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Inequality, Corruption, and Competition in the Presence of Market Imperfections

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Abstract

We analyze the relation between inequality, corruption and competition in a developing economy context where markets are imperfect. We consider an economy where different types of households (efficient and inefficient) choose to undertake production activities. For production, households borrow capital from the credit market. They also incur non-input costs which they could avoid by bribing inspectors. Due to information asymmetry and wealth inequality, the credit market fails to screen out the inefficient types. In addition to the imperfect screening, the inefficient type's entry is further facilitated by 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 along with greater competition.

Keywords: corruption, competition, credit market, inequality, screening

JEL classification: D31, D43, K42, O12

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1 Introduction

Corruption has received a lot of attention from various quarters — especially in the context of developing economies.[1] These economies are typically characterized by inequality, poverty, government controls and market imperfections in varying degrees. Our objective in this paper is to examine the link between corruption and wealth inequality in a liberalized economy with imperfect markets.

In non-market settings like government provisioning of goods and services through public officials or issuing of licenses and permits for economic activities, corruption by allowing for more opportunities to some, can adversely impact the wealth constrained section of the society. Empirical evidence (Gupta et al. 2002, Li et al. 2000) have shown that corruption does have substantial effects on the level and distribution of income. The poor, unable to meet demands for bribe payments, are denied access to various public services and employment opportunities (Narayan et al. 2000). Similarly, if entrepreneurial activities require licenses issued by bribe seeking officials, the wealth constrained entrepreneurs might be left out of the production sector. This suggests that as economies move towards liberalized market regimes the link between corruption and wealth inequality, as described above, should weaken. Contrary to this, our analysis shows that, in such a setting, wealth inequality may itself acts as a catalyst for corruption, and wealth constrained individuals continue to be adversely affected by corruption through the market outcome.

Recent empirical evidence indeed confirms that increased inequality can lead to higher corruption. Using an instrumental variable approach on a sample of 125 countries and controlling for factors such as democracy, legal origins and endogeneity issues, You and Khagram (2005) finds strong links

[1] The World Bank (2005) puts corruption as the 'single biggest obstacle to economic and social development'.

from inequality to corruption. One drawback of their empirical analysis, however, is the use of perception based measure of corruption. Although direct data on corruption are rare, the World Bank (1999) Business Environment and Enterprise Performance Survey (BEEPS) data contains such information on firms of transition countries. In a simple empirical exercise (described later) using this data, and controlling for factors such as GDP per capita and number of firms, we find that inequality has a significant and positive impact on corruption.

A plausible reason put forward to explain this is that in a highly unequal society the rich will engage in corruption (or some other form of subversion of institutions) to maintain their privileged positions (Glaeser et al. 2003, Do 2004). But as Hellman and Kaufman (2002) point out, this explanation is more about the 'inequality of influence' rather than wealth inequality per se. Further, corruption may not be the only type of subversive activity that the rich may undertake. Therefore, presumably, anyone with influence will be able to exploit weak institutions to expropriate more wealth. Then explaining the link from inequality to corruption using the above reasoning becomes ambiguous. To avoid such ambiguity, we explicitly bring in the role of wealth inequality and show that, in presence of other imperfections, it can lead to corruption. This direct link from wealth inequality to corruption, to the best of our knowledge, has not been established before.

For our model we have an economy characterized by free entry, where households (potential firms), differentiated both in terms of efficiency (intrinsic profitability) and wealth, may choose to undertake (entrepreneurial) production activities. For production, households need to borrow capital from the credit market. Additionally they incur some legal cost of business (such as taxes and costs of meeting standards and quality control) which could be avoided by bribing inspectors. In our framework, households (or firms) differ in terms of their benefits from corruption and only the inefficient (low profitability) end up paying bribes for various illegal activities.[2] The presence of these bribe paying inefficient types in the market affect the profitability of the efficient wealth constrained households. We show that in the presence of imperfection in the credit market, increase in wealth inequality facilitates the entry of inefficient firms, which also are the ones that engage in corruption. Increased wealth inequality then leads to increased corruption.

In our model poor entrepreneurs are unconstrained in terms of bribe paying ability and they can benefit as much as the rich entrepreneurs through bribing. Therefore the direct role of inequality in engendering corruption may be limited. However, using a multi-market framework, we show that inequality can affect corruption indirectly through channels in other markets. Hence, the multi-market framework becomes important. This aspect also has so far not been analysed in the literature.

Since, in our model, corruption can facilitate entry of the inefficient firms, it is not surprising that we find greater corruption coexists with a larger number of firms entering the market. Therefore, while capturing the link between inequality and corruption, we also shed light on how corruption and competition may coexist. Although it is widely held that competition lowers corruption (Rose-Ackerman, 1996; Ades and di Tella, 1999; World Bank, 1997),[3] experience of transition and other developing countries reveal that despite embracing considerable deregulation and liberalization to increase competition, corruption is on the rise (Leiken 1996-97, Kaufman and Siegelbaum 1997). We argue that changes in the underlying distribution of wealth may offer a plausible reason for such occurrence.[4]

[2]This is opposite to the 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 becasue they are subject to extortion.

[3]Recently, however, this view has come under further scrutiny (Laffont and N'Guessan, 1999).

[4]Other reasons, put forward in the literature include institutional features and policy

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.[5] Bribe paying agents are not viewed as the real beneficiaries. Corruption, viewed this way always reduces profitability. We do not deny this but we argue that the extortion view does not explain the whole picture. Corruption in the sense of collusion between officials and agents can be beneficial to the agents too. According to Hellman, Jones and Kaufman (2000) one of the main aspects of corruption in transition countries is the 'phenomenon of "state capture" by the corporate sector'. What it shows is that corruption also involves collusion between the government and private agents although agents may differ in terms of their benefits from corruption. This feature of corruption is key to the present paper.

To summarize, our paper differs from the literature in three main aspects. First, our paper provides a plausible explanation of how inequality may engender corruption. The few papers (Gupta et. al 2002, Li et. al. 2000) which discuss inequality in the context of corruption mainly look at how corruption leads to more inequality empirically.[6] Second, the paper uses a multi-market framework to explore the link between corruption, competition and wealth inequality. In the literature,[7] 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

failures to implement proper derugulation (Kaufman 1997, Shelifer 1997).

[5] Most of the leading models such as. Shleifer and Vishny (1993), Bliss and di Tella (1997) and the recent firm level studies (Svensson 2003), follow the extortion view. This is not true for the agency based models of corruption such as. Besley and McLaren (1993), Mookherjee and Png (1995), Laffont and N'Guessan (1999).

[6] As mentioned earlier, You and Khagram (2005) empirically examine the effect of inequality on corruption. In different contexts, Banerjee (1997) and Do (2004) also study the effects of inequality on corruption.

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

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 corruption alone. Third, the collusion-view of corruption generates different implications compared to the extortion-view of corruption. We feel that both features are important to our understanding of corruption in developing economies.

The plan of the paper is as follows. In the remainder of this section we provide a few empirical observations to highlight the link between corruption, competition and inequality. In the next section we first provide a brief description and intuition of the basic model. We then describe the characteristics of the different agents and how they interact strategically in our model. Section 3 contains the results and analysis under different scenarios. We consider the complete information case and the incomplete information case with wealth constraints arising from inequality. Lastly, section 4 concludes with a few brief remarks and some directions for future research

1.1 Some Empirical Observations

The purpose of this simple empirical exercise is mainly to motivate our theoretical model better. For 26 transition countries, BEEPS provides the percentage of firms engaged in corruption.[8] The firms have been asked specific questions about the frequency and the reasons for engaging in corruption such as whether it was for tax purposes, for the provision of public services etc. We take the proportion of firms engaged in corruption for tax purposes as a measure of corruption. The BEEPS survey made consistent efforts to select a representative sample of firms from each country (Hellman et al. 2000). We take the number of firms surveyed in each of these coun-

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

tries as an indicator for the total number of firms in each country and hence an indicator of the level of competition, though in our theoretical model we include some deeper parameters of competition (see Bliss and di Tella 1997). Since data on wealth inequality are extremely rare, lagged Gini index for income or consumption inequality have been used as proxy; the intuition being that previous years income or consumption 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 Human Development Reports (UNDP 2002, 2003)and the WIDER (2004) WIID data set on inequality for these countries for 1999. Further, to get a broader picture, we have also considered how GDP per capita[9] is interlinked with corruption, inequality and competition.

Table 1a in the Appendix provides the summary statistics and Table 1b shows the correlation matrix of our variables of interest. The full data is presented in Table 3. We find that (a) GDP per capita and corruption are negatively correlated (correlation coefficient -0.76) and it is significant; (b) the level of wealth inequality (indicated by the lagged gini index for income inequality) is positively and significantly correlated with corruption (correlation coefficient is 0.70); (c) the level of competition (indicated by the number of firms) does not seem to be correlated with corruption.

Taking this further in Table 2, 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, which we call the log of the odds ratio. Model 1 regresses the number of firms and the GDP per capita on the log of the odds ratio. Model 2 includes the gini index instead of the GDP per capita. The last specification regresses all the three variables together on the log of the odds ratio.

In all the three models in Table 2 that the effect of competition on cor-

[9] The GDP data per capita is from the World Development Indicators website at http://devdata.worldbank.org/dataonline/

ruption is statistically insignificant. It validates the point that increase in number of firms may not necessarily lead to a 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. We understand that the relationship between competition and corruption is a complex one and our empirical model may be too simplistic. One, however, can still use this observation to make the point that the link between competition and corruption is quite ambiguous.

In line with more rigorous empirical studies (Treisman 2000, Mauro 1995) we find a strong negative relation between GDP per capita and corruption. However, Table 2 also indicates that as inequality increases the number of corrupt firms relative to non corrupt firms will increase. This is valid for both models 1 and 2. This aspect, where increased inequality leads to more corruption, has not been analyzed rigorously before and it will be one of our goals in this paper to provide an analytical explanation for the observed link from inequality to corruption. Although informational problems also play an important role in our analysis, we have not been able to take that explicitly, for most transition countries, however, such market imperfections remain pervasive (Svenjar, 2002; Berglof and Bolton, 2002).

2 The Model

2.1 A Summary

In our model, households[10] are basically classified in to two types: good (with high probability of success) and bad (with low probability of success). Given non-convexity in the production process all households must borrow a certain amount say, K. Households staying out of the production sector

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

do not need to borrow, and receive some fixed outside income. Firms also incur non-input costs of running a legal business. 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 non-input costs or 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 the costs.[11] *Hence some households who would not have entered the production sector in the absence of corruption would find it profitable to do so in the presence of corruption.* The extent of corruption, however, 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 because the efficient high profitable firms are less likely to engage in concealment and corruption where as the corruption-prone firms are likely to exit the market. As is well known, under certain conditions these types can be separated even when there is informational asymmetry. This is where wealth inequality comes in to play. Because some households are wealth constrained, it is not possible to separate the different types completely. That means some good types get pooled with the bad types. This raises the cost of capital for these good types and lowers the cost of capital for the bad types. Both these factors contribute to a rise in the number of the bad types and fall in

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

the number of the good firms.

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.

2.2 Inspectors

Inspectors are in charge of monitoring compliance by the firms. As we shall discuss later, firms have to incur various types of costs in running a legitimate business but they can choose to avoid these. These costs include various types of taxes, costs of meeting quality and other regulatory standards. A firm faces a fine, F, if its non-compliance is reported. However, inspectors are corruptible and can collude with the firm in exchange for a bribe. We assume the corruptible inspectors constitute a certain fraction q of the total population of inspectors.[12] Hence, q stands for the corruption environment describing the scope of corruption or corruptibility of the system.

2.3 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 μ_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, δ, 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

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

[12] We do not model the anti-corruption measures, hence q is taken as given. However, this can be done without affecting the main qualitative results.

where $\delta < 1$ shows the cost the banks face in keeping a collateral 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

$$\pi_B = \sum \theta_i . \pi_B^i \geq \pi_0. \quad (2)$$

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.

2.4 The Households

Households can either join the production sector (firms) or engage in some outside option. They differ in terms of the payoff from 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, that is, $\mu_g > \mu_b$. Each project yields Y in the successful state and zero in the failure state.[13] We shall argue in the next section that μ_i can also be interpreted as the degree of competitiveness. In a highly competitive environment, the inefficient firms are unlikely to succeed and μ_b is likely to be very small.

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 and denote this group as p. So effectively we have three groups, the rich households with good projects (g), the poor households with good projects (p) and the rich households with the bad projects (b). For convenience, at times we shall

[13] It is possible to consider the case where output or profit in the successful state differs across the types, but it does not affect our results.

be referring to the fraction of p-households relative to g-households as the level of inequality.

In addition to the standard input costs, households (firms) engaged in production have to incur various costs in running a legitimate business. Some of these would depend on their output or profit and some are fixed in nature. In many developing economies, these would take the form of costs of compliance with various regulatory standards, quality control, safety and labour laws. We assume that firms can avoid these costs. For example, firms can choose to disregard pollution control, use substandard inputs, substitute adult labour with child labour. In addition to all these, firms can of course hide output and sales to save on various sales taxes and profit tax. In economies with high levels of compliance, firms do not have so much of a choice and hence no strategic importance can be attached. However, these play an important role in our model. All these non-production costs of legitimate business will be denoted by T. While some components are likely to be incurred after output is realized, we assume that firms have to invest T before the true state is revealed. In some ways this discourages households from entering the market, specially those with bad projects (as the b-types). However, in presence of corruption, 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 T and the cost of borrowing K. Depending on whether the household incurs the legitimate cost T or not, the j^{th}-household of type-i will undertake production if and only if

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

or

$$V_{ij} = \mu_i.\{(Y - r_i.K) - X_i)\} - (1 - \mu_i).w_i \geq V_{ij}^0, \tag{4}$$

where V_{ij} represent the expected income of the j^{th}-household within type-i, X_i is the expected cost (which includes bribes, fines) and V_{ij}^0 is the outside option available to the j^{th}-household of type-i. Note when households undertakes production activities $V_{ij} = V_i$, $\forall j \in i$.

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.

2.5 The Game

After production has been undertaken, depending on the realization of Y, 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. In the successful state, the firm makes the due repayment $r_i.K$ to the bank.

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. 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 (or firms) (r_i, w_i).

3. The firms choose particular contracts.

4. Firms choose $l \in \{0, 1\}$, where $l = 1$ refers to firm's decision to incur the cost T (and not engage in corruption). Inspection is carried out by the inspectors. Corrupt inspectors can collude with the firm. Once the output is realized, firm repays the bank according to the agreed contract.

5. Following the inspector's report, all bribes or fines are paid.

For convenience, we shall label stages 2-3 as the credit market game and stages 4-5 as the bribe game. Clearly, the outcome in the bribe game will determine the outcome in the credit market. We shall be looking at equilibria satisfying backward induction.

Definition 1 *An equilibrium is defined as a tuple* $\{a_{ij}, l_i, (r_i, w_i)\}$ *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.*

An equilibrium in the game stages 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. Note that within each type, households differ only in terms of their outside option V_{ij}^0. Therefore when it comes to the decision to enter or not, households within each type may behave differently, whereas when it comes to the credit market and the bribe amount they will behave identically. To distinguish this fact, in the equilibrium, we have an extra subscript j for the entry variable a.

We shall find it convenient to describe household's choice to enter, by the participation rate of each type of household — denoted by λ_i. It represents the fraction of households of type-i 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 $\theta_i = (N_i\lambda_i)/\sum N_i\lambda_i$ where $i = g$, b, p.

Notice that both the total number of firms entering production and the number of firms choosing evasion and bribery will be determined in equilibrium. In that sense, both corruption and competition are endogenously determined. In addition, we have two model parameters q and μ_b which describe the scope of corruption and the degree of competitive pressures in the economy respectively. Our comparative statics exercises will be in relation to these two parameters.

3 Results and Analysis

3.1 Tax and Bribe

Suppose the firm decides not to incur the cost T, it can be inspected by an inspector with some probability ρ. We shall assume that to discourage such non-compliance the firm has to pay a fine F, where $F \geq T$. However, a corrupt inspector can always collude with the firm and not report the non-compliance in exchange for a bribe. The bribe amount obviously will depend on the relative bargaining powers, we shall simply assume it to be αF, where $\alpha < 1$. This can be interpreted as the outcome of a game where the inspector makes a take-it-or-leave-it proposal with probability α and the firm can accept or reject. The firm makes a similar offer with probability $(1-\alpha)$. If accepted, the firm is not reported. We also assume limited liability which implies that fines can not be collected from non-successful firms and for successful firms $F \leq Y - r_i K$. Hence a firm will choose $l = 0$ if and only if

$$\mu_i.\rho\left(qF + (1-q)\alpha F\right) \leq T \tag{5}$$

which implies,

$$\mu_i \leq \mu(\rho, T, q, F) = \overline{\mu}. \tag{6}$$

Remark 1 *There is a critical success rate $\overline{\mu}$, such that all firms with $\mu_i \leq \overline{\mu}$ will engage in corruption.*

This is a direct implication of the fixed fine and limited liabilities. Alternatively, we could take this fine to be complete or partial loss of net profit of the firm. In such a case, $F_i = (Y - r_i K)$. Suppose this could be interpreted as a situation where a firm ceases to operate once its illegal behavior is detected. In that case only firms with lower expected profitability 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 engage in illegal behavior.

Using the same bargaining framework, it is easy to see that the bribe will be $\alpha(Y - r_i K)$. Denoting $(Y - r_i K)$ as Z_i, a firm will choose $l = 0$ if and only if

$$\mu_i Z_i - T < \mu_i \left[(1-\rho) Z_i + \rho q (1-\alpha) Z_i \right],$$

from which it follows that,

$$\mu_i < \frac{T}{\rho(1 - q(1-\alpha)).Z_i} = \overline{\mu}_i. \tag{7}$$

Although this is similar to the inequality in (6), but unlike the fixed penalty case, $\overline{\mu}$ is now type specific. This is because it now depends on Z_i, which in turn will depend on the credit market outcome. From (7) it is clear that for a given μ_i, a high r_i and consequently a lower Z_i, will increase the possibility that a type will be corrupt. In the next section we discuss how the r_i is determined both under complete and incomplete information in the credit market.

Notice that as q, which measures the scope of corruption, rises, $\overline{\mu}_i$ also rises and more firm types would be encouraged to choose $l = 0$.[14]

[14] Note that all firm within a type choose l in the same way irrespective of their wealth or outside option. One can address the firm specific choice but it complicates the analysis considerably.

3.2 Credit Market

In this sub-section we discuss the credit market game. First we consider a benchmark case where there are no imperfections in the credit market. We show that when the banks can identify the different types (good or bad) of households, wealth inequality among the households does not matter. Wealth here is mainly in terms of collateralizable 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.[15]

3.2.1 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 Figure 1.

[Insert Figure 1.]

Figure 1 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 their loans completely. It can be checked that the slopes (absolute values) of the indifference curves and the iso-profit curve are given by

[15] A natural interpretation of this wealth would be various assets which can not be subsititued directly for capital in the production process but households could borrow money against these. For instance, it is unlikely that one with more land would need less capital and borrow less.

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

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. Firms with a good projects will be offered contract E and firms with a bad projects will be offered D. The g-type firms will pay a lower interest rate where as the high risk b-type firms will pay a higher interest rate. Note that this situation will not change if there is wealth inequality. Since there is no collateral use in equilibrium, the wealth constrained p-type firms (who differs from the g-types only in term of their wealth) would be charged the same low interest rate as the g-types.

Let r_g^c and r_b^c denote the corresponding interest factors. The superscript c denote the outcome under complete information. The net income Z_i^c of the different types in the successful state would be $(Y - r_i^c.K)$. Clearly, $Z_b^c < Z_g^c = Z_p^c$. Hence, from (7), one can show that for the bribe market, the critical success rates of the b-types are higher than the g-types, that is, $\overline{\mu}_g^c < \overline{\mu}_b^c$. Therefore, if $\mu_g < \overline{\mu}_g^c$, all firms choose the illegal course of action. On the other hand if $\overline{\mu}_b^c < \mu_b$ then none of firms will be corrupt. Although such extreme cases may be plausible, our focus is on the in between scenario where only the b-types engage in corruption, which will be the case if,

$$\mu_b < \overline{\mu}_g^c < \overline{\mu}_b^c < \mu_g. \tag{9}$$

However, this does not guarantee that corruption will take place in equilibrium. That depends on whether the b-types will enter production in the first place, that is, whether

$$V_b^c = \max\{\mu_b(Z_b^c) - T,\ \mu_b(Z_b^c - X_b^c)\} > \underline{V}, \tag{10}$$

where $X_b^c = (1-\rho)Z_b^c + \rho q(1-\alpha)Z_b^c$. Similarly, g-types enter whenever

$$V_g^c = \mu_g(Z_g^c) - T > \underline{V}. \tag{11}$$

We shall assume that $\underline{V} < V_g^c$, so that some g-types always enter. The participation rates for the complete information case will be given by

$$\lambda_b^c = \max\left\{0, \frac{V_b^c - \underline{V}}{\Delta V}\right\},\ \lambda_g^c = \lambda_p^c = \min\left\{1, \frac{V_g^c - \underline{V}}{\Delta V}\right\}, \tag{12}$$

where $\Delta V = \overline{V} - \underline{V}$. This completes the description of the equilibrium under complete information. It is clear that wealth inequality does not play any role but even in this simple setting we can see the relation between competition and corruption.

Suppose $V_b^c = \underline{V}$ and $\overline{\mu}_b^c > \mu_b$, then a rise in the number of corrupt inspectors would facilitate entry by the b-types by reducing X_b^c. The number of bribe paying firms will rise as the b-types are going to avoid T. Here the entry of b-type firms has no effect on the entry or exit decisions of the g-type or p-type firms. Hence, along with corruption, the total number of firms, which reflects competition, will increase.

We can interpret μ_b as a measure of competitiveness of the market.[16] In a competitive market without any friction only the most efficient firms are likely to succeed. In our case since the b-type firms are inefficient, a lower chance of success can be viewed as an increase in competitiveness. A fall in μ_b can have mixed results. Define μ_0 as the level of competitiveness so

[16]In our framework, μ depends on both the level of efficiency and the level of competitiveness. More precisely, at higher levels of efficiency, increase in competitiveness has negligient effect on μ, but for lower levels of efficiency, competitiveness reduces μ.

that there is no-entry by the b-type; $V_b^c = \underline{V}$. Now consider the case where the market forces are not that competitive (reflected in $\mu_b > \mu_0$), but the b-types are not corrupt, that is, $\mu_b > \overline{\mu}_b^c$. A fall in μ_b will reduce entry by the b-types but for those entering the market it can induce them to choose the illegitimate mode if the second inequality is reversed i.e. $\mu_0 < \mu_b < \overline{\mu}_b^c$. Hence competitive pressures can drive these firms towards corruption. However, a substantial reduction in μ_b can eliminate both entry of inefficient firms and corruption, if μ_b is less than μ_0. It is clear that with a greater scope of corruption (q), the required level of competition has to be greater (lower μ_0). As we shall see in the next section, it also depends on the extent of credit market imperfections.

We can summarize these in the following proposition.

Proposition 1 *In the complete information case, wealth inequality does not matter and* $1 \geq \lambda_g^c = \lambda_p^c > \lambda_b^c \geq 0$. *Corruption facilitates the entry of b-types without any distorting effects on the g-types. Rise in competitiveness can lead to greater corruption if it does not succeed in preventing entry by b-type firms.*

3.2.2 Incomplete Information and Wealth Inequality

Next, we study the case where the banks can not identify the different types. Banks, however, have (common) belief about the distribution of the three types. The treatment of the credit market is standard except that (i) there are some p-type households who are wealth constrained and hence cannot put up any collateral and (ii) the distribution of different types in the credit market is not exogenously given.

Since the banker cannot a priori distinguish between the different types, the banker uses the two instruments, r and w, at his disposal to screen the different types.[17] It is clear that the complete information pair D and

[17] See Bester (1985) for an early model of screening with collateral.

E would not be incentive compatible because the b-type could always get a higher payoff by choosing E. Due to the presence of p-type firms the standard screening outcome of the credit market, where the different types are completely separated, is not feasible. This is because in any separating outcome, the g-type will have to put up some collateral, but since the p-types[18] are collateral constrained, 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 p-types. Similarly, it is easy to show that a pooling outcome is also not possible. In Figure 1 the pooled contract satisfying the zero profit condition is given by G. Drawing the V_b, V_g passing through point G, it can be seen that a bank can always offer a contract like point F. The b-types will not choose but the g-types will prefer to choose F. Since this point lies above the zero profit line for the g-types, the bank can earn positive profit by offering such a contract. Hence G can not be the equilibrium outcome.

However, as seen in Figure 2, a semi-separating equilibrium is possible, where the g-types are separated out and the b and p-types pool.

[Insert Figure 2.]

Contract pair (r_g^*, w_g^*) and $(\bar{r}^*, 0)$ (represented by B and A respectively), is offered. The g-types chooses 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. From these expected payoffs we can find the participation rates $\lambda_i^s = (V_i^s - V_0)/\Delta V$. The probability that a borrower belongs to type-i household undertaking entrepreneurial

[18] Recall the p-types are the same as the g-types, except that they cannot put forth any collateral.

activity, when the credit market outcome is a semi-separating one is given by θ_i where

$$\theta_i = \frac{\lambda_i^s N_i}{\sum_i \lambda_i^s N_i}. \tag{13}$$

The semi-separating contract pair, (r_g^*, w_g^*) and $(\overline{r}^*, 0)$, will indeed be an equilibrium if a bank can not deviate and offer a pooled contract fetching non-negative profit. Such deviations can be ruled out if the pooled interest rate G lies above the point H, since in that case the g-types will not prefer the pooled contract. We broadly characterize the result below.

Let $\overline{r}$ be the interest rate where all three types are pooled and the bank's zero profit condition is met (point G). It is given by the following

$$\overline{r} = \frac{\pi_0}{\left[(\theta_g + \theta_p).\mu_g + \theta_b.\mu_b\right].K}. \tag{14}$$

Likewise, under the semi-separating equilibrium the pooled interest rate (partial pooling of b and p-types) is given by

$$\overline{r}^* = \frac{\pi_0}{(\phi_p.\mu_g + \phi_b.\mu_b).K}\ , \tag{15}$$

where ϕ_i represents the proportion of type-i engaged in production and accepting the pooled contract under the semi-separating equilibrium; $\phi_i = \theta_i/(\theta_b + \theta_p)$, $i = b, p$. Comparing (14) and (15), it is easy to see that $\overline{r}^* > \overline{r}$.

Define r' as the interest rate such that the g-types are indifferent between the equilibrium contract (r_g^*, w_g^*) and $(r', 0)$ (point H), that is,

$$\mu_g(Y - r_g^* K) - (1 - \mu_g) w_g^* = \mu_g(Y - r'K). \tag{16}$$

Moreover, (r_g^*, w_g^*) is given by the incentive compatible condition for b-type,

$$w_g^* = \frac{\mu_b(\overline{r}^* - r_g^*)K}{1 - \mu_b}, \tag{17}$$

and the zero profit condition of the bank,

$$\mu_g r_g^* K + (1-\mu_g)\delta w_g^* = \pi_0. \tag{18}$$

The equilibrium requirement (G lying above H) is reduced to $r' < \overline{r}$. This condition will depend on various model parameters μ_i, N_i and δ. Intuitively, if N_g is not too large relative to N_b and N_p; and μ_b is not too small, $r' < \overline{r}$ will be satisfied. Suppose, there are very few b-type households and their success probability is also very low, then one would expect very few of them in the credit market. On the other hand if there are many g-types in the credit market the pooled interest rate will be lower and closer to the complete information interest rate for the g-types. Given that screening is costly, the g-types would prefer the pooling outcome.[19]

It is easy to compare the semi-separating outcome with 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. More b-types will enter the market at the cost of mostly p-types. Hence we have $\lambda_b^s > \lambda_b^c$, $\lambda_g^s \leq \lambda_g^s$, $\lambda_p^c \leq \lambda_p^c$. If we have $V_g^s > \overline{V}$, $V_p^s > \overline{V}$ then despite the fall in expected payoff, the participation rates (of g and p-types respectively) can remain the same at $\lambda_g^s = \lambda_p^s = 1$.

Which of the groups will engage in corruption, will depend on what happens to $\overline{\mu}_b^s$, $\overline{\mu}_g^s$ and $\overline{\mu}_p^s$. For the p-types since $Z_p^s < Z_p^c$, it implies that $\overline{\mu}_p^s > \overline{\mu}_p^c = \overline{\mu}_g^c$. Although in the complete information case the p-types were not paying any bribes, now there is a possibility they might do so if, $\overline{\mu}_p^s > \mu_p > \overline{\mu}_p^c$. The situation will be similar for the g-types; they may engage in corruption in this situation, if $\overline{\mu}_g^s > \mu_g > \overline{\mu}_g^c$. These conditions, however, will fail to hold in presence of (9), which is $\mu_b < \overline{\mu}_g^c < \overline{\mu}_b^c < \mu_g$.

[19]Since the distribution of types itself is equilibrium determined (through λ), the analytical conditions are very messy. We have chosen to present a numerical example (later in this section) to show the equilibrium construct and its properties.

This is because the lowest possible income is earned by the b-types under complete information, that is $Z_b^c < Z_p^s < Z_g^s$ which leads to $\overline{\mu}_b^c > \overline{\mu}_p^s > \overline{\mu}_g^s$. Given (9), it must then be the case that $\mu_g = \mu_p > \overline{\mu}_b^c > \overline{\mu}_p^s > \overline{\mu}_g^s$. Hence, in our framework the p-types and the g-types do not engage in corruption under the incomplete information scenario.

For the b-types, $Z_b^s > Z_b^c$ implies that $\overline{\mu}_b^s < \overline{\mu}_b^c$. Hence there could arise a possibility that b-types do not engage in corruption if $\overline{\mu}_b^s < \mu_b < \overline{\mu}_b^c$. As before, this case can be ruled out since (9) holds. We know that since the g-types income under the complete information scenario is the highest possible income, which implies $Z_g^c > Z_b^s$. Hence it must be the case that $\overline{\mu}_b^s > \overline{\mu}_g^c > \mu_b$. Therefore the b-types will continue to choose $l = 0$.

Since more b-types enter the market the number of firms in equilibrium opting for the illegal route, and as a consequence bribery, will rise. This would imply that the level of corruption as measured by the ratio of corrupt firms to the total number of firms could be higher. We summarize the previous discussion in the following proposition.

Proposition 2 *Under incomplete information and wealth inequality, there exists a semi-separating screening equilibrium* $[\{r_g^*, w_g^*\}, \{\overline{r}^*, 0\}]$ *where the* b *and* p *types pool at* $\overline{r}^*$ *and* g *type separates at* $\{r_g^*, w_g^*\}$. *We have* $\lambda_b^s > \lambda_b^c$, $\lambda_g^s \leq \lambda_g^s$, $\lambda_p^c \leq \lambda_p^c$. *In addition, if* $\mu_b < \overline{\mu}_g^c < \overline{\mu}_b^c < \mu_g$, *a larger fraction of the total firms in the market will engage in bribery.*

An Example. Consider an economy with a large number of b-types. $N_b = 6000$, $N_p = 1200$, $N_g = 517$. Let $K = 20$, $\pi_0 = 20$, $\delta = 1/2$, $\mu_b = 1/4$, $\mu_g = 1/2$, $Y = 200$, $T = 20$. For the bribe game, let $\rho = q = 1/2$, $\alpha = 1/3$ and $F = 120$. For simplicity we are considering the fixed penalty case (see (6)). Using (6) it is clear that $\overline{\mu} = 1/2$, hence only b-types will find it profitable to evade T. The expected payments (bribe with probability ρq and fine F with probability $\rho(1-q) = X$) is 40. Recall that these payments are made only in the successful state. The support of the outside options is given by $\underline{V} = 20$, $\overline{V} = 60$. For the complete information case, using (1), (10), and (11) it is easy to check that $r_g^c = 2$, $r_b^c = 4$ and $V_g^c = 60$, $V_b^c = 20$. Using the expressions for λ (12), we can show that $\lambda_g^c = \lambda_p^c = 1$ and $\lambda_b^c = 0$. Hence, despite the presence of corruption prone firms there will be no corruption in equilibrium.

Now consider the semi-separating outcome. It is given by $r_g^* = 28/15$, $w_g^* = 16/3$ and $\overline{r}^* = 8/3$. This leads to $\lambda_g^s = (5.8/6)$, $\lambda_p^s = 5/6$ and $\lambda_b^s = 1/6$. As expected, the p-type's participation rate falls by 1/6. Using (15)-(18), it can be checked that this constitutes an equilibrium. From (13), the participation rates imply the following distribution of types $\theta_p = \theta_b = 2/5$ and $\theta_g = 1/5$. The zero profit condition (2), and (18) for the banks is satisfied. If a bank were to deviate and offer a completely pooled contract (while still earning zero profit), the corresponding interest factor (as in 14) will be 5/2. However, at this interest factor, the g-types earn an expected payoff of 55 which is lower than their equilibrium payoff of 58.66. Hence such a deviation will not be successful. In this equilibrium, 40 percent of the firms will be engaging in evasion and bribery. Therefore, compared to the complete information case, there is an increase in corrupt activities.

3.2.3 Changes in Inequality

Consider a redistribution of wealth where wealth inequality increases such that N_b stays the same, N_g falls and N_p rises. The pooled interest rate in the semi-separating equilibrium will fall (as N_p increases). At the pre-redistribution participation rates, rise in N_p will lead to a rise in θ_p and fall in θ_b. Since $\mu_g > \mu_b$, it is clear that (using (15)) $\overline{r}^*$ will fall. Consequently, $\{r_g^*, w_g^*\}$ will also change. Following a fall in $\overline{r}^*$ payoffs to all the three types

$(V_g^s,\, V_p^s,\, V_b^s)$ will rise. It can be verified that

$$\begin{aligned}
\frac{dV_b^s}{d\overline{r}^*} &= -\mu_b K, \\
\frac{dV_p^s}{d\overline{r}^*} &= -\mu_g K, \\
\frac{dV_g^s}{d\overline{r}^*} &= -K\left[\frac{(1-\delta)(1-\mu_g)\mu_b\mu_g}{(1-\mu_b)\mu_g - \delta(1-\mu_g)\mu_b}\right].
\end{aligned} \tag{19}$$

Hence,

$$\frac{dV_i^s}{d\overline{r}^*} < 0,\ i = g,\ p,\ b \text{ and } \left|\frac{dV_g^s}{d\overline{r}^*}\right| < \left|\frac{dV_b^s}{d\overline{r}^*}\right|. \tag{20}$$

So participation rates will increase for all types. However, as we explain in the following paragraph, the post-distribution participation rate of the p-types will always be lower than the pre-distribution participation rates. Hence some of the erstwhile g-type will exit the market as a result of this distribution. The rise in V_b^s leads to more b-type households in the market. The rise in λ_b will in fact be the equilibrating force as this would lead to a rise in θ_b and arrest the fall in the pooled interest rate.

The effect on the market outcome depends on the pre-distribution participation rates. Suppose, prior to redistribution, $\lambda_g^s = 1$, $\lambda_p^s = 1$ and $\lambda_b^s > 0$. In such case, there will be no change in the participation rates of entrepreneurs with good projects and only the number of bad projects increases in equilibrium. The result will be an increase in the total number of firms in the production sector and a rise in the number of corrupt firms.

On the other hand, consider a case where prior to redistribution $1 \geq \lambda_g^s > \lambda_p^s > \lambda_b^s > 0$. Let λ' denote the participation rates in the new equilibrium and N' be the post-distribution numbers of different households in the economy. Let $N_g - N_g' = N_p' - N_p = \Delta n$. The change in the total number of good projects (Δn_g) entering production will be given by

$$\Delta n_g = (N_g')(\lambda_g' - \lambda_g^s) + (N_p')(\lambda_p' - \lambda_p^s) - \Delta n(\lambda_g^s - \lambda_p'). \tag{21}$$

It can be shown that $\lambda_g^s - \lambda_p' > 0$. Suppose it is not true, then it follows that for the new pooled rate (for p and b types) A shifts down and lies below G in Figure 2. But this implies the existence of a common pooled interest rate with all g-types that lies below G. This, however, violates the initial equilibrium condition that no bank can offer a pooled rate and attract the g-types. Since the first two terms are positive, the total number of good projects will be reduced if the third term dominates the first two terms. From (20) it is clear that $(\lambda_g' - \lambda_g^s)$ is always likely to be small. Hence, a large $(\lambda_g^s - \lambda_p')$ would lead to $\Delta n_g < 0$. The difference between the participation rates of the g-types and the wealth constrained p-types is likely to be higher if there are too many b-types in the market. With more b-types in the market, the distance AH (in Figure 2) is also greater implying a higher value for $(V_g^s - V_p^s)$. Hence if we start from a situation where there are lot of bad projects and the fraction of wealth constrained households with good projects is not very large, the rise in inequality leads to a fall in the number of good projects. However, the number of bad projects can never go down. Following the previous discussion we can state the following proposition.

Proposition 3 *As the fraction of poor households increases following a rise in wealth inequality, more b-type firms enter the production sector and some g-type firms leave.*

If $\mu_b < \overline{\mu}_g^c < \overline{\mu}_b^c < \mu_g$, the number of firms engaging in evasion and bribery will also be higher. This matches well with our earlier observation in section 1 that a rise in inequality is associated with greater incidence of corruption.[20] However, note that the adverse effects of this rise in inequality have greater bite when there are more b-types in the market. This is where the environmental parameter q (fraction of corruptible inspectors)

[20] Banerjee (1997) models inequality in a similar manner and obtains a similar result in a different context.

comes into play. As discussed earlier, a high value of q induces greater participation by the b-types. Hence inequality matters more in a corruption prone environment.

It must be pointed out that not all forms of redistributions will lead to similar outcome. We are considering redistribution amongst households with same project types. Recall that the p-types are essentially wealth constrained g-types, hence the redistribution discussed in the previous paragraph refers to a redistribution within the households with good projects. By introducing another type — wealth constrained b-types (say pb) — we can consider similar redistribution within the b-types. But it is not going to affect the equilibrium outcome in any significant manner. Hence following any such redistribution N_b and $(N_g + N_p)$ stay the same. This means that any redistribution that leaves the number of wealth constrained households, N_p, unaffected will not have any impact on the market outcome. We can allow for redistribution of wealth across the different types without affecting the total number of good and bad projects. For example, if we transfer some wealth from the rich households with bad projects to the wealth constrained households with good projects, the end result will be a fall in N_p and a rise in N_g without affecting N_b. This will have exactly the same effect as a reduction in inequality of the type of redistribution (from rich g-type to the p-type) that we discussed earlier.

3.2.4 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 T. We can re-examine the level of competitiveness that can eliminate corruption. Since $V_b^s > V_b^c$, the level of competitive pressures μ_0 at which the b-types do not enter at all is much lower in the semi-separating equilibrium case. Higher the level of inequality (fraction of

p-type) lower will be the pooled interest rate and higher will be the payoff to the b-type, V_b^s, resulting in a lower μ_0. This means that competitive pressures have to be of the highest order to eliminate entry by these inefficient firms and hence corruption. There is now a bigger range in which b-type firms enter the market and engage in bribery.

On the other hand, the presence of a corrupt environment now affects the market outcome in a different way. Unlike the complete information case, corruption not only affects the b-type firms, it also affects the incentives of the p-type and g-type firms as well. A high value of q facilitates entry by more b-type firms and leads to a rise in the pooled interest rate $\overline{r}^*$. The resulting fall in V_p^s, V_g^s leads to lower participation by the p-type and g-type firms. The total number of firms of course will depend on the relative strengths of these two effects.

Hence, to summarize, in the presence of credit market imperfections the level of competitiveness required to eliminate corruption is always higher and the households with good projects are adversely affected by a rise in the scope of corruption.

4 Conclusion

In this paper we analyzed how wealth inequality may lead to increased corruption in an economy characterized by free entry conditions. This is made possible by the presence of inefficient firms who can not be prevented from the entering production due to imperfections in related markets. As more and more inefficient firms enter the market, the total number of firms might rise but corruption also rises. Corruption has a distorting role; it encourages entry by inefficient firms and can lead to exit by some efficient firms. As we have shown (Propositions 1 and 2) this is feasible because of wealth inequality and incomplete information in the credit market. In fact such imperfections play a significant role in determining the evolution of corruption and competition. It also highlights how greater competition coexists with greater corruption in a market free from pre-liberalization controls.

The multi-market orientation of our model 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 takes a partial equilibrium approach and focuses on the same market where corruption takes place. In the present case that would mean raising inspection probability (ρ) or fine (F), and create incentive for the inspectors to reduce q. Our paper, complementary to this approach, would point also in the direction of the credit market. As seen in our numerical example, elimination of imperfections in the credit market can eliminate corruption by preventing the entry of the corruption prone firms. 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, but is worth emphasizing in the context of corruption.

We have not modelled competition in an explicit way, but it is clear that competition in the sense of the number of firms in the production sector is being determined endogenously. However, as has been rightly pointed by Bliss and di Tella (1997), one would need to go beyond the simple measure of the number of firms to capture competition. Moreover, for comparative static exercises we have to look at other deeper parameters of competition. Unfortunately, apart from the success probabilities of the different types we do not have any parameters which can capture the degree of competition. It is possible to overcome this by modelling the interaction between the efficient (g-type) and inefficient (b-type) firms in the product market.[21] However, given the multi-market nature of our model, the analysis gets quite complicated and we have chosen not to pursue this line.

Similar issues arise in our treatment of corruption. A firm's incentive to engage in illegal evasion and bribery is determined to a large extent by its own type description (μ_i) and structural parameter including the fraction of corruptible inspectors (q). In fact, for the fixed penalty case (given by (6)), the level of corruption is completely determined by these parameters. It is possible to address this by endogenizing q to some extent. For example, as the prospect of bribe income goes up (due to more evading firms or higher bribe), one would expect q to go up. This, in turn, will affect bribe decisions of other firms in the market.

Wealth inequality and corruption are related in another important way. It is possible that wealthier households would spend more resources into buying power and access to politicians and bureaucrats.[22] 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 a 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 household's investment in access buying as a function of household wealth and the type of the project. Such a framework can be used to examine whether corruption makes the persistence

[21] Straub (2004) analyzes the relation between corruption and competition in a model where firms compete in a Cournot or Betrand fashion.

[22] Do (2004) analyzes how coaltions of wealthy individuals would bribe the regulator for retaining sole access to production activities. This could, in turn, lead to persistence of wealth inequality as the less wealthy are left out of the production sector.

of inequality more likely in the long run. We leave that for future work.

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A Appendix

	Mean	Std dev	Min	Max	Obs
Proportion of corrupt firms	0.38	0.16	0.138	0.738	23
Number of firms	147.95	88.75	86	532	23
GDP per capita (1999)	2407.55	2132.87	267.02	9257.41	23
Lagged Gini	34.67	7.47	21.7	50.3	23

Table 1a: Summary Statistics

	Proportion of corrupt firms	Number of firms	GDP per capita[1]	Lagged Gini
Proportion of corrupt firms	1			
Number of firms	-0.003	1		
GDP per capita[1]	-0.764*	-0.088	1	
Lagged Gini	0.699*	0.023	-0.567*	1

Table 1b: The correlation matrix

∗Significant at 1%. 1: GDP per capita 1999 (constant 2000 US$)

	Model 1	Model 2	Model 3
	Coefficients		
Number of firms	-0.0005	-0.0000[b]	-0.0004
	(0.0004)	(0.0005)	(0.0004)
Gini index		0.0678**	0.0338*
		(0.0164)	(0.0178)
GDP per capita	-0.0003**		-0.0002**
	(0.0000)[a]		(0.0000)[c]
Constant	0.2319	-2.8557**	-0.6152
	(0.2173)	(0.5513)	(0.4244)
R^2	0.6284	0.4625	0.7065
F-statistics	12.88**	8.79**	16.91**
Observations	23	23	23

Table 2: Regression on log of the odds ratio

The numbers in the brackets are the (robust) standard errors.

$*$ Shows significance at 5% level. $**$ Shows significance at 1% level.

a: The actual value is 0.00005. b: The actual value is -0.000009.

c: The actual value is 0.00005

Countries	Proportion of Corrupt firms[1]	Number of firms[1]	GDP per capita 1999∗[2]	Lagged Gini[3]
Armenia	0.488	125	573.59	37.90_a
Azerbaijan	0.738	130	594.49	46.20_a
Belarus	0.244	123	1199.66	21.70_a
Bulgaria	0.393	117	1457.25	34.50_a
Croatia	0.261	119	3937.46	29.00_a
Czech Republic	0.167	126	5215.32	26.15_b
Estonia	0.152	125	3681.59	37.60_a
Georgia	0.467	120	565.09	50.30_a
Hungary	0.210	138	4405.72	24.40_a
Kazakhstan	0.386	127	1089.68	35.40_b
Kyrgyzstan	0.689	122	267.03	41.10_a
Latvia	0.303	155	3026.66	32.40_a
Lithuania	0.453	86	3101.77	32.87_a
Macedonia	0.442	113	1700.94	28.20_a
Moldova	0.442	129	294.35	42.60_a
Poland	0.287	209	4144.50	31.60_a
Romania	0.458	107	1640.02	31.10_a
Russia	0.383	532	1613.70	34.60_a
Slovakia	0.295	112	3672.74	26.20_a
Slovenia	0.138	116	9257.41	28.40_a
Turkey	0.412	136	2799.82	41.50_c
Ukraine	0.555	220	591.51	39.10_a
Uzbekistan	0.578	116	543.30	44.60_a

Table 3: Data

Subscript indicates data year a: 1998; b: 1996; c: 1994. ∗Constant 2000 US$.

Source: 1: BEEPS (World Bank 1999); 2: World Development Indicators

3:WIDER WIID (2004) and Human Development Report (2002, 2003).

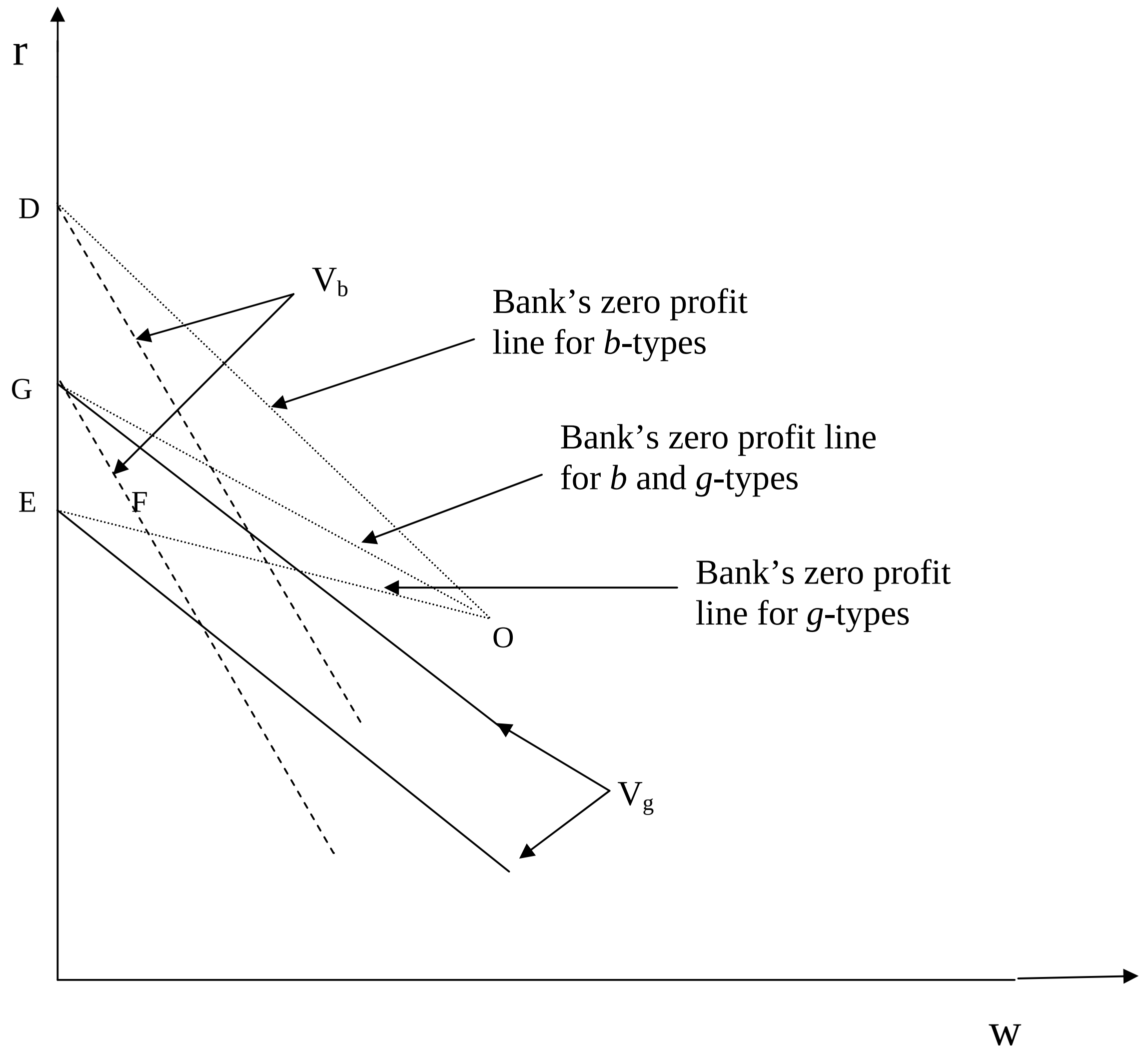

Figure 1: Separating equilibrium with two types.

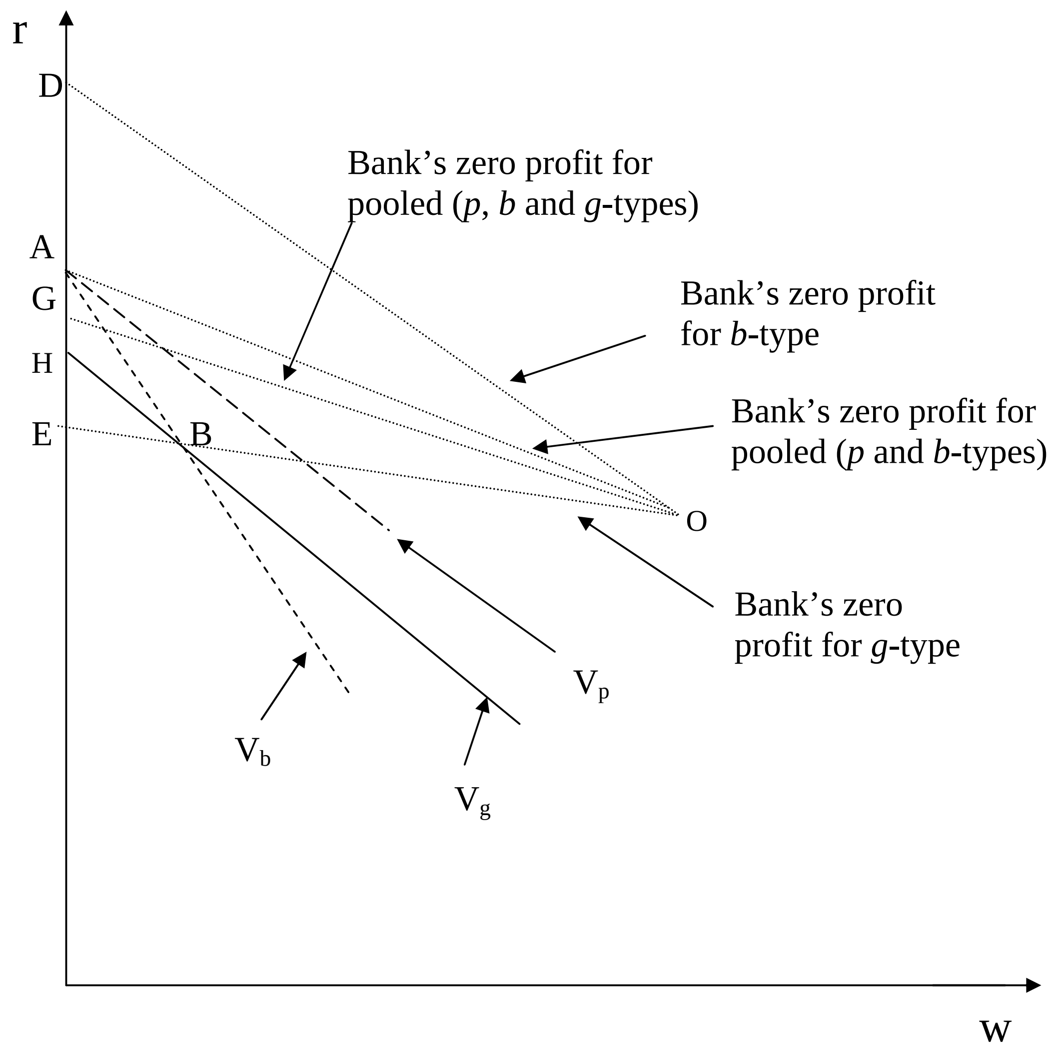

Figure 2: Semi-separating equilibrium under wealth inequality.