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Corruption and Competition in the presence of Inequality and Market Imperfections *

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ABSTRACT

We analyze the relation between corruption, competition and inequality in a developing economy context where markets are imperfect and there is wealth inequality. We consider an economy where different types of households (potential firms) choose whether to enter production sector or not. The potential firms may be either efficient or inefficient. The credit market is characterised by information asymmetry and wealth inequality. As a result the market fails to screen out the inefficient types. In addition to the imperfect screening in the credit market, the inefficient type's entry is further facilitated by corruption in the product market. These inefficient types also find it profitable to engage in corruption and their presence in the market leads to a rise in corruption. We analyze the market equilibrium and look at some of the implications. We show that a rise in inequality can lead to an increase in corruption, and greater competition and higher levels of corruption can co-exit.

Key Words: Corruption, Competition, Credit Market, Inequality, Screening.
JEL Classification Number: D60, I20, R20.
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1 Introduction

Corruption has received a lot of attention from various quarters- especially in the context of developing economies. In both academic as well as policy circles, there is a general perception that greater competition is associated with low levels of corruption (Rose-Ackerman, 1996; Ades and di Tella, 1999). Recently, however, this view has come under further scrutiny (Laffont and N'Guessan, 1999). The last decade has seen liberalization, freeing up of many markets and large scale entry of private firms[1], but corruption seemed to be on the rise. One can associate many developing and transitions economies with 'increases in competitiveness of the economic environment and a rise in corruption'. In this paper we provide an explananation of why competition and corruption may co-exist. Our approach analyzes corruption in a multimarket framework and explicitly takes into consideration other factors which are common features of these economies- wealth inequality and market imperfections. We show that inequality plays a crucial role in understanding the link between corruption and competition. In the literature[2], corruption is studied mainly in the context of problems in that particular market, be it informational asymmetries or incentive structure. While we do not doubt the merit of this, we feel that it is important to see if this problem is related to imperfections in other related markets. Here, our focus is on the link between corruption in the product market and wealth inequality and imperfections in the credit market. We argue that they reinforce each other and it may not be sufficient to look at just corruption alone.

In this context it is important to bear the nature of corruption in mind. Most of the literature adopt what we call a 'victimization' approach- agents pay bribes because of extortionary demand by the public officials[3]. Bribe paying

[1] The number of firms reported by CMIE for the manufacturing sector of India has gone up from 1481 in 1990 to 4272 in 1999. Similarly, in many East Europen countries the growth in the number of small private firms is quite noticeable.

[2] See Bardhan (1997), Andvig and Fjeldstad (2001) for recent surveys on corruption.

[3] Most of the leading models i.e. Shleifer and Vishny (1993), Bliss and di Tella (1996) and the recent firm level studies discussed later, follow the extortion view. This is not true for the agency based models of corruption-i.e. Mookherjee and Png (1995), Laffont and N'Guessan(1999).

agents are not viewed as the real beneficiaries. We don't deny this but we argue that the extortion view does not explain the whole picture. Corruption also involves collusion and agents differ in terms of their benefits from corruption. This feature of corruption is key to the present paper.

It is quite clear from the extortion view of corruption that as extortion payments increase, profitability decreases and fewer firms stay in the market[4]. The causation can run in reverse also. Fewer firms would mean higher profit (monopoly rent) and this leads to greater possibility of bribe extraction and more corruption. Firms with monopoly rents have the incentive to bribe officials to retain their monopoly profit. So in this case, corruption would imply that potential competitors are denied entry into the market, hence corruption helps reduce competition. On the other hand, if we take the collusion view and consider markets where efficient and inefficient firms can coexist, the opposite results may follow. It is possible that these highly inefficient firms thrive because of corruption and corruption allows the entry of these firms.

However, corruption alone may not be sufficient. Other forms of imperfections are also necessary for the presence of these firms. If these firms are inefficient (high risk and low return), how do they exist in the market? Won't market forces drive them out? Possibly yes, but as we show informational problems and wealth constraints in the credit market may contribute to these inefficient firms' existence. Hence, in some sense, corruption surfaces in the product market because of inequality and informational problems in the credit market. More specifically, we analyze how the credit market is not able to screen out inefficient firms. The screening mechanism breaks down because some households are wealth constrained. Since the inefficient type firms engage in corruption, it affects not just their payoffs but also the payoffs of the efficient firms and determines the overall market outcome. The inefficient firms tend to get subsidised

[4]Bliss and diTella (1996) first addressed the relation between corruption and competititon. The same issue has been developed from different perspectives in Laffont and N'Guessan (99), Ades and diTella (99). This howerver is not related to other notion of competititon among public officials which might reduce corruption. Some would argue (see Rose-Ackerman (1996)) that any kind of competition would reduce corruption.

inthe credit market and benefit from corruption- thus making their operation viable and possibly profitable.

Even though we do not model competition in the product market, our paper is similar to the studies looking at the relation between competition and corruption. Here also the number of firms in the production sector is being determined endogenously. As has been rightly pointed by Bliss and di Tella (1996), one would need to go beyond the simple measure of the number of firms to capture competition. But we don't have any alternative measure. Competition, in the sense of simply the number of firms, may not be a good outcome in our model context. If too many inefficient types enter the market at the cost of the efficient types then the total number of the firms might go up but the total expected output might be less. So the effect of corruption on competition is not quite straightforward. Corruption can lead to a rise in the total number of firms[5].

Although corruption manifests itself in many ways, here we only consider the problem of firms engaging in various acts of bribery to avoid legal costs of doing their business. These costs could include taxes, hiding of output, failure to meet standards and controls. There is a sizable literature looking at this problem but mainly from the public organizational point of view. It looks at why public officials accept bribes and what can be done to reduce this problem. Only recently, the focus has shifted somewhat towards the firms and one can ask why firms pay bribes. Hellman et.al. (2000) report a firm level questionnaire based survey[6] and argue that firm governance should also be considered in addition to national governance. Similarly, Johnson et.al. (1999) use a survey of private manufacturing firms in a selected set of East European countries to study the relationship between corruption and hiding of output by the firms. Svensson (2003) finds (based on a survey of firms in Uganda) that there is significant differences between bribe payments by firms. In our framework, firms differ in

[5] Over-crowding due to market imperfections has been noted, see for example deMeza and Webb (1992).

[6] They use the 1999 BEEPS data and analsye response from a large sample of firms in more than 20 countries in Eastern Europe and former Soviet Bloc. We discuss it in the next section.

terms of their benefits from corruption and only the inefficient (low profitability) end up paying bribes for various illegal activities[7].

Our paper differs from other papers in the literature in three main aspects. First, the paper uses a multi-market framework to explore the link between corruption, competition and wealth inequality. Credit market imperfections coupled with wealth inequality leads to corruption. Corruption makes the situation worse by leading to exit of the low risk firms and further entry of high risk firms. Our model captures the various kinds of externalities that one type might generate for other types. This can lead to a somewhat different focus so far as policy implications are concerned. It shows that policy intervention crucially depends on the nature of outcomes in the other market. Policy intervention in the credit market, for example, will depend on the extent of corruption. In some cases, corruption makes it difficult to implement other policies aimed at addressing the credit market problems arising out of inequality. Likewise, anti corruption policies have to be evaluated in the light of the credit market outcomes. In general, anti corruption policy analysis take a partial equilibrium approach and focus on the same market where corruption takes place (in this case tax collection). In the present case that would mean looking at tax reforms and system of incentives for the tax inspectors. Our paper, complementary to this approach, would point also in the direction of the credit market. This, we consider, is an important point to bear in mind while designing policies especially in developing countries where more than one market exhibit various kinds of imperfections. This view in a wider context is not new[8], but is worth emphasizing in the context of corruption.

Second, the collusion-view of corruption generates different implications compared to the extortion-view of corruption. We feel that both the features

[7]This is opposite to view that firms hide and engage in illegal activities because they are subject to extortion, see Shleifer (1997). But as Johnson et.al. (1999) rightly point out, it is not possible to ascertain whether firms pay bribes because they hide or they hide beasue they are subject to extortion.

[8]To consider a recent example from the debate on child labour, many authors (see Basu 2000) would argue that the prescription does not necessarily lies in reforming labour laws or trade laws.

of corruption are important in understanding corruption in most developing economies.Third, to the best of our knowledge, ours is the first paper to provide a plausible explanation of how inequality may engender corruption. The few papers (Gupta et. al 2002, Li et. al. 2003) which discuss inequality in the context of corruption mainly look at how corruption leads to more inequality empirically.

The plan of the paper is as follows. In section 2, we provide some empirical observations showing how inequality can be crucial in understanding the link between competition and corruption. In the next section, the basic model is described and we provide a short summary of the main arguments and results. Section 4 contains the results and analysis. In section 5 we discuss various implications and extensions. Lastly, section 6 concludes.

2 Some empirical observations

In this section we present some simple empirical observations which illustrate the link between corruption, competition and inequality. Our empirical analysis is based on the BEEPS survey by the World Bank (1999). For a set of 26 transition countries, the survey provides the percentage of firms engaged in corruption[9]. The firms have been asked specific questions about the reason for engaging in corruption such as whether it was for tax purposes or for the provision of public services etc. Keeping with our basic framework, we have considered only those firms that have indulged in corruption for tax purposes. The number of firms surveyed in each of these countries is used as a proxy for the total number of firms in each country. Since data on wealth inequality are extremely rare, previous years gini index for income inequality have been used as proxy; the intuition being that previous years income inequality will reflect on the current periods wealth inequality through savings and investments. We have used the most recent available gini index (of the past years) from the world

[9] For our analysis we have used 23 countries. Three countries (Albania, Bosnia and Republic of Serpska) have been dropped because recent gini indices for these countries were unavailable.

development indicator and the WIDER data set on inequality in these countries for 1999.

We use three separate logit models to test the link between corruption, competition and inequality. Our dependent variable is the log of the ratio of corrupt firms to non-corrupt firms. As is standard for logit models, we name the ratio of corrupt firms to non-corrupt firms as the odds ratio. As we will demonstrate later, increase in corruption in our model comes from the increase in the number of corrupt firms in the economy relative to the number of non-corrupt firms. Hence the odds ratio allows us to measure the impact of a change in the exogenous variables on corruption. The first two specifications regresses the number of firms and the gini index separately on the log of the odds ratio. The last specification regress both inequality and number of firms together on the log of the odds ratio. Table 1 summarizes the results from the regression.

Table 1: Regression on log of the odds ratio.

	Model 1	Model 2	Model 3
	Coefficients		
Number of firms	0.000		-0.016*
	(0.000)		(0.001)
Gini index		0.047**	0.052**
		(0.013)	(0.015)
Constant	-0.524*	-2.170**	-2.113
	(0.229)	(0.460)	(0.441)
R^2	0.000	0.325	0.356
F-statistics	0.04	12.40**	6.61**
Observations	23	23	23

The numbers in the brackets are the (robust) standard errors. * Shows significance at 10% level. ** Shows significance at 1% level.

From the above table it is clear that while inequality is significant in explaining the odds ratio, number of firms, which is an indicator of competiton, does not have any impact on corruption. Model 1 therefore validates the point that increase in number of firms may not necessarily lead to decrease in corruption. This does not rule out, however, that for some countries competition may indeed decrease corruption. On the other hand, there may be countries where competition leads to increased corruption. On the whole, the effect of competition on corruption remains insignificant. Moreover, the R^2 is extremely low and therefore we need to consider other variables to understand the impact of the competition on corruption. As we shall argue in the paper, the relationship between competition and corruption is a complex one; and our simplistic empirical formulation does not capture it properly.

Nest we test for the link between inequality and corruption. Most empirical exercises in this context have regressed corruption on inequality, thus examining the case whether corruption worsens the income distribution (Gupta et. al. 2002, Li. et al. 2001). Model 2 on the other hand tests for whether inequality leads to an increase in corruption. Results from Table 1 indicate that as inequality increases the number of corrupt firms relative to non corrupt firms will increase. Although we do not deny that the causality between inequality and corruption may run in both directions, our interest in this paper is to provide for an analytical explanation for the observed link from inequality to corruption. As will be evident later, our analytical model would rely on market imperfections to establish the link. It should be kept in mind, while we do not explicitly take market imperfection into account in our empirical exercise, for most of the transition countries maket imperfections remain pervasive(Svenjar, 2002; Berglof and Bolton, 2002).

However, the most striking result of the empirical analysis comes from model 3. When we control for inequality the coefficient for number of firms becomes negative. This implies that given inequality, as competition increases, we will see a higher proportion of non-corrupt firms entering the market thereby reducing corruption. Therefore, it seems, implicit behind the assertion that competition reduces corruption, is the assumption that inequality remains unchanged.

This paper on the other hand attempts to understand the link between competition and corruption when there is a change in inequality.

3 The model

3.1 A Summary

We consider an economy with different types of households[10] (potential firms) who may choose to undertake (entrepreneurial) production activities. Given non-convexity in the production process the households choosing production activity have go to the bank to borrow a certain amount K. Households staying out of the production sector don't need to borrow and they have some fixed outside income. Households are classified into basically two types: good (low risk) and bad(high risk). The latter type is assumed to be inefficient in the sense that its production plan fetches lower expected returns. Hence an optimal mix would seek to maximize the proportion of good type. Production also involves other costs like taxes, fees and costs of meeting standards and quality control. We denote these as simply tax T. Inspectors are supposed to ensure compliance by the firms, but they can collude with the firm and avoid reporting.

The focus is on two levels of interactions. One takes place in the credit market between the firm and the bank, and the other takes place in the product market between the firm and the inspector. A particular household's expected payoff from undertaking production depends on its type and the outcome of these two interactions. The first interaction referred to as the credit game determines the cost of capital and the second determines the effective tax payment.

Corruption facilitates the entry of the inefficient firms by raising the expected payoff. Households can calculate their expected payoff after taking into account the fact that they can bribe the inspector and save on their tax payment[11]. *Hence some households who would not have entered the production sector in*

[10] We shall be using both terms 'households' and 'firm'. Households in the production sector will be referred to as firms.

[11] This is somewhat similar to the distortionary effect of corruption on occupational choice or technology choice in Acemoglu and Verdier (1998).

the absence of corruption would find it profitable to do so in the presence of corruption. However, the extent corruption also depends on the outcome in the credit market. If the different types are completely screened in the credit market then it is difficult to sustain corruption in the tax collection because the efficient high profitable firms are less likely to engage in concealment and corruption. As is well known, under certain conditions these types can be separated even when there is informational asymmetry. This is where wealth inequality matters. Because some households are wealth constrained, it is not possible to separate the different types completely. That means some low risk types get pooled with the high risk types. This raises the cost of capital for these low types and lowers the cost of capital for the high risk types. The high risk types, in turn, engage in corruption and earn higher than their true profit. Both these factors contribute to a rise in the number of the high risk types and fall in the number of the low risk households.

We have three different agents who act in a strategic fashion: a) households, b) banks and c) inspectors. We describe the characteristics of each agent below.

3.2 Inspectors

Inspectors are in charge of collecting taxes. However, they are corruptible and can collude with the firm in exchange for a bribe, d. We assume that there is, however, an anti-corruption system in place. The anti-corruption inspectors, presumed to be honest[12], monitor the firms and the tax inspectors. If the firm evades tax payment by bribing the tax inspector, the bribery is likely to be discovered with some probability q and both the evading household and the corrupt inspector are penalized.

[12] We do not go into issues concerning the corruptibility of these super inspectors, see Basu et.al.(1992).

3.3 The Banks

The banks (B) borrow funds from the public at a fixed interest factor r_0, and extend loans of fixed amount K to the firms. Project returns are stochastic. Let $(1 - \mu_i)$ be the probability of success in a project undertaken by type-i household. Let r_i be the interest factor paid and w_i be the amount of collateral pledged. Various types of assets, which constitute household's wealth, can serve as collateral. We assume that the bank incurs a cost associated with having a collateral. If the bank can observe the types of borrowers then for each type the bank chooses $\{r_i, w_i\}$ such that the bank maximizes

$$\pi_B^i = (1 - \mu_i).r_i.K + \mu_i.\delta.w_i \geq \pi_0, \tag{1}$$

where $\delta < 1$ shows the cost the banks face in keeping a collateral and i represents the type of borrowers and $\pi_0 = K.r_0$. In case the bank cannot observe the different types of borrowers but instead knows the distribution θ_i of the different types of the borrowers, the bank maximizes

$$\pi_B = \sum \theta_i.\pi_B^i \geq \pi_0. \tag{2}$$

We assume there is perfect competition in the banking sector, so that the above condition is always satisfied with equality. We shall call it the zero-profit condition.

3.4 The Households

Households, in our model, can either undertake entrepreneurial activity (firms) and join the production sector or engage in some outside option. Households differ in terms of the payoff form their outside option.

As mentioned earlier, when it comes to production, there are two different types of households, i) households with good projects (g) and ii) households with bad projects (b). The good projects have a higher probability of success and in successful states they lead to higher output/gross profit as well. Let Y_i

be the output produced by type-i. We assume for type i, where $i = g, b$, the output $Y_i = 0$ with probability μ_i and $Y_i > 0$ with probability $(1 - \mu_i)$. We assume that $\mu_g < \mu_b$ and $Y_g > Y_b$.

Households also differ in terms of their initial wealth. We assume that some households have no wealth. These wealth constrained households can have good or bad projects, but to simplify the analysis we assume that these wealth constrained households have only good projects[13] and denote this group as p. So we have three groups, the rich household with good project (g), the poor household with good project (p) and the rich household with the bad project (b).

Households (firms) engaged in production have to pay various types of taxes. Some of these would depend on their output or profit and some are fixed in nature. These include various license fees, lump sum taxes, compliance costs of various kinds. In many developing economies, these would take the form of costs associated with safety laws, labour laws. We concentrate on these types of costs and treat the total cost of doing business to be fixed for all types of households. This is captured through a lump-sum tax T. In some ways this should also discourage the b-types from entering the market. However, as mentioned earlier, the households can bribe the inspector and end up paying a smaller amount.

It is clear that household's expected income from entrepreneurial activity will depend on the cost of evading taxes and the cost of borrowing funds from the bank. Let V_{ij} represent the expected income of the j^{th}-household within type-i where

$$V_{ij} = (1 - \mu_i).\{(Y_i - r_i.K) - X_i)\} - \mu_i.w_i \geq V_{ij}^0 \tag{3}$$

where X_i is the expected cost (which includes bribe or tax payment) and V_{ij}^0 is the outside option available to the j^{th}-household of type-i. Note when production takes place $V_{ij} = V_i$, $\forall j \in i$.

[13] We assume that no high risk borrower is collateral constrained. But this can be relaxed and the qualitative results will not be affected.

If $V_{ij} \geq V_{ij}^0$ then the j^{th}-household of type-i will enter into production. We assume that $V_{ij}^0 \in [\underline{V}, \overline{V}]$ and all types have the same uniform distribution over $[\underline{V}, \overline{V}]$. So V_i will determine what fraction of the household of type-i will undertake production and enter the credit market.

3.5 The game

After production has been undertaken, depending on the realization of Y_i , the firm makes a report of its income. The failure state can be viewed as a bankruptcy state and can always be verified. If the firm declares bankruptcy, the bank will verify the state and claim the value of collaterals w_i. As is standard in the literature, we assume that a firm will never declare bankruptcy with positive output[14]. In the successful state, the firm makes the due repayment $r_i.K$ to the bank. It is in this state the firm is supposed to pay a tax. However the firm can pay a bribe to the tax inspector and avoid paying taxes.

Before we begin the analysis it will be useful to summarize the sequence of moves in the model.

1. Nature chooses the different types of the household $i = g, b$. The households decide whether to undertake entrepreneurial activity or not. This decision is denoted by $a \in \{0, 1\}$, where $a = 1$ refers to production activity.

2. The bank offers a contract or a menu of contracts to the households/firms $\{r_i, w_i\}$.

3. The firm chooses a particular contract.

4. Once the output is realized the inspector and the firm decide whether to collude and the amount of bribe d to be paid.

5. Following the inspector's report, taxes are paid and all bribe or incentive payments are also made.

For convenience, we shall label stages 2-3 as the credit market game and stages 4-5 as the bribe (tax and corruption) game. Clearly, the outcome in the bribe game will determine the outcome in the credit market. We shall be

[14] Here, we are simply following the standard interpretation of debt contracts under costly state verification.

looking at equilibria satisfying backward induction and hence we shall always work with the bribe game first. Note that a precise definition of an equilibrium would require us to specify actions at each stage 2-5. This will necessitate introduction of more notation and formal analysis. Hence we shall simply focus on the household's decision to enter production. An equilibrium in the game 2-5 will induce a unique outcome on household's entry decisions. Household's choice of a depends on the expected payoff V_{ij} from production and the outside option V_{ij}^0. As discussed earlier, expected payoff V_{ij} depends on the credit market outcome. An equlibrium is defined as a tuple $\{(a_{ij}), (r_i, w_i)\}$ such that given households' decision, the credit market is in equilibrium and given the credit contracts (r_i, w_i), each household's decision is optimal. We shall find it conveneient to describe household's choice by the particpation rate of different types of households- denoted by λ_i. It is the fraction of households entering production sector. Let n_i be the number of i-type households, then given λ_i,we can calculate the distribution of different types in the credit market as $\theta_i = (n_i\lambda_i)/\sum n_i\lambda_i$.

4 Results and analysis

4.1 Tax and Bribe

After the output is realized, if the firm decides not to pay the required amount of tax, T, it can approach the regulator for a bribe negotiation. If a bribe agreement is reached, the firm pays d to the inspector. However, with some probability q this bribe/ illegal transaction can be discovered. Then both the firm and the inspector are penalized. The inspector faces a fine f, which may be loosing the job or a promotion. The firm faces fine h, which may include a loss of production and loss of reputation in the market in addition to the penalty. We assume that $h_i = \beta.Z_i$, where $\beta > 0$ and Z_i is net profit $(Y_i - r_i.K)$.

It is clear that bribing occurs iff

$$T - q(f + \beta.Z) \geq 0 \tag{4}$$

$$Z \leq \frac{T - q.f}{\alpha} = \frac{T}{q} - \frac{f}{\beta} = \overline{Z}. \tag{5}$$

where $\alpha = q.\beta$.

Remark 1 *There is a critical net income, $\overline{Z}$, such that all firms with net profit, $Z_i \leq \overline{Z}$, will engage in corruption.*

The intuitive interpretation of this result is that the benefit of corruption does not increase with income but the cost does. The high profit efficient firms stand to loose more from the illegal transaction. Alternatively, this could be interpreted as a situation where a firm looses its license or ceases to operate once its illegal behavior is detected. In that case only firms who do not have a long future in the market are likely to take the risk of being illegal. This argument has been used in the literature in the context of efficiency wage of the tax inspectors. An inspector is not likely to engage in bribery if the wages are high, because the inspector would not like to loose this high future stream of wage income for the present bribe. In our case it is the prospect of future profitability (not explicitly modelled) which determines a firm's willingness to enagage in risky bribe transactions.

To see the bribing process more clearly, let each party make a take it-or-leave it offer with equal probability. This leads to the standard Nash Bargaining solution. In that case, with probability $\frac{1}{2}$ the firm will offer $q.f$. This is the minimum amount the inspector will accept. On the other hand, with probability $\frac{1}{2}$ the inspector will demand $(T - \alpha.Z)$, as this is the maximum the firm would be willing to pay. Hence the expected bribe would be given by

$$d = \frac{1}{2}\left[T + q.f - \alpha.Z\right]. \tag{6}$$

Hence the firms would bribe and evade tax iff

$$T \geq \frac{1}{2}\left[T + qf - \alpha Z\right] + \alpha Z \tag{7}$$

This yields inequality (5) given earlier.

Remark 2 *Notice that as q falls (or T rises), $\overline{Z}$ rises and more firms would be encouraged to engage in corruption.*

4.2 Credit market

In this section we discuss the credit market game. First we consider a benchmark case where there is no imperfection in the credit market. We will show that when the banks can identify the different types (g or b) of projects, the wealth inequality among the households does not matter. Wealth here is mainly in terms of collaterizable assets. Wealth inequality leads to a situation where some households can put up collateral and others cannot. The level of wealth does not affect a household's need to borrow K or income streams Y_i[15].

4.2.1 Complete information benchmark

Note that under complete information, there is no need for collateral. This is a direct implication of the collateral cost. This can be seen in the figure below.

Insert figure 1.

The figure shows the iso-profit curves and indifference curves (V_i) of the different types of households in the $r \times w$ plane. Given that $\mu_b > \mu_g$, the b-type high risk households have a steeper indifference curve. The dotted lines show the zero profit lines for the bank. Notice that there is a cost associated with the collateral. This means that the banks will prefer not to have collateral to cover

[15] A natural interpretation of this wealth would be various assets which can not be used in the production but households could borrow money against these. It is unlikely that one with more land would need less capital and borrow less.

their loans completely. It can be checked that the slopes (absolute values) of the indifference curves and the iso-profit curve are given by

$$\begin{aligned} \left.\frac{\partial r_i}{\partial w}\right|_V &= \frac{\mu_i}{(1-\mu_i).K} \\ \left.\frac{\partial r_i}{\partial w}\right|_\pi &= \frac{\mu_i.\delta}{(1-\mu_i).K} \end{aligned} \tag{8}$$

Since $1 > \delta > 0$, the household's indifference curve is steeper than the banks indifference curve. Under complete information, points D and E, in figure 1, are the equilibrium contracts. Both the p and the g-types will be offered contract E and the b-types will be offered D.The g-type and the p-type firms will pay a lower interest rate where as the high risk b-type firms will pay a higher interest rate.

Let r_g and r_b denote the corresponding interest factors[16]. Let superscript c deonte the outcome under complete information. Then the net income Z_i of the different types in the successful state would be $(Y_i - r_i.K)$. Clearly, $Z_b^c << Z_g^c = Z_p^c$. So according to our previous discussion, the b-types are likely candidates for engaging in corruption. We assume that

$$Z_b^c < \overline{Z} < Z_g^c = Z_p^c \tag{9}$$

However, this does not guarantee that corruption will take place in equilibrium. In this case if the b-types enter production, the expected cost it incurs is

$$X_b^c = \frac{1}{2}\left[T + qf - \alpha Z_b^c\right] + \alpha Z_b^c,$$

which includes the bribe it pays and the expected fine if caught. Let V_{ij}^c be the expected income of the j^{th}-firm of type-i under complete information. As mentioned earlier, when production takes place $V_{ij}^c = V_i^c$, $\forall j \in i$. The following condition guarantees that only the households with good projects (rich as well

[16]Since $r_g = r_p$ and $Y_g = Y_p$, we are suppressing the notation for the poor in this subsection.

as poor) will enter production and the households with bad projects will opt for the outside option.

$$V_b^c = (1-\mu_b)(Z_b - X_b) < V_{bj}^0, \ \forall j \in b \quad (10)$$

$$V_g^c = (1-\mu_g)(Z_g - T) > V_{gj}^0, \ \forall j \in g. \quad (11)$$

Condition (11) also implies that $V_g^c > \overline{V}$. For all households of b-type it is better not to enter production as they will get a higher payoff if they choose the outside option. Since only households with good projects enter production then condition (9) leads to no corruption.

Proposition 3 *In the complete information case with wealth inequality, if (9) (10) and (11) hold, only the good projects are undertaken and there is no corruption in equilibrium. We have* $\lambda_g^c = 1$ *and* $\lambda_b^c = 0$.

From society's welfare point of view this would be the ideal case.

4.2.2 Incomplete information and wealth inequality.

The banks do not have information about the types of the households. However, the distribution of the different types of households is common knowledge. It is obvious that we are not going to have the standard screening outcome of the credit market, where the good types are separated from the bad types. Screening will require the use of collaterals and the poor types with good projects will not be able to put up the required collaterals. However, the rich types with good projects can be separated. This can be seen in figure 1.

Recall that contracts E and D are offered under complete information. However, when types are not known, the above pair of contracts can not be offered. The bank could now use collateral as an instrument to screen[17] the different types. It is easy to see that a completely separating outcome is not feasible. In

[17] See Bester (1985) for an early model of screening with collateral. Screening can be achieved using loan size also but in the present case it is fixed.

any separating outcome, the g-type will have to put up some collateral. But since the p-types cannot put up any collateral, the bank is forced to offer them a contract with no collateral. In that case, it is easy for the high risk b-types to act as the wealth constrained good types.

As seen in the figure, a semi-separating equilibrium is possible. The g-types are offered contract B and the p and b-types pool at A. Note that the b-types have no incentive to deviate from A to B. The p-types cannot deviate to any contract with $w > 0$. Moreover, the g-types also have no incentive to deviate to A. Using superscript s to denote the outcome under semi-separating equilibrium under incomplete information, let V_i^s represent the expected income of type$-i$. Then compared to the complete information case; $V_p^s < V_p^c$, $V_b^s > V_b^c$and $V_g^s < V_g^c$. However, note that $V_p^c - V_p^s > V_g^c - V_g^s$. In other words, the loss in income is much higher for the p-types compared to the g-types..

We can rule out a completely pooling outcome if the pooled interest rate lies above G. This also ensures that no bank can deviate and offer a pooled contract $[\overline{r}, 0]$ where

$$\overline{r} = \frac{\pi_0}{((\theta_g + \theta_p).(1 - \mu_g) + \theta_b.(1 - \mu_b)).K} \tag{12}$$

The θ_i refers to the distribution of different types in the market. The probability that a borrower belongs to type-i household undertaking entrepreneurial activity, when the credit market outcome is a pooled one, is gien by θ_i. Likewise, under the semi-seperating equilibrium the pooled interest (partial pooling of b and p-types) is given by

$$\overline{r}^* = \frac{\pi_0}{(\overline{\theta}_p.(1 - \mu_g) + \overline{\theta}_b.(1 - \mu_b)).K} \tag{13}$$

where $\overline{\theta}_i$ represents the proportion of type-i engaged in production and accepting the pooled contract under the semi-separating equilibrium; $\overline{\theta}_i = \theta_i/(\theta_b + \theta_p), i = b, p$. Comparing (12) and (13), it is easy to see that $\overline{r}^* > \overline{r}$. This implies that more b-types would enter the market under a completely pooled contract and it will not be profitable to offer such a contract in equilibrium.

As we have observed in the previous section, the b-types are more likely to be corrupt because $Z_b^c < \overline{Z}$. Now in the semi-separating case, $Z_b^s > Z_b^c$, because they end up paying a lower interest rate. However, if $Z_b^s < \overline{Z}$, the b-types will evade taxes and pay a bribe. We continue to assume that

$$Z_b^s < \overline{Z} < Z_p^s < Z_g^c \tag{14}$$

Now their expected income of the b-types would be given by

$$V_b^s = (1 - \mu_b)(Z_b^s - X_b^s), \quad \text{where } X_b^s = \frac{1}{2}\left[T + qf - \alpha Z_b^s\right] + \alpha Z_b^s \tag{15}$$

Clearly, $V_b^s > V_b^c$. Now it is more likely that for some b-types $V_{bj}^s > V_{bj}^0$. Hence more b-types are likely to enter. On the other hand some of the p-types will exit the market since $V_p^s < V_p^c$. There will also be a drop in the g-types but not of the same order. All this will depend on the distribution of the outside payoff. Suppose the following condition holds.

$$\overline{V} > V_b^s > \underline{V}, V_g^s > \overline{V}, V_p^s > \underline{V} \tag{16}$$

This implies that despite the reduction in V_g, all the g-types continue to enter the production and $\lambda_g = 1$. The same need not be true for the poor households with good projects. On the other hand, compared to the benchmark case, $b-$types also enter production sector and $\lambda_b > 0$.This leads to the following proposition.

Proposition 4 *Under incomplete information and wealth inequality, there exists a semi-separating screening equilibrium* $[\{r_g^*, w_g^*\}, \{\overline{r}^*, 0\}, \{\overline{r}^*, 0\}]$ *where the* b *and* p *types pool at* $\overline{r}^*$ *and* g *type separates at* $\{r_g^*, w_g^*\}$. *We have* $\lambda_g^s = 1, \lambda_p^s \leq 1$ *and* $\lambda_b^s > 0$. *There is positive corruption in equilibrium as the* b *types will enter the production sector and engage in bribery.*

Note that if condition (14) is not staisfied and we have $Z_p^s < \overline{Z}$; then the poor households with good projects will also find it worthwhile to engage in corruption. In this sense, corruption can spread because of the presence of the b-types in the market.

4.2.3 Changes in Inequality

Suppose there is a rise in inequality of wealth such that the number of wealth constrained poor households is higher. We can consider a redistribution of wealth such that n_b stays the same, n_g falls and n_p rises. Let us assume that, prior to redistribution, $\lambda_g^s = 1, \lambda_p^s = 1 \; and \; \lambda_b^s > 0$. This means that as n_p rises, the pooled interest rate will fall. At the pre-redistribution particpation rates, rise in n_p will lead to a rise in θ_p and fall in θ_b. Since $(1-\mu_g) > (1-\mu_b)$, it is clear that (using (13)) $\overline{r}^*$ will fall. Consequently, $\{r_g^*, w_g^*\}$ will also change and V_g^s will rise, but it will make no change to their particpation rate. On the other hand, V_b^s will increase and that would lead to more b-type households in the market. The rise in λ_b will in fact be the equilibriating force as this would lead to a rise in θ_b and arrest the fall in the pooled interst rate. But it is clear that in the new equilibrium, following the redistribution of wealth, λ_b is higher. Since the partcipation rates of the poor and the rich households with good projects do not change and the redistibution is confined only to them, a rise in the particpation of the b-type households would lead to an increase in the number of firms in the production sector and a rise in the number of corrupt firms. We can state the following corrollary.

Corollary 5 *As the fraction of poor households increases following a rise in welath inequality, more b-type households enter the production sector and there is a rise in corruption.*

This matches well with our earlier observation in section 2 that a rise in inequality is associated with greater incidence of corruption[18]. In terms of the

[18] A recent empirical exercise using cross-country regressions also find that income inequality increases corruption. See You and Khagram (2003).

number of firms, the total number of firms can go up or down depending on the distribution of the outside option and the value of λ_p before the redistribution. For example, if $\lambda_p < 1$, then following the redistribution, λ_p goes up but the total number of firms in the market might go down. Irresepective of what happens to the total number, the number of b-type firms will always go up.

Though it is linked with corruption in an indirect way, wealth inequality plays a major role in our analysis. In the absence[19] of wealth constrained households informational imperfections in credit market can arise but they will not have significant bite. As can be seen in figure 1, the complete information outcome D and E can not be sustained. But one can easily devise a screening contract shown by points D and F in figure 1, to distinguish the two types of households. In that case, the g-type households are worse off as a result but the b-type households are not necessarily better off. Hence, if there is no wealth inequality, we are not likely to see a large influx of these households into the production sector.

5 Discussion.

5.1 Competition and Corruption

The b-type households benefit in two ways-their cost of funds is subsidized by the other households to some extent and they also manage to increase profitability by avoiding tax payments. Either of these factors alone may not be sufficient to encourage increased participation by the b-type households. In the text we showed that in the absence of imperfections in the credit market, there are no b-type households engaged in production. One could make a similar claim concerning corruption also. Suppose government pursues a policy (q, β, T) such

[19] As the number of p-type households decreases, the partcipation of b-type households also falls. The nature of the equilibrium does not change so long as there are sufficient number of p-type households. But in the limit, when there is no p-type household, we can have the well known problem of existence of equilibrium .

that corruption can be completely deterred. In such a case if $(1-\mu_b)[Y_b - r_g K - T] \leq V^0_{bj}$, then no b-type will choose to enter even when it can borrow funds at a subsidized rate. In the credit market, both the g-type and p-type will be treated in identical fashion and will be offered r_g. Neither wealth inequality nor informational asymmetry will matter. This shows how both these factors reinforce each other.

Depending on the distribution of the outside options (income from non entrepreneurial activity), increased participation by the b-types could lead to a overall rise in the number of households in the production sector. The rise in the b-type's participation can compensate for the drop in the households with good projects (mainly the p-types) participation. In this sense, a higher number households in production can coexist with greater corruption. This has been noted also in Laffont and N'Guessan (1999) in a different context. They note that increased corruption can co- exist with greater competition in an agency setting because it might be optimal to tolerate more corruption in equilibrium. Moreover, greater competition always raises welfare despite increase in corruption. We are making a separate point here. There is increased corruption in equilibrium because more households would choose to engage in it. Secondly, as more b-types participate, welfare might go down. This is because the presence of these types exert negative externalities and the b-types are more inefficient. Without adding more structure to the model, it is not possible characterize welfare in a precise way.

The entry of the b-type households has implications for the anti-corruption policy. Note that one crucial determinant of the anti-corruption policy is the probability of detection q. It is possible that q will fall as the number of households in the production sector increases. The same number of inspectors will have to monitor a larger population now. This would lead to a rise in $\overline{Z}$ implying that more households would find it profitable to engage in bribery. Similarly, a rise in T would also imply a rise in $\overline{Z}$. However, there is a discontinuity in the rise of corruption here. As T rises sufficiently, the b-type households might not enter the production sector even though they would have engaged in bribery had they entered. So we might see elimination of corruption for sufficiently high T. The rise in T can also be interpreted in various ways. It could mean that there are stricter quality controls and standards and non-subsidized inputs. In that case, a rise in T can be an welcome policy. But the feasibility and success of the policy would also depend on how profitable the g- type households are. A high T should not end up discouraging them too. On the other hand if T is due to high taxes, controls and red tapes, it would be ideal to reduce T.

5.2 Persistence of Inequality

What implications does corruption have on inequality[20] in general? Our model has no immediate answer but extensions to the model can throw some light. First, one can argue that corruption is reducing the gap between the different households and in this sense it is reducing (income) inequality. But this might be misleading. Suppose, nature does not decide the distribution of b and g types. Households (either poor or rich) have to make some investment (effort) e prior to the realization of their project type. This investment could be broadly interpreted as activities like searching for ideas, gather information, exploring networks and markets. Let the cost of this be given by $C(e)$ and $C', C'' > 0$.The probability ρ that the project would be g-type will depend on $e, 0 \leq \rho(e) \leq 1$, $\rho' > 0$ and $\rho'' < 0$. Like before, let V_b, V_g denote the net payoffs associated with a bad and a good project respectively. V_p refers to the payoff associated with a good project by the poor household. Households choose e^* by maximizing

$$\{\rho(e)V_g + (1 - \rho(e))V_b\} - C(e)$$

We have seen that in the absence of any imperfections, $V_p = V_g$ and $(V_g - V_b)$ is also maximized. This will lead to both poor and rich households choosing same optimal levels of e^*. However, with market imperfections and corruption, $V_p < V_g$ and V_b is higher. The general level of investment will be lower than the

[20] See Gupta et. al. (1998) for a discussion of the effect of corruption on inequality and poverty.

no-imperfection case. More importantly, the poor will always invest less than the rich households and will have bad projects more often. This could mean that inequality will be sustained.

6 Conclusion

We have shown that when market imperfections exist, greater competition can coexist with greater corruption. The scope of corruption allows inefficient firms to survive in the market. As more and more inefficient firms enter the market, the total number of firms might rise but corruption also rises. It is not our intention to say which causes what, whether greater competition reduces corruption or corruption reduces competition. Both these can coexist because of several other factors- in our case wealth inequality and incomplete information in the credit market.

We have not modelled competition in an explicit way. Preliminary results show that this can be done to some extent. The interaction between the efficient (g-type) and inefficient (b-type) firms in the product market can be analyzed. This will allow us to make more definite welfare comparisons.

Similarly, wealth inequality affects corruption in a very indirect way. Because of wealth constraints, credit market fails to screen the b-type and hence they enter and corruption rises. We can explore the link more directly. One can model a situation where the household, in addition to choosing whether to produce or not, also chooses how much to invest (monetary as well as non monetary resources such as effort) in buying access. This would be similar to the case where firms spend money on campaign contributions, buy contacts and spend effort in building political and bureaucratic network. A firm with access can evade taxes with a higher probability. This ex-ante choice of investment in access buying can replace the current framework where they bribe later. This way we can derive a household's investment in access buying as a function of household wealth and the type of the project. We leave it for future work.

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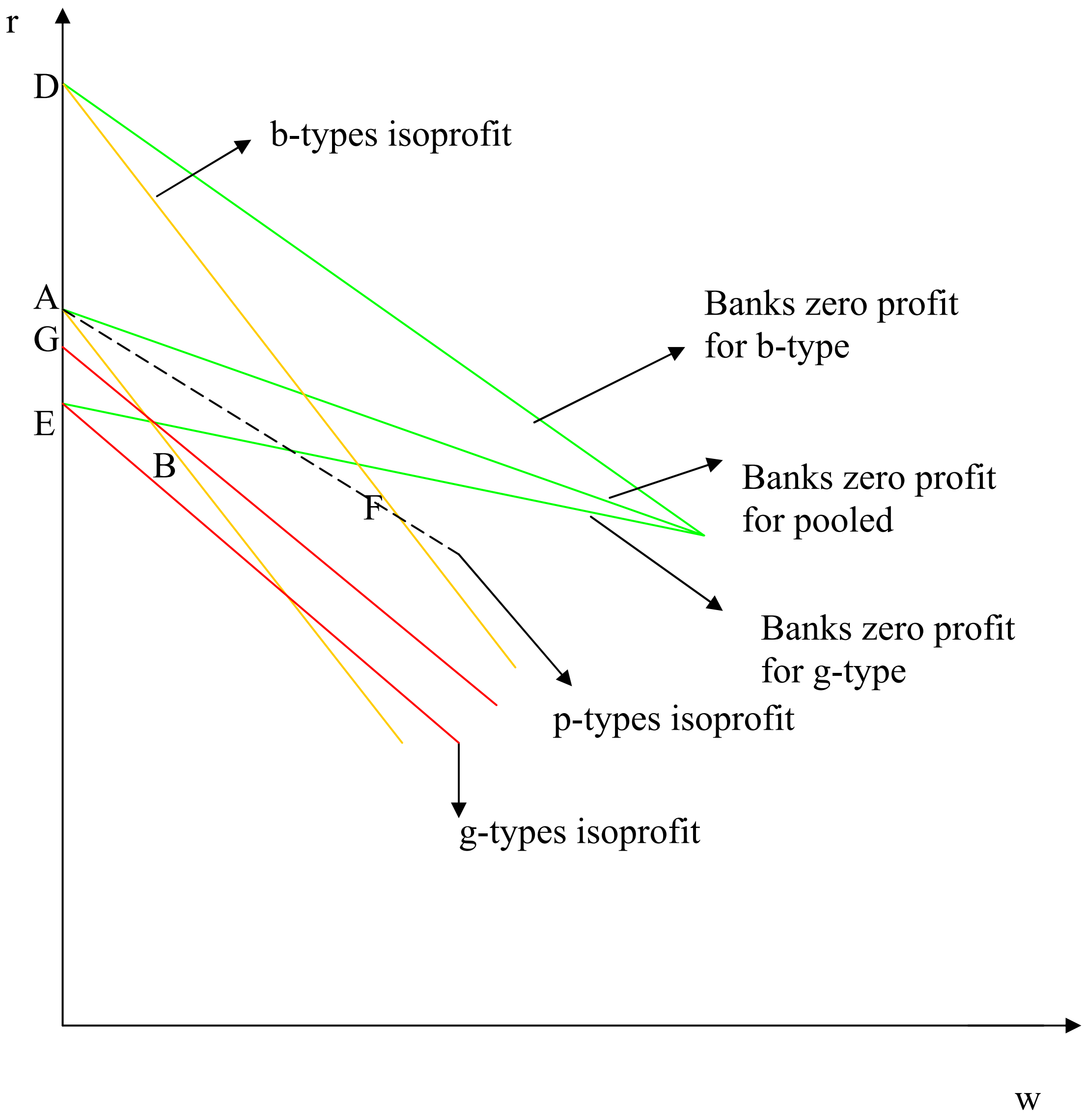
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Figure 1