics, University of Bath, Bath, U. K.

*Publication date:*  
2010

*Document Version*  
Publisher's PDF, also known as Version of record

[Link to publication](#)

## University of Bath

**General rights**

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

**Take down policy**

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Informality, Corruption and Inequality

Ajit Mishra & Ranjan Ray

No. 13/10

**BATH ECONOMICS RESEARCH PAPERS**

**Department of Economics**



# Informality, Corruption, and Inequality\*

Ajit Mishra<sup>a</sup>

Ranjan Ray<sup>b</sup>

University of Bath, UK

Monash University, Australia

## Abstract

*The paper looks at the determinants of the size of the informal sector. We argue that corruption and informality complement each other and are jointly determined by various market and non-market variables. Our theoretical model as well empirical exercises focus on wealth and income inequality as a key determinant. High degree of inequality leads to bigger informal sector. We offer several plausible channels through inequality can impact the size of the informal sector.*

**JEL Classification Codes: O15; O17; D73**

**Keywords: Informal Sector, Corruption, Inequality, Credit Market, Product Differentiation**

---

\*We have benefited from discussions with Dilip Mookherjee, Andrew Samuel, Jihyun Kim and Indranil Dutta. We would like to thank Ishita Chatterjee for invaluable research assistance. Part of the work was done while Ajit Mishra was visiting Monash University. Financial support and hospitality for his visit are gratefully acknowledged.

a Department of Economics, University of Bath, Bath, UK, BA2 7AY Email: [a.mishra@bath.ac.uk](mailto:a.mishra@bath.ac.uk); corresponding author.

b Department of Economics, Monash University, Clayton, Victoria, 3800, Australia. Email: [Ranjan.ray@buseco.monash.edu.au](mailto:Ranjan.ray@buseco.monash.edu.au)

# Informality, Corruption, and Inequality

## 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. Adopting the conventional Wikipedia definition of the informal sector as “economic activity that is neither taxed nor monitored by a government, and is not included in that government’s Gross National Product (GNP), as opposed to a formal economy”, it is clear that the existence of this sector poses, in the words of Straub (2005, p. 299), “a major challenge to economic and social policies in developing countries”. The informal sector impedes economic progress on principally three counts: first, it is a significant source of revenue leaks for the government that deprives the economy of funds that could have been used for development; second, since its activities are hidden from public scrutiny, it is not subject to labour standards such as minimum wages, decent and non hazardous working conditions, child labour laws, etc; third, in denying access to official credit channels, firms operating informally are denied access to modern technology leading to loss of productivity and, additionally, are deprived of protection from extortion and other forms of corruption due to the unregistered nature of their businesses. Consequently, there have been attempts to measure the size of the informal economy [Friedman, et. al. (2000)] and examine some of the factors that explain the existence and size of the informal sector<sup>1</sup>. While, by nature of the concept of informality, all such measures must be tentative, the available evidence suggests that the size of the informal sector is quite significant. For example, according to information contained in “Measuring the Size of the Informal Sector” in the World bank website, <http://lnweb90.worldbank.org/eca/eca.nsf/>, the informal sector employment accounts for 10 % or more urban employment in several transition countries. Estimates presented in Schneider and Enste (2000) suggest that even in developed countries, such as those in Western Europe and the USA, the size of the shadow economy relative to GNP is upwards of 15 % in many cases with double digit growth rates in the past three decades.

---

<sup>1</sup> Examples include Djankov, et. al. (2002), Straub (2005), Dabla-Norris, et. al. (2008),

Due to the wide appreciation of the threat that the informal sector poses to development, there has been renewed interest in the informal sector or shadow economy, its determinants and implications for overall economic performances.<sup>2</sup> With the availability of good quality data sets , mostly involving survey data containing firms' responses to questions on their formal and informal operations, analytical modeling have been substantiated by hard empirical evidence. The present exercise is in this recent tradition.

This paper examines two aspects of the informal sector that have not featured much in the literature, namely, the interaction of the informal sector with corruption, and vice versa, and the role that rising income inequality plays in supporting and expanding the size of the informal sector. As attention increasingly turns to the reasons for informality, it is important from a policy viewpoint to examine if corruption and informality feed on each other. This paper provides analytical arguments that suggest that corruption and inequality provide possible explanations for the existence of the informal sector. An increase in these variables leads to an increase in the size of the informal sector. The paper provides support for the propositions with hard empirical evidence based on a large cross country survey data containing firms' responses. While Straub (2005) stresses the role of lack of access to formal credit mechanisms in explaining the existence of the informal sector, Dabla-Norris, et. al. (2008) focus on poor quality legal framework and legal obstacles as possible explanations for the rise of the informal sector. Though Djankov et. al. (2002) suggest that "countries with heavier regulation of entry have higher corruption and larger unofficial economies", we are not aware of any previous studies that investigate the link between corruption and informality.

Corruption entails social and economic costs to development that are similar to those of informality. The magnitude of corruption is also believed to be comparable to that of the informal sector. Consequently, the same concern that underlines the recent

---

<sup>2</sup> See Straub (2005), Dabla-Norris et al (2008), Choi and Thum (2005), Johnson et al (2000 ), Friedman et al (2000), Schneider and Enste (2000) among others.

interest in the informal sector also explains the resurgence of work on corruption.<sup>3</sup> It is worth pointing out that factors such as “the rise of the burden of taxes...declining tax morale” identified by Schneider and Enste (2000) or the lack of a quality legal system identified by Dabla-Norris, et. al. (2008) as possible explanations for the informal sector also figure prominently as likely explanations for corruption. However, to our knowledge, there has not been any serious attempt to examine the nature of interaction between informality and corruption. Yet, from a policy viewpoint, this is an important issue to investigate since if, as this paper shows, the interaction between the two is mutual, positive and significant, with informality and corruption feeding off one another, then an integrated strategy to combat both forms of illegality is likely to be effective. Such an attempt is the principal motivation of this study. The issue of increasing inequality possibly leading to rising informal sector is also significant in the present context since increasing inequality has also been identified as leading to increasing corruption. Incidentally, while Straub (2005) argues that lack of access to formal credit encourages firms to go informal, the inequality variable adds to this explanation since in a more unequal society individuals and firms at the lower end of the distribution find it harder to get access to formal credit and modern technology.

Before we discuss the formal analytical model, the main arguments can be described as follows. Firm’s choice to be in the informal sector (or keeps part of its business in the informal sector) can be studied under two different but related approaches. One approach treats this as an enforcement problem not very different from the classical tax evasion problem (Rauch 1991, Dabla-Norris et al 2008). Operation in the formal sector entails certain fixed costs like cost of obtaining license (including extortion by issuing bureaucrats), taxes of various kinds and other costs of meeting various regulatory standards. By choosing to be in the informal sector a firm avoids these costs but runs the risk of apprehension and penalties. Hence factors contributing to either the fixed costs (taxes and regulatory burden) or actual enforcement (rule of law, corruption) will affect the extent of informal activities. As mentioned earlier, corruption is a key determinant in our model but we argue that it is affected by the size of the informal sector.

---

<sup>3</sup> See Mishra (2005) for a comprehensive survey and for some of the important contributions in the corruption literature.

The other approach entails looking at structural characteristics like market imperfections and unequal distribution of wealth and income to explain why it might be profitable to locate in the informal sector. Imperfect credit markets would lead to firm's total investment being determined by available wealth. The existence of fixed operation costs in the formal sector would imply that only the very wealthy would find it profitable to be in the formal sector. An economy with very few wealthy potential entrepreneurs will exhibit a small formal sector. But a small formal sector does not necessarily lead to a large informal sector. Profitability in the informal sector also has to be sufficiently high relative to non-production activities. First, at low levels of development returns to non-production activities (subsistence sector or wage employment) are likely to be low. Second, firms in the informal sector enjoy higher profitability because of favorable demand conditions for their product. Informal sector is likely to be associated with lower quality products whose demand is sustained by unequal distribution of income amongst the consumers. It is difficult to test the actual mechanism but we do find strong evidence that greater inequality supports a larger informal sector.

The rest of this paper is organized as follows. Section 2 presents a simple model that is used to explain how corruption and informality are jointly determined. In Section 3 the model is extended in different ways to study the impact of inequality. Given the complex nature of interaction between informality and inequality, we consider various channels through which inequality might affect the size of the informal sector. Section 4 reports the empirical evidence that provides support to the propositions outlined in Section 2 and compares the determinants of informal sector and corruption. We end on the concluding note of Section 5.

## 2. A Simple Model

We consider a set of potential entrepreneurs of measure one. Each entrepreneur is endowed with asset/income  $A$  and the distribution of this asset is given by the distribution function  $G(A)$ ,  $0 \leq A \leq \bar{A}$ .<sup>4</sup> An entrepreneur can make an investment of  $K$  and produce output  $RK$ . Production can take place either in the formal sector (F) or in

---

<sup>4</sup> The corresponding density is denoted by  $g(A)$ , the upper bound on  $A$  allows us to consider simple constant returns technology.

the informal sector (I). Formal sector production involves fixed non-production cost  $C$ . This cost has several components. It includes the costs of obtaining various licenses and permits to undertake production, costs of compliance with government stipulated rules and regulations, and a lump sum tax  $t$ . As various authors have noted, it also includes the bribe payments (extortion) that the entrepreneur has to make before undertaking the project.

However, by locating in the informal sector an entrepreneur can avoid incurring such costs. But entrepreneurs in this sector always run the risk being apprehended by an inspector. If apprehended the entrepreneur loses all its profit. It is possible to argue that productivity in the informal sector is likely to be low because producers do not have access to various publicly provided goods and services or benefits of protection from the legal system. We do not dispute this but we begin with the simpler formulation where an investment of  $K$  in the informal sector produces exactly same amount of output  $RK$ . This will be relaxed later in section 3.

## 2.1 Credit Market

We consider a simple variant of credit market imperfections where credit contracts are not enforced perfectly.<sup>5</sup> Credit market is otherwise competitive where everybody takes the gross interest rate  $\rho$  as given. Suppose the entrepreneur borrows an amount  $B$  and the total investment is  $K$ . If a borrower defaults the bank can recover only a fraction  $\tau$  of the total return  $RK$ ,  $0 \leq \tau \leq 1$ . The borrower will default if the cost of default  $\tau RK$  is lower than the repayment obligation  $B\rho$ . To avoid such default, lender will choose  $B$  (for a project of size  $K$ ) such that

$$B \leq \tau RK / \rho \tag{1}$$

We assume that all entrepreneurs have equal access to the same credit market. This is in contrast to Straub (2005) where entrepreneurs in the informal sector do not have access to the formal credit market, rather they rely on the informal credit market.

However, we can introduce differential cost of capital or borrowing constraints without any problem.<sup>6</sup>

---

<sup>5</sup> There are various ways in which credit market imperfections in the presence of wealth constraints can be modeled. The present version follows Matsuyama (2000).

<sup>6</sup> We do not find strong empirical justification for such dual access. Note that output may not be declared by producers in the informal sector, but that does not mean output can not be verified ex post. This ex post verification is needed to enforce (however imperfectly) credit contracts. Secondly, formality and informality are only two ends of a spectrum where each firm hides output to some extent.



Consider an entrepreneur in the formal sector. 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  $K$ , the entrepreneur needs to borrow  $(K-A+C)$ . Using (1) it is clear that the maximum investment a formal sector entrepreneur with asset  $A$  can undertake will be given by

$$K^F(A) = \eta(A-C) \text{ where } \eta = \rho/(\rho-\tau R) > 1, \rho > 0 \quad (2)$$

In our model, producers will in fact borrow and invest the maximum amount.

Likewise, for the informal sector producer,

$$K^I(A) = \eta A \text{ where } \eta = \rho/(\rho-\tau R) > 1 \quad (3)$$

Note that that the amount that a producer in the formal sector can borrow gets severely constrained because of  $C$ . Condition (2) implies that anyone with  $A < C$  can never be in the formal sector. However, we are interested in examining why are there producers with  $A > C$  who might be in the informal sector.

## 2.2 Informality

A producer is inspected with probability  $\theta$  by an inspector. A producer in the informal sector faces a fine of the entire net profit. However, the inspector is corruptible and can be bribed. Suppose the likelihood of the inspector being corrupt is  $q$  and the producer has to pay a fraction  $b$  of the profit as bribe. We are treating corruption as exogenous for this section only; both  $q$  and  $b$  will be derived explicitly in the next section. Following the previous discussion and assumptions, payoffs (expected payoffs) to producers in the formal ( $V_F$ ) and informal sectors ( $V_I$ ) can be easily derived.

$$\begin{aligned} V_F &= RK^F - (K^F + C - A)\rho \\ V_I &= \theta q b \{RK^I - (K^I - A)\rho\} + (1 - \theta) \{RK^I - (K^I - A)\rho\} \end{aligned} \quad (4)$$

Using (2) and (3), a potential entrepreneur will choose to be in the formal sector if and only if its assets/income  $A \geq A^*$  where  $A^*$  is given by

$$A^* = \frac{C}{\theta(1 - qb)} > C \quad (5)$$

It is straightforward to show that

$$\frac{\partial A^*}{\partial q} > 0, \frac{\partial A^*}{\partial C} > 0, \text{ and } \frac{\partial A^*}{\partial \theta} < 0 \quad (6)$$

Let  $V_0$  be the payoff to a potential entrepreneur who chooses not to enter 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 agents with  $A_0 \leq A < A^*$  will choose to be the informal sector.

It can be argued that reservation payoff  $A_0$  depends on the level of economic development. Then the informal sector will be larger at low levels of development. But this may not be so straightforward because at lower levels of development productivity parameter  $R$  is also likely to be lower. Note that  $A^*$  does not depend on  $R$  but  $A_0$  falls as  $R$  is raised.<sup>7</sup> This suggests that as productivity rises without a change in costs  $C$ , rule of law  $\theta$  and level of corruption  $q$ , we will see a rise in the informal sector.<sup>8</sup> Let  $F$  and  $I$  denote the sizes of formal and informal sector respectively.

$$I = \int_{A_0}^{A^*} g(A) dA, \quad F = \int_{A^*}^{\bar{A}} g(A) dA \quad (7)$$

It will be convenient to consider the relative size of the informal sector as  $S = I/(I+F)$ .

It is easy to verify that

$$\frac{\partial S}{\partial q} > 0, \frac{\partial S}{\partial C} > 0, \frac{\partial S}{\partial R} \geq 0, \frac{\partial S}{\partial \theta} < 0, \frac{\partial S}{\partial V_0} < 0 \quad (8)$$

**Proposition 1:** Suppose the level of corruption ( $q$ ) is given and same for all producers. The relative size of the informal sector is positively related to the extent of non-production costs ( $C$ ) in the formal sector and the level of corruption in the informal sector ( $q$ ), and inversely related to the effectiveness of the rule of law ( $\theta$ ). While the formal sector may not be affected by the average productivity, informal sector is likely to be higher.

### 2.3 Corruption

To see how corruption interacts with informality we shall extend the basic model of the previous section. The regulator employs some (measure  $P$ ) inspectors to inspect the producers and each inspector receives wage  $w$ . We assume that each inspector can detect upon inspection whether the producer has complied or not, and we shall also

---

<sup>7</sup> In fact  $A^*$  does not depend on credit market variables ( $\delta, \rho$ ) also. This does not mean that credit market imperfections do not matter. This is partly due to the fact that we have taken total bribe payment to be proportional to the net output. If bribe payment is a constant  $b$ , then  $A^*$  will depend on  $R$  and  $\eta$ . But then a rise in  $R$  would lead to a rise in  $A^*$ - suggesting a fall in the formal sector.

$$A^* = \frac{C}{\theta(1-q)} - \frac{qb}{(1-q)Rx}$$

<sup>8</sup> Since we have taken productivity to be same in both sectors, we do not wish to make too much of this observation. But later we shall introduce different  $R$  for the two sectors.

assume that each inspector inspects only one firm. The inspector can (truthfully) report non-compliance by the informal sector producer or suppress this information in exchange for a bribe.<sup>9</sup> But bribery gets exposed with some probability  $\delta$  and following exposure the corrupt inspector is fired. In addition to the loss of wage income, dismissal implies a personal cost  $m$ . This cost  $m$  is uniformly distributed over an interval  $[0, M]$ . We shall assume that this cost  $m$  is independent of total bribes received by the inspector.<sup>10</sup>

Since all producers will have to be inspected, the probability that an informal sector producer will be apprehended is given by  $\theta = P/(I+F)$ . We shall take that  $\theta$  is not a choice variable of the regulator. Hence  $P$  is adjusted to maintain this audit probability. The inspector will choose to report honestly if the following condition is satisfied.

$$w \geq (1-\delta)(y+w) + \delta(-m) \quad (9)$$

where  $y$  is the total bribe income received by the inspector. As is evident from the corruption literature, bribe will depend on several factors including the distribution of bargaining powers between inspector and the producer, the disagreement payoffs and the total benefit from collusion. In the previous section we had taken  $y = b(RK - (K - A)\rho)$ .<sup>11</sup> We assume that the firm makes a bribe offer to the inspector after being apprehended. Note that the private cost  $m$  is known only to the inspector. Hence while making an offer the firm takes in to account the fact that a low bribe offer will be rejected with a higher probability. More specifically a firm chooses bribe offer by solving the following problem,

$$\text{Max}(x - y) \left( \frac{1-\delta}{\delta} y - w \right) \quad x = RK - (K - A)\rho$$

where the second term is the probability that a bribe offer  $y$  will be accepted.

Assuming an interior solution and solving the first order conditions we get

$$y^*(x) = \frac{x}{2} + \frac{w\delta}{2(1-\delta)}, q(x) = \frac{(1-\delta)x - w\delta}{2\delta M} \quad (10)$$

---

<sup>9</sup> 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.

<sup>10</sup> When an inspector is found to have taken bribe from some producer, the moral indignation suffered is same as discovery of bribery from several producers. In the absence of heterogeneity this cost does not play any significant role. See Bose and Echazu (2007) for an analysis of bribery in the informal sector with other types of agent heterogeneity.

<sup>11</sup> Various authors (See Mishra 2005 and references therein) approach bribe determination as the solution to a symmetric Nash bargaining problem. For example, it can be shown that the producer has to pay a bribe of  $RK/2$  in the symmetric case with  $\delta=0$ . This can be thought of as a situation where the inspector makes a take it or leave it offer with probability  $1/2$ . In the present context, since  $m$  is private information, alternating offer approach gets very complicated.

Since  $x$  essentially depends on  $A$ , this implies that an entrepreneur with higher  $A$  (hence higher  $K$ ) will offer a higher bribe and has a greater chance of succeeding in bribing the inspector. The smaller and less wealthy firms will not be able to bribe their way out so easily. Once we solve for the bribe, we can rework the expected payoff in the informal sector.

$$V_I = (1 - \theta)x + \theta \frac{\{(1 - \delta)x - \delta w\}^2}{4(1 - \delta)\delta M} \quad (11)$$

$$x = RK - (K - A)\rho = \frac{AR\rho}{\rho - \delta R}(1 - \delta)$$

This implies that for a given  $w$  and  $m$ , an inspector is more likely to be honest when facing a producer with low  $K$ . Each firm will be inspected with the same probability  $\theta$ , but the probability of a corrupt deal between the firm and the inspector will depend on the firm's output  $RK$ . Informal sector producers have to be profitable enough for inspectors to actually participate in bribery

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 (11) and (4). Consider the marginal entrepreneur ( $A^*$ ) who is just indifferent between being in the formal or informal sector. Like before (see (5))  $A^* > C$  and it is reasonable to assume that  $A^*$  exists ( $A^* < \bar{A}$ ) in the present case. Consider the other marginal entrepreneur ( $A_0$ ) who is indifferent between staying in the informal sector and staying out of the production sector. Since the probability of a corrupt deal is increasing in  $A$  and  $V_I$  crucially depends on successful corrupt deals,  $A_0$  is associated with the threshold level of corruption which makes operation in the informal sector viable.

Figure 1 below plots  $V_F$  and  $V_I$ . The intersection of these two gives us  $A^*$ . As shown in the Figure 1 below, the position of  $A_0$  in relation to  $C$  (to the left or right) depends on the extent of corruption. Note that entrepreneurs lying to the left of  $C$  will not be in the formal sector, irrespective of the corruption possibilities. There are entrepreneurs ( $C < A < A^*$ ) who could have chosen to be in the formal sector but prefer to be in the informal sector. A fall in  $\theta$  or/and an increase in corruption possibilities would shift  $V_I$  upwards (shown by the dotted curve) leading to greater informal sector. From (11) it is clear that corruption possibilities are determined by wage rate  $w$  and the distribution of private cost  $m$ .

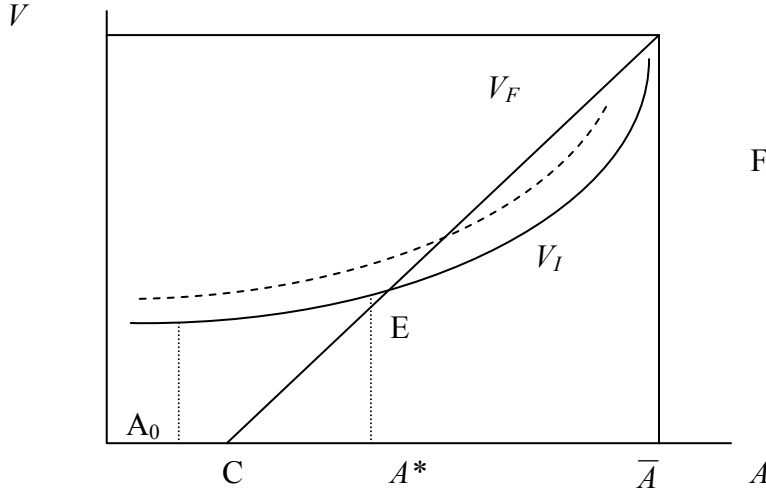


Figure 1

Obviously, for higher values of  $w$ , there will be less scope for corruption.<sup>12</sup> However,  $w$  can not be set arbitrarily. As discussed earlier, the total cost  $C$  also includes a tax component  $t$ . Since we have assumed that monitoring intensity  $\theta$  is given,  $w$  is determined by the following condition.<sup>13</sup>

$$wP = w\theta(F + I) = tF \quad (12)$$

A higher  $I$  (when the formal sector is unchanged) necessitates employment of more inspectors and hence a lowering of  $w$ . Likewise a higher informal sector at the cost of formal sector (so that  $I + F$  is unchanged) will lead to a lower wage.<sup>14</sup> A lower  $w$  in turn would mean a higher  $q$  for each level of  $A$ . We can describe this implicit relationship as  $q(S)$  with  $\frac{\partial q}{\partial S} > 0$ . To capture the extent of corruption, it will be convenient to refer to the average corruption level given by the following.

$$\hat{q} = \frac{1}{I} \int_{A_0}^{A^*} q(A)g(A)dA \quad (13)$$

<sup>12</sup> One can derive efficiency wage levels which will deter corruption. We have chosen the efficiency wage approach to corruption control. But corruption could be tackled through other means also. For example, the inspectors could receive rewards (as some fraction of producer's profit) for reporting. See Besley and McLaren (1990), Mookherjee and Png (1995) for different approaches.

<sup>13</sup> We have not included revenue collected from informal sector in this budget constraint. Inclusion of this revenue tilts the model in favor of a higher wage, since higher wage can induce greater honesty and hence the regulator is likely to collect penalties with greater probability. However, the basic insight that a smaller formal sector or/and a larger informal sector leads to a reduction in the inspector's wage carries through.

<sup>14</sup> It can be shown that we can not have a case where  $I$  rises but  $(I+F)$  falls significantly to raise  $w$ .

## 2.4 Joint determination

As discussed earlier, an entrepreneur's payoff from being in the informal sector will depend on the probability that the entrepreneur is able to bribe the inspector. As the level of corruption rises (probability of meeting a corrupt inspector rises), the expected payoff from being in the informal sector is higher and as a consequence  $A^*$  is also higher.

Figure 2 plots  $S(q)$  and  $q(S)$  showing the equilibrium levels of informality and corruption (point E). Recall that  $S$  refers to the relative size of the informal sector. To guarantee the existence of an interior equilibrium point, we assume that  $q(1) < 1$  and  $S(1) < 1$ . The first inequality is always going to be satisfied for higher values of  $M$ . This is similar to the assumption made in various models of corruption where a certain (however small) fraction of the population is always honest. Likewise, the second inequality will follow from the fact bribery is not costless. The producer in the informal sector will escape the stipulated punishment with certainty, but will nonetheless pay a substantial bribe to do so. Additionally,  $S(0) > 0$  and  $q(0) = 0$ .

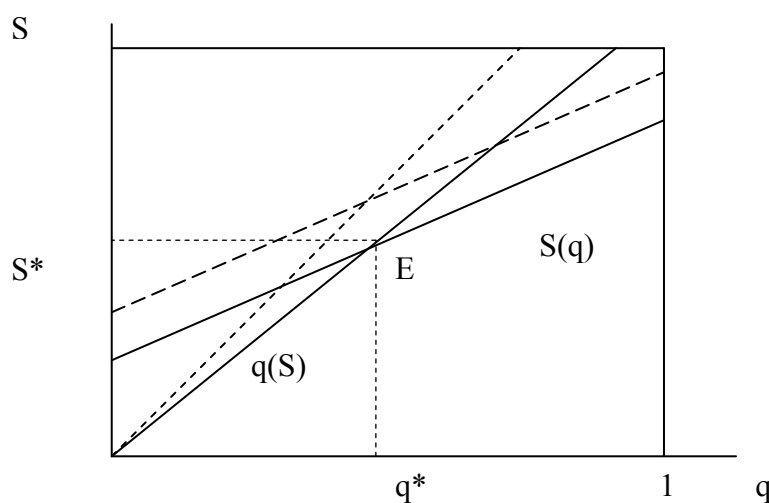


Figure 2

Following a rise in  $C$  the relative size of informal sector is higher even when the level of corruption is same. This leads to a shift in the  $S(q)$  (shown by the dotted line) resulting in higher informality and corruption.<sup>15</sup> Similarly, suppose anti-corruption

<sup>15</sup> While authors have linked  $C$  with extortion and bribery in the formal sector (i.e. Choi and Thum 2005), this result shows that corruption in the informal sector is also affected by changes in  $C$ . These complementarities between different forms of corruption have not been modeled.

efforts are more effective ( $\delta$  is higher) or the private cost of punishment goes up. This will lead to a shift in  $q(S)$  (shown by the dotted line) resulting in a fall in the levels of corruption and informality. In some other instances both these curves will shift.

Suppose enforcement efforts are raised by raising  $\theta$ . From proposition 1 we know that this will lead to a fall in the size of informal sector. But once we allow for level of corruption to be endogenously determined, the result is not unambiguous. A rise in  $\theta$  will imply a smaller  $w$  and consequently more corruptibility. Hence the deterrence effects of higher inspection get negated by a rise in corruption. The net effect will depend on the relative shifts in  $S(q)$  and  $q(S)$ .

**Proposition 2:** Let,  $q(I)$ ,  $I(q) < 1$  and  $I(0) > q(0)$ . Informality and corruption are jointly determined. Levels of informality and corruption will be higher following a rise in cost of entering the formal sector  $C$  or/and deterioration in anti-corruption efforts ( $\delta$ ). However, a rise in enforcement effort without corresponding rise in anti-corruption efforts will not have the desired affect on the size of the informal sector.

### 3. Inequality

How does the distribution of  $A$  affect the inspector's and the entrepreneur's choice? Recent empirical exercises (Rosser et.al. 2000, Chong and Gradstein 2007) have noted a negative link between inequality (as measured by Gini coefficient of income) and the size of informal sector. Similarly, the level of perceived corruption in an economy has also been shown to be negatively related to income inequality (You and Khagram 2005 Gupta et al 2000).<sup>16</sup> Our analytical construct suggests that inequality is likely to affect levels of both informality and corruption.

But the effect of changes in inequality is not so straight forward. Using figure 1 we can get an idea of how changes in inequality will affect the size of the informal sector.<sup>17</sup> Let  $G'$  denote the distribution of  $A$  following a redistribution of assets/income. Following the definition of  $I$ , it would follow that the informal sector will also go up if  $G'(A^*) > G(A^*)$ . However, informal sector is likely to be unchanged if  $G'(A_0) > G(A_0)$  and  $G'$  and  $G$  coincide over the interval  $[A_0 A^*]$ . Clearly inequality has increased, number of potential entrepreneurs with small  $A$  has increased but they

<sup>16</sup> While the negative link is not debated, the causation can run either way. A more unequal society leads to more corruption (see Dutta and Mishra (2005) for a theoretical contribution). Likewise, a corrupt society can worsen inequality by diverting productive resources to the rich.

<sup>17</sup> It must be noted that Straub (2005) will also lead to similar conclusion regarding effect of inequality. This highlights the fact that credit market imperfections are important but not the differential access.

are so poor that they don't enter the informal sector. In such case, inequality will have no effect on informality. Of course one can consider specific distributions of  $A$  and then show that a rise in inequality will raise informality.

Suppose asset  $A$  is distributed according to Pareto distribution.<sup>18</sup> This distribution captures the fact that in many developing countries, a very small fraction of the population own substantial wealth and there is concentration of individuals at the lower end. Since we are considering a population of potential entrepreneurs, it is expected that most will have asset in excess of certain absolute minimum  $A_m$ . We denote the Pareto index as  $\alpha$ . Then the cumulative distribution function of  $A$  is given by  $G(A) = 1 - (\frac{A_m}{A})^\alpha, \alpha \geq 1, A > A_m$ . Using (7) it can be shown that

$$S = 1 - (\frac{A_0}{A^*})^\alpha, \quad \frac{\partial S}{\partial \alpha} < 0 \quad (14)$$

For the Pareto distribution, the Gini coefficient of inequality  $\nu$  can be shown to be

$$\nu = \frac{1}{2\alpha - 1}, \quad \nu = 1 \quad \text{if} \quad \alpha = 1 \quad (15)$$

For a fixed  $A_m$ , this is a single parameter distribution and a rise in  $\nu$  (worsening inequality) can be interpreted as a fall in  $\alpha$ . From this it is clear that for higher values of  $\nu$ ,  $S$  will also be higher for the same level of corruption. This means the  $S(q)$  curve will shift upwards (like the dotted line in Figure 2). As a result, both corruption and informality rise in equilibrium.

**Proposition 3:** A rise in inequality (of assets) as measured by the Gini coefficient will lead to a rise in the size of the informal sector and the level of corruption.

As discussed earlier, some studies (i.e Dabla-Norris et.al. 2008) have noted that the informal sector is populated by less productive firms. Firms in the informal sector do not have access to benefits associated with various public goods and secure property rights.<sup>19</sup> However, our earlier discussions suggest that profitability in the informal sector can not be too low. What prevents informal sector profitability from being driven down? To answer this we need to consider the product market in the analysis. Firms in the formal and informal sectors receive the profits/returns  $R$  specified in

<sup>18</sup> However, it has to be a truncated distribution, since  $A$  has to be bounded above. We can not have infinitely large  $A$  as it would imply infinite  $K$  too. So all results presented in the text are approximations only.

<sup>19</sup> It is clear that causality runs both ways. A firm is less productive because it is located in the informal sector. The reverse is also possible, only less productive firm prefer to join the informal sector.



earlier sections through some form of competition. What determines the level of  $R$ , especially in the informal sector? We consider two different ways in which inequality and market forces affect  $R$ .

First, informal sector returns depend on the composition of firms operating in the formal sector. If the formal sector consists of highly productive efficient firms, one expects informal sector returns to be lower. We argue that inequality limits the entry of productive but wealth constrained firms in the formal sector. As a result, informal sector enjoys higher returns.

Second, informal sector returns are likely to be determined by the demand composition. It is reasonable to assume that there will be some amount of product differentiation between the formal and informal sector firms. Suppose formal sector produces higher quality good than the informal sector. We do not have data on product characteristics of firms in these two sectors but this assumption seems quite plausible.<sup>20</sup> In such a scenario income distribution of the consumers will determine the demand for informal sector goods.<sup>21</sup> Greater inequality means bigger demand and profitability for the informal sector.

### 3.1 Efficiency

Consider the basic model of Section 2 with the following differences. Potential entrepreneurs can be of two types of entrepreneurial ability; high ( $h$ ) and low ( $l$ ). Let  $H$  and  $L$  denote the measures of these two types of potential entrepreneurs. We also assume that credit market is non-existent. Productivity of the  $h$ -type entrepreneur in the formal sector is given by  $R_h$ . Productivity of the  $l$ -types in the formal sector and productivity of both types in the informal sector is simply  $R_l$ ,  $R_h < R_l$ . As discussed earlier  $R_l$  depends on the number of  $h$ -type entrepreneurs in the formal sector. In the informal sector, we consider the simpler version of section 2.2 where the probability of meeting a corrupt inspector is same for all firms and is fixed at  $q$ . Assuming  $\theta = l$ , we can derive the  $V_F$  and  $V_I$  as follows.

$$V_{Fh} = R_h(A - C), V_I = q.b.R_l A, V_{Fl} = R_l(A - C) \quad (16)$$

---

<sup>20</sup> A small roadside garage running an informal business is likely to provide lower quality services than the organized large garages.

<sup>21</sup> Note that these two routes refer to inequality of different sets of agents. The first argument relies on the distribution of income or wealth amongst producers, while the second uses the distribution of income amongst consumers to derive demand functions. Empirically, the inequality measure refers to the overall economy wide distribution.

The h-type entrepreneurs with  $A \geq A_h^*$  will choose to be in the formal sector where

$$A_h^* = \frac{R_h C}{R_h - q.b.R_l} \quad (17)$$

We can derive a similar condition for the l-type entrepreneurs. The number of h-type formal sector entrepreneurs will be given by

$$F_h = H \int_{A_h^*}^{\bar{A}} g(A) dA \quad (18)$$

Recall that  $R_l = R(F_h)$  and  $R' < 0$ . Consider a situation where  $G(A_h^*)$  is small. This suggests that  $F_h$  is large leading to a low  $R_l$ . But a lower  $R_l$  means that  $A_h^*$  is also lower and more h-type entrepreneurs would join the formal sector. The informal sector will be populated by some h-type ( $A < A_h^*$ ) and more l-types with  $A < C/(1 - qb)$ . However, a lower  $R_l$  implies that those with lower  $A$  will choose to be outside the production sector. In the limiting case, as  $R_l \rightarrow 0$ ,  $F_h$  reaches its maximum ( $A_h^* \rightarrow C$ ). If the number of wealth-constrained entrepreneurs rises following a redistribution of assets, the number of h-type entrepreneurs entering the formal sector shrinks significantly. As  $F_h$  falls initially due to redistribution,  $R_l$  increases leading to further expansion of the informal sector and fall in  $F_h$ . The figure below shows how the informal sector grows following a change in distribution of  $A$ . The solid and dashed  $V_l$  lines show the payoff to being in the informal sector before and after the redistribution. The initial redistribution might have been small but the resultant effect on the informal sector is substantial.

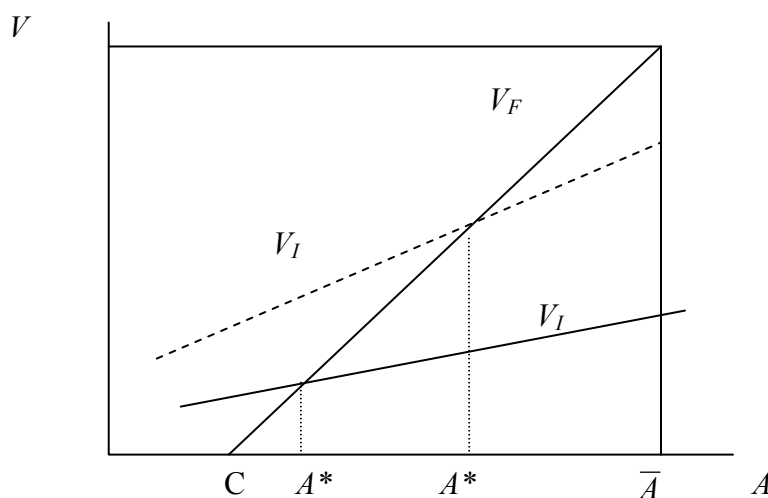


Figure 3

### 3.2 Product Differentiation

Suppose we have N industries, each industry has two potential firms (one in the formal sector (F) and the other in the informal sector (I)) which are producing goods that are close substitutes.<sup>22</sup> These two firms compete by choosing prices  $p_F$  and  $p_I$ . On the demand side consumers have identical tastes for this good but have different income  $Y$ . Let  $Y(j)$  be the income of consumer  $j$ , where  $j$  is distributed uniformly over  $[0, 1]$  and  $Y(j) = b + zj$ ,  $z > 0$ .<sup>23</sup> Consumers purchase either one unit of this good (F or I) or none. Utilities are given by

$$\begin{aligned} U_0 &= u_0 \cdot (Y(t)), U_F = u_F \cdot (Y(t) - p_F), U_I = u_I \cdot (Y(t) - p_I) \\ u_F &> u_I > u_0 \end{aligned} \quad (19)$$

Firms F and I compete in the market by choosing prices  $p_F$  and  $p_I$ . Let  $R_F, R_I$  denote the corresponding profit functions. We shall be looking at an equilibrium price pair  $(p_F^*, p_I^*)$  such that

$$R_F(p_F^*, p_I^*) \geq R_F(p_F, p_I^*), R_I(p_F^*, p_I^*) \geq R_I(p_F^*, p_I) \quad (20)$$

To see how distribution of income matters, let us consider specific example with  $u_F=20$ ,  $u_I=10$  and  $u_0=5$ . Consumer  $j$  is indifferent between buying F and I if and only if

$$20(Y(j) - p_F) = 10(Y(j) - p_I) \quad \text{or} \quad Y(j) = 2p_F - p_I \quad (21)$$

Hence all consumer with income greater than  $Y(j)$  will purchase from firm F.

Likewise, consumer  $i$  is indifferent between buying the low quality I and not buying if and only if

$$10(Y(i) - p_I) = 5Y(i) \quad \text{or} \quad Y(i) = 2p_I \quad (22)$$

Using this we can write down the demand functions facing the two firms

$$\begin{aligned} d_F &= \frac{Y(1) - Y(f)}{z} = \frac{b + z - 2p_F + p_I}{z} \\ d_I &= \frac{Y(f) - Y(0)}{z} = \frac{2p_F - p_I - b}{z} \end{aligned} \quad (23)^{24}$$

<sup>22</sup> It is essentially a slight variation of price competition model studied by Gabszewicz and Thisse (1979) and several others in later years. It shows that high income inequality is necessary for the informal sector firm to have a positive market share.

<sup>23</sup> It can be verified that for this distribution the mean income  $\mu$  and standard deviation  $\sigma$  are given by

$$\mu = b + \frac{z}{2}, \quad \sigma = \frac{z}{2\sqrt{3}}$$

<sup>24</sup> This implies that all the consumers are being served and  $Y(i) < Y(0)$ , the lowest income is greater than the income of the consumer indifferent between purchasing I and not purchasing. We can have other cases as well. The demand functions will be piece-wise linear. We have considered just one linear

The corresponding profits are given by

$$R_F = (p_F - c_F)d_F \text{ and } R_I = (p_I - c_I)d_I \quad (24)$$

Taking the first order conditions and solving the two reaction functions, it can be shown that there is an equilibrium where

$$R_I^* = \frac{\{(z-b) - (c_I - 2c_F)\}^2}{3z} \quad (25)$$

It can be verified that this indeed is the unique equilibrium over the relevant range of parameters. This equilibrium is feasible if and only if

$$z - b > c_I - c_F \quad (26)$$

From the mean and standard deviation of  $Y(j)$  (see footnote 23) it follows that income disparities captured by  $\sigma$  has to be high enough for the above condition (26) to hold.

Then condition (26) can be rewritten as

$$\sigma \geq \frac{\mu + c}{3\sqrt{3}} \quad c = (c_I - c_F) \quad (27)$$

Basically, without sufficient income disparity it is not possible to generate demand for the low quality product, the informal sector firm in the present case. Suppose different industries have differing cost gap  $c$ . Then as inequality rises, it is possible more and more industries to have viable informal sector firm. For low levels of income disparity, we can have only F type firms in most industries and informal sector will be small.<sup>25</sup> Hence the product market considerations imply a negative link between informality and inequality. The discussions of the previous two subsections can be summarized as follows.

**Proposition 4:** Higher inequality helps to boost returns to production in the informal sector (i) by preventing wealth-constrained but efficient firms from entering production and (ii) by generating greater consumer demand for low quality informal sector products. Consequently, greater inequality will lead to a rise in informality and corruption.

---

segment for each, this would require us to verify that the equilibrium prices are such that demands lie in these segments.

<sup>25</sup> It is possible to demonstrate this formally but the analytics seem to take us beyond the scope of this paper.

## 4. Data and Empirical Analysis.

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 is perceived by individual firms, how it changes over time, and about the various constraints on firm performance and growth. It provides the world's most comprehensive company-level data in emerging markets and developing economies<sup>26</sup>. 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. The data set, one of the largest of its kind, is a cross country data set covering a range of developing and developed countries at various stages of development. 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) and International Country Risk Guide (ICRG), respectively, which have been widely used in recent studies<sup>27</sup>. 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. Unlike the study by Dabla-Norris et. al. (2008) , which also used the WBES data covering around 40 countries but for only a single year, the present study considered the same countries but pooled over multiple years, thus, allowing us to record the direction of change in informal shares over time after controlling for its principal determinants. The list of countries by years and showing the number of

---

<sup>26</sup> 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.

<sup>27</sup> See the following websites on details of these perception indicators:  
[http://en.wikipedia.org/wiki/Corruption\\_Perceptions\\_Index](http://en.wikipedia.org/wiki/Corruption_Perceptions_Index) ;  
<http://www.adbi.org/3rdpartyedrom/2004/12/01/1359.international.country.risk/>

firms interviewed in each country is presented in Appendix table A2. Starting from a total of 27,086 observations ,as 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.

Tables 1a and 1b presents 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 was based on the treatment of the corruption perception indicator ,icrg, for possible endogeneity. Tables 1a and 1b differ because while the former (table 1a) includes the bribe demand on the individual firm as a determinant of that firm's informal sales, the latter (table 1b) 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. Table 1a and 1b provide strong and robust support to the proposition on a positive association between corruption perception and informal sales. In other words, firms that operate in countries that are perceived to be at higher risk from corruption report, ceteris paribus, a higher share of its sales as informal sales. It is worth noting that this result is robust to the instrumentation of corruption perception by freedom of press and CO<sub>2</sub> emissions. The positive, large and statistically significant estimate of the coefficient of the bribe demand variable in Table 1a 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. Income inequality has a strong and positive effect on informal sales. Consistent with the proposition<sup>28</sup> derived earlier, increasing inequality leads to a large increase in the size of the informal sector. 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 increase requiring early policy intervention. 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

---

<sup>28</sup> 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.

exogenous determinant. These tables also provide evidence on the validity of the instruments used.

Other results from table 1a, 1b 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 1a and 1b 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. The evidence contained in Tables 1(a) and 1(b) provide strong empirical support to the propositions in Sections 2 and 3. The results presented in Table 1a establish a positive correlation between bribe demand and informality and, in particular, suggest that firms that are asked to pay bribes will declare a lower share of their sales and increase informality. However, this relationship can go the other way as well since firms that go informal are more likely to receive bribe demands. 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 consistent with the discussion on their joint determination in Section 2.4. The results are presented in Table 2 which 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 1a, namely, the positive impact of bribe demand on informality is not only robust but the effect is actually stronger in Table 2 which allows for two way feedback between the two. Table 2 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 1 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, consistent with our earlier discussion, inequality 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 2 suffers from the limitation that while the joint estimations consider the effect of micro level business corruption in the form of the WBES variable, bribe demands, on informal sales, it does 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 3. 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 1a,1b, 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 1 and 3 to be robust between the single equation and the simultaneous equation estimates. Note from Table 3 that rising inequality as measured by the Gini leads to an increase in both informal sales and bribe demands as stated in our Proposition, but the effect on the latter is much weaker. Increasing literacy rates and improvements in the human development index lead to lower bribe demand in the country. Table 3 reports that, after controlling for a host of firm level characteristics and country indicators, there has been a large increase in informality in contrast to a small decline in bribe demand.

## 5. Conclusion

We have looked at the determinants of the size of the informal sector in developing countries. Large informal sectors are predominant in developing countries. Corruption is also pervasive in many of these countries. This is not a simple coincidence. The paper proposes an analytical model where corruption and informality are closely linked. In fact corruption and informality are jointly determined by a common set of variables. Our empirical exercises using firm level data support this approach. While we do not dispute several earlier observations that higher tax rates in the formal sector and inefficient regulations drive firms to the informal sectors, these observations fail to explain why firms in the informal sector find it viable and in

many cases profitable to operate. Corruption in the informal sector allows the informal sector firms to enjoy greater protection from enforcement and consequently higher profits. Corruptible inspectors, in turn, thrive when there is a large informal sector. For a fixed size of formal sector, a larger informal sector implies poorer enforcement effort and lower efficiency wages for the inspectors.

Corruption and informality complement each other and are jointly determined by several firm level as well as economy level variables like levels of development, literacy levels. Our key contribution lies in exploring the link between informality and inequality. Our theoretical model as well empirical exercises focus on wealth/income inequality as a key determinant. High degree of inequality leads to bigger informal sector. We offer several plausible channels through inequality can impact the size of the informal sector.

There are three different ways in which inequality can affect informality and corruption. The first one is the most obvious and direct route where greater wealth inequality in the sense of large number wealth constrained individuals can lead to larger informal sector. Formal sector is normally associated with larger fixed costs and these wealth constrained individuals are forced to join the informal sector in the absence of well functioning credit markets. The other two are less obvious. We argue that greater inequality limits the entry of productive but wealth constrained firms in the formal sector. As a result, informal sector enjoys higher returns. Third, informal sector returns are likely to high due to a strong demand for informal sector goods emanating from distributional issues. Greater inequality in income distribution of the consumers will mean bigger demand and profitability for the informal sector. The empirical exercises show that this relation between informality and inequality is indeed quite robust.

**Table 1a: OLS and IV Estimates of Informal Sales<sup>a</sup> (with the bribe demand variable included)**

Variables <sup>b</sup>	Coefficient <sup>c</sup>	Robust SE	P> t	Variables <sup>b</sup>	Coefficient <sup>c</sup>	Robust SE	P> t
icrg	2.55*	0.29	0.000	icrg_IV <sup>d</sup>	5.99*	0.61	0.000
Bribe demand	1.79*	0.39	0.000	Bribe demand	2.08*	0.43	0.000
size	-1.70*	0.26	0.000	size	-1.71*	0.27	0.000
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	0.194	DEffGovt	0.41	0.76	0.590
BClegalsyst	0.64*	0.22	0.004	BClegalsyst	0.69*	0.20	0.000
BCcanticomp	1.21*	0.18	0.000	BCcanticomp	1.15*	0.17	0.000
BCcrime	-1.41*	0.21	0.000	BCcrime	-1.28*	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	0.062
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	0.058
Dexport	0.60	0.49	0.225	Dexport	1.03**	0.48	0.032
Dforeign	-4.35*	0.55	0.000	Dforeign	-4.23*	0.59	0.000
year	0.30***	0.18	0.096	year	0.45**	0.19	0.019
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	0.007
lgnp	-0.31	0.75	0.683	lgnp	-1.97**	0.78	0.011
rol	-6.31*	0.50	0.000	rol	-7.68*	0.61	0.000
literacy	0.51*	0.05	0.000	literacy	0.49*	0.04	0.000
constant	-583.65	367.23	0.112	constant	-867.58**	390.11	0.026
Number of Obs.			17662	Number of Obs.			17606
F(23, 17638)			140.99	F(23, 17582)			133.96
Prob>F			0.000*	Prob>F			0.000*
R-squared			0.148	Anderson stats: $\chi^2$ (2)	4353.198		0.000*
Root MSE			23.753	Sargan stats: $\chi^2$ (1)	0.22		0.6387*

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 CO<sub>2</sub> emission.

**Table 1b: OLS and IV Estimates of Informal Sales<sup>a</sup> [with the bribe demand variable excluded]**

Variables <sup>b</sup>	Coefficient <sup>c</sup>	Robust SE	P> t	Variables <sup>b</sup>	Coefficient <sup>c</sup>	Robust SE	P> t
icrg	2.47*	0.29	0.000	icrg_IV <sup>d</sup>	5.73*	0.61	0.000
size	-1.74*	0.27	0.000	size	-1.75*	0.27	0.000
firmage	-0.07*	0.01	0.000	firmage	-0.07*	0.01	0.000
conf_justice	-0.84*	0.14	0.000	conf_justice	-0.93*	0.13	0.000
DEffGovt	1.19	1.00	0.234	DEffGovt	0.32	0.76	0.676
BClegalsyst	0.63*	0.22	0.005	BClegalsyst	0.68*	0.20	0.001
BCanticomp	1.24*	0.18	0.000	BCanticomp	1.17*	0.17	0.000
BCcrime	-1.43*	0.21	0.000	BCcrime	-1.30*	0.20	0.000
BCcorrupt	1.95*	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	0.41**	0.18	0.024
BClabregu	0.77*	0.20	0.000	BClabregu	0.70*	0.19	0.000
income	1.40*	0.40	0.000	income	0.90**	0.43	0.037
Dexport	0.59	0.49	0.231	Dexport	1.00**	0.48	0.038
Dforeign	-4.29*	0.55	0.000	Dforeign	-4.17*	0.59	0.000
year	0.24	0.18	0.195	year	0.37***	0.20	0.057
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	0.038
lgnp	-0.29	0.75	0.702	lgnp	-1.87**	0.78	0.017
rol	-6.53*	0.50	0.000	rol	-7.87*	0.61	0.000
literacy	0.48*	0.05	0.000	literacy	0.47*	0.04	0.000
constant	-448.48	369.48	0.225	constant	-697.25***	391.42	0.075
Number of Obs.			17662	Number of Obs.			17606
F(22, 17639)			141.93	F(22, 17583)			139.13
Prob>F			0.000*	Prob>F			0.000*
R-squared			0.147	Anderson stats: $\chi^2(2)$	4402.454		0.000*
Root MSE			23.764	Sargan stats: $\chi^2(1)$	0.652		0.4195*

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 CO<sub>2</sub> emission.

**Table 2: Joint Estimates of Informal Sales and Bribe Demand (with country level corruption perception indicators excluded)**

Informal Sales <sup>a</sup>				Bribe demand <sup>a</sup>			
Variables <sup>b</sup>	Coefficient <sup>c</sup>	Robust SE	P> z	Variables <sup>b</sup>	Coefficient <sup>c</sup>	Robust SE	P> z
Bribe demand	2.95*	0.42	0.000	informal_sales	0.00*	0.00	0.000
size	-1.55*	0.27	0.000	size	-0.02*	0.00	0.000
firmage	-0.08*	0.01	0.000	firmage	0.00*	0.00	0.000
conf_justice	-0.83*	0.13	0.000	conf_justice	-0.02*	0.00	0.000
DEffGovt	3.69*	0.74	0.000	DEffGovt	-0.07*	0.01	0.000
BClegalsyst	0.42**	0.20	0.033	BClegalsyst	-0.01***	0.00	0.091
BCanticomp	1.29*	0.17	0.000	BCanticomp	0.01*	0.00	0.001
BCcrime	-1.07*	0.19	0.000	BCcrime	-0.01**	0.00	0.032
BCcorrupt	2.46*	0.20	0.000	BCcorrupt	0.04*	0.00	0.000
BCinstable	1.10*	0.19	0.000	BCinstable	-0.01**	0.00	0.014
BCpolicy	-0.69*	0.20	0.000	BCpolicy	0.00	0.00	0.454
BClic	0.15	0.18	0.410	BClic	0.03*	0.00	0.000
BClabregu	0.53*	0.18	0.004	BClabregu	0.01*	0.00	0.006
income	1.16*	0.36	0.001	income	0.04*	0.01	0.000
Dexport	0.64	0.47	0.174	Dexport	-0.01	0.01	0.504
Dforeign	-4.98*	0.59	0.000	Dforeign	0.03*	0.01	0.001
year	0.52*	0.19	0.006	year	-0.04*	0.00	0.000
npl	0.21*	0.05	0.000				
gini	0.47*	0.03	0.000	gini	-0.01*	0.00	0.000
lgnp	-3.69*	0.65	0.000	lgnp	0.09*	0.02	0.000
				rol	-0.15*	0.01	0.000
				hdi	-1.12*	0.18	0.000
				unempl	0.00***	0.00	0.064
				literacy	-0.02*	0.00	0.000
				lpop	-0.03*	0.00	0.000
constant	-1013.53*	382.12	0.008	constant	77.56*	6.56	0.000
Number of Obs.			17904	Number of Obs.			17904
Wald test of significance:				Wald test of significance:			4713.72
$\chi^2$ (20)			2632.51	$\chi^2$ (24)			
Prob > $\chi^2$			0.000*	Prob > $\chi^2$			0.000*
R <sup>2</sup>			0.126	R <sup>2</sup>			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 3: Joint Estimates of Informal Sales and Bribe demand (with country level corruption perception indicators, icrg and cpi included)**

Informal Sales <sup>a</sup>				Bribe demand <sup>a</sup>			
Variables <sup>b</sup>	Coefficient <sup>c</sup>	Robust SE	P> z	Variables <sup>b</sup>	Coefficient <sup>c</sup>	Robust SE	P> z
Bribe demand	-0.66	0.52	0.204	informal_sales	0.00*	0.00	0.002
icrg	3.60*	0.42	0.000	cpi	0.01	0.01	0.131
size	-0.41	0.34	0.232	size	-0.01***	0.01	0.094
firmage	-0.08*	0.01	0.000	firmage	0.00*	0.00	0.000
conf_justice	-0.84*	0.17	0.000	conf_justice	-0.02*	0.00	0.000
DEffGovt	3.21*	1.00	0.001	DEffGovt	-0.02	0.02	0.184
BClegalsyst	0.61**	0.26	0.018	BClegalsyst	0.00	0.00	0.622
BCanticomp	1.62*	0.22	0.000	BCanticomp	0.02*	0.00	0.000
BCcrime	-0.81*	0.25	0.001	BCcrime	-0.01	0.00	0.169
BCcorrupt	1.75*	0.26	0.000	BCcorrupt	0.05*	0.00	0.000
BCinstable	0.95*	0.24	0.000	BCinstable	0.00	0.00	0.743
BCpolicy	-1.27*	0.25	0.000	BCpolicy	0.00	0.00	0.702
BClic	0.04	0.23	0.865	BClic	0.03*	0.00	0.000
BClabregu	0.36	0.23	0.123	BClabregu	0.02*	0.00	0.000
income	-1.78*	0.48	0.000	income	0.17*	0.01	0.000
Dexport	0.83	0.59	0.161	Dexport	-0.01	0.01	0.177
Dforeign	-4.53*	0.77	0.000	Dforeign	0.00	0.01	0.928
year	15.00*	0.71	0.000	year	-0.06*	0.01	0.000
npl	2.49*	0.11	0.000				
gini	1.68*	0.06	0.000	gini	0.00*	0.00	0.000
lgnp	2.65**	1.07	0.013	lgnp	0.22*	0.03	0.000
				rol	-0.24*	0.03	0.000
				hdi	-3.02*	0.40	0.000
				unempl	0.01*	0.00	0.000
				literacy	-0.05*	0.00	0.000
				lpop	-0.05*	0.00	0.000
constant	-30154.39*	1424.96	0.000	constant	121.50*	26.58	0.000
Number of Obs.			10883	Number of Obs.			10883
Wald test of significance: $\chi^2$ (21)			3030.20	Wald test of significance: $\chi^2$ (25)			2450.56
Prob > $\chi^2$			0.000*	Prob > $\chi^2$			0.000*
R <sup>2</sup>			0.218	R <sup>2</sup>			0.184
Root MSE			23.110	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 A1: Appendix – Variable Definitions and Data Sources.**

<b>WBES Variables</b>	<b>Firm characteristics</b>	<b>Definition (Source: A)</b>
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	Small if 5-50 employees; medium if 51-500 employees; large if >500 employees
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	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
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
---------	----------	---

**Table A1: Continued**

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
<b>Country Variables</b>	<b>Country characteristics</b>	<b>Definition (Source)</b>
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 <sub>2</sub> Emission	Per capita CO <sub>2</sub> 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)
<b>Source:</b>		
<b>A</b>	WBES	<a href="http://www.worldbank.org/wbi/governance/">http://www.worldbank.org/wbi/governance/</a>
<b>B</b>	WDI	<a href="http://www.worldbank.org/data">www.worldbank.org/data</a>
<b>C</b>	HDR, UNDP	<a href="http://hdr.undp.org/en/">http://hdr.undp.org/en/</a>
<b>D</b>	CPI	<a href="http://www.transparency.org/">http://www.transparency.org/</a>
<b>E</b>	ICRG	International Country Risk Guide, Report by The PRS Group, Inc. (1984-2008)
<b>F</b>	World Governance Indicators 96-07	<a href="http://info.worldbank.org/governance/wgi/index.asp">http://info.worldbank.org/governance/wgi/index.asp</a>
<b>G</b>	Wikipedia	<a href="http://en.wikipedia.org/wiki/Landlocked">http://en.wikipedia.org/wiki/Landlocked</a>
<b>H</b>	World Database of Happiness	<a href="http://worlddatabaseofhappiness.eur.nl/statnat/statnat_fp.htm">http://worlddatabaseofhappiness.eur.nl/statnat/statnat_fp.htm</a>



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

<b>Country</b>	<b>Year</b>	<b>Number of firms</b>
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
<b>Table A2: Continued</b>		
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
<b>Total</b>		<b>27086</b>

## References

- Ades, A., Di-Tella, R., 1999. Rents, competition and corruption. *American Economic Review*, 89( ) 982-93.
- Batra, G., Kaufmann, D., Stone, A.H., 2003. The firms speak: what the World Business Environment Survey tells us about constraints on private sector development. Working Paper, World Bank.
- Besley, T., Maclaren, J., 1993. Taxes and bribery: The role of wage incentives. *Economic Journal*, 103(416), 119-141.
- Bose, P., Echazu, L., 2007. Corruption with heterogenous enforcement agents in the shadow economy. *Journal of Institutional and Theoretical Economics*. 163, 285-296.
- Choi, J., Thum, M., 2005. Corruption and the shadow economy. *International Economic Review* 46, 817-836.
- Chong, A., Gradstein, M., 2007. Inequality and Informality. *Journal of Public Economics* 91, 159-179.
- Cule, M., Fulton, M., 2005. Some implications of the unofficial economy. *Economics Letters* 89, 207-211.
- Dabla-Norris, E., Gradstein, M., Inchauste, G., 2008. What causes firms to hide output? The determinants of informality. *Journal of Development Economics* 85, 1-27.
- Djankov, S., La-Porta, R., Lopez-de-Silanes, F., Shleifer, A., 2002. The regulation of entry. *Quarterly Journal of Economics*, 117, 1-37.
- Dutta, I., Mishra, A., 2005. Inequality, corruption and competition in the presence of market imperfections. WIDER Research Paper Series RP 2005/46, UNU-WIDER, Helsinki.
- Friedman, E., Johnson S., Kaufmann, D., Zoido-Lobaton, P., 2000. Dodging the grabbing hand: The determinants of unofficial activity in 69 countries. *Journal of Public Economics*, 76, 459-493.
- Gabszewicz, J., Thisse, J., 1979. Price competition, quality and income disparities. *Journal of Economic Theory* 20, 340-359.
- Gupta, S., Davoodi, H., Alonso-Terme, R., 2002. Does corruption affect inequality and poverty? *Economics of Governance* , 3, 23-45.
- Johnson, S., Kaufmann, D., Zoido-Lobaton, P., 1998. Regulatory discretion and the unofficial economy. *American Economic Review Papers and Proceedings* 88,387-392.
- Loayza, N., 1996. The economics of the informal sector. Carnegie-Rochester Conference Series on Public Policy 45, 129-162.
- Matsuyama, K., 2000, Endogenous Inequality. *Review of Economic Studies* 67, 743-759.
- Mishra, A., 1995. *Economics of Corruption*. Oxford University Press, New Delhi.
- Mookherjee, D., Png, I., 1995. Corruptible law enforcers: how should they be compensated. *Economic Journal*, 105, 149-159.
- Rauch, J., 1991. Modeling the informal sector formally. *Journal of Development Economics* 35, 33-47.
- Rosser, J.B. Jr, Rosser, M.V., Ahmed, E., 2000. Income inequality and the informal economy in transition countries. *Journal of Comparative Economics* 28, 156-171.
- Schneider, F., Ernste, D., 2000. Shadow economies: Size, causes and consequences. *Journal of Economic Literature*. 38, 77-114.

- Shaked, A., Sutton, J., 1982. Relaxing price competition through product differentiation. *Review of Economic Studies* XLIX, 3-13.
- Straub, S., 2005. Informal sector: the credit market channel. *Journal of Development Economics* 78, 299-321.
- You, J-S., Khagram, S., 2005. A comparative study of inequality and corruption, *American Sociological Review* 70, 136-157.