Does Inequality Foster Corruption?*

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ABSTRACT

We investigate how inequality affects corruption and provide a new insight to the possible channels through which such effect may work. We favour an explanation based on a multi-market framework where corruption in one market (or sector) arises because of imperfections exacerbated by inequality in related markets. We demonstrate that even when an individual's ability to pay bribes and benefit from engaging in corruption are not affected by wealth level, greater (wealth) inequality will lead to an increase in corruption.

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1 Introduction

Bureaucratic corruption, commonly defined as misuse of public office for private gains, is widespread in many of the developing economies typically characterised by market imperfections of varying degrees and inequalities. Our aim in this paper is to analytically explore how wealth inequality in the presence of market imperfections may engender corruption.

Although empirically some recent papers have found strong causal links from inequality to corruption (see You, 2005 and You and Khagram, 2005) it is not obvious how such causality may work.[1] Typical explanations of the direct role of inequality in corruption relies on the phenomena of 'state capture' by powerful groups, according to which, in a highly unequal society the rich will engage in corruption (or some other form of subversion of institutions) to maintain their privileged positions (Hellman et al 2000; Glaeser et al 2003; Do 2004). As pointed out by Hellman and Kaufman (2002) and demonstrated in Slinko et al. (2005) this explanation is more about the 'inequality of influence' rather than wealth inequality per se. More importantly this explanation is predicated on the rich being more corrupt than the others, the evidence for which is at best patchy.

We eschew such explanation in favour of one where all agents derive the same benefits from corruption and have the same abililty to pay their bribes. This may seem to imply that the level of corruption will be independent of the existing levels of wealth. Yet we are able to demonstrate that in a multi-market framework it is possible for corruption to emerge or escalate in one market (where agents produce output and pay taxes), due to the effects of wealth inequality in a related imperfect market (where agents borrow resources to produce output).

We consider a scenario where agents (henceforth referred to as households or firms) differ along two dimensions: wealth and profitability/prodcutivity of production plans. While wealth levels do not affect a particular firm's expected benefit from bribery, less productive firms are (under some conditions) more likely to engage in corruption. This is not an unrealistic assumption, as Dabla-Norris et.al. (2008) in their recent study of determinants of informality find that informality is associated with less productive firms. In

[1] There is a small empirical literature which looks at the impact of corruption on poverty and income inequality. See Gupta et al (2002), Li et al (2000) and Gyimah-Brempong and Munz de Camacho (2006). There is, of course, a large literature looking at the effects of wealth inequality on growth (See Benabou (1996), Aghion-Bolton (1997)).

fact in our model context, there are situations where ithese firms are able to survive in a market because they happen to be corrupt.

Wealth levels matter because firms have to borrow capital in an imprefect credit market. We show how informational problems coupled with the wealth constraints in the credit market contribute to the existence of the less productive firms. Hence, in some sense, corruption rises in the product market because of inequality and informational problems in the credit market. More specifically, we analyse how the credit market is unable to screen out less productive firms when some households are wealth constrained. These firms tend to get subsidized in the credit market and benefit from corruption — thus making their operation viable and possibly profitable. Since the less productive firms are more likely to engage in corruption, their presence in the product market determines the extent of corruption. Further, as wealth inequality rises it leads to an increase in the level corruption by effecting the entry of less productive firms and exit of wealth constrained productive firms.

Our paper is related to earlier work by Banerjee (1997) which also explores the effects of wealth inequality on level of equilibrium red tape. Our treatment of wealth inequality is very similar but concerns and notions of corruption are different. Our paper is also related to the recent paper by Foellmi and Oechslin (2007) which looks at the redistributive effects of corruption in the presence of credit market imperfections and wealth constraints. Credit market suffers from imperfect enforcement of credit contract and hence lenders ration the amount of credit to prevent voluntary default. The amount of credit available to a particular agent will depend on the agent's wealth level. Thus, agents with low level of wealth may not be able to generate enough funds to become entrepreneurs. Such market imperfections will prevent agents from becoming entreprenuers even in the absence of any kind of corruption. We, on the other hand, consider an alternative model of credit markets characterized by informational asymmetries and imperfect screening. Additionally, they consider non-collusive corruption and we focus on collusive corruption.[2] In collusive corruption both the bribe payer and payee

[2] As is well known, corruption takes various forms. Papers such as Shleifer and Vishny (1993), Bliss and di Tella (1997) and the recent firm level studies (Svensson 2003), focus on corruption as extortion, where agents pay bribes because of extortionary demand by the public officials and are not the real beneficiaries. In agency based models of corruption such as Besley and McLaren (1993), Mookherjee and Png (1995) both the briber and bribee benefit. There are also studies where both the features are present (Marjit et.al

stand to benefit from the corrupt act. 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. In this sense our notion of a corrupt firm is very similar to the notion of informality used by Dabla-Norris et. al. (2008) who look at the determinants of informality in a completely different context.

The plan of the paper is as follows. In the next section we describe the characteristics of different agents and how they interact strategically in our model. Section 3 contains the results and analysis under different scenarios. We explore the link between corruption in the product market and imperfections in the credit market. We argue that they reinforce each other and it may not be sufficient to just study one market alone in this context. We discuss its implications for the relation between corruption and inequality. Lastly, section 4 concludes with a discussion of the policy implications and the limitations of our model.

2 The Model

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

2.1 The Households

Households can either join the production sector (firms) or engage in some outside option.[3] They differ in terms of the payoff from their outside option. When it comes to production, there are two 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.[4]

2000, Guriev 2004). See Mishra (2005) for an analysis of the different forms of corruption.

[3] Our model can be interpreted as a model of occupational choice with corruption and wealth constraints (see Acemoglu and Verdier 1998, Ghatak et al. 2008 for similar exercises in different contaxts). The terms 'households' and 'firms' essentially refer to the same entities. Households in the production sector will be referred to as firms.

[4] It is possible to consider the case where output or profit of the b-types are lower than that of the g-types, but it does not affect our results.

Households also differ in terms of their initial wealth which is private information. Wealth inequality is captured through the existence of some wealth constrained households. 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.[5] 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). The total number of different types of households is given.

All households must borrow a certain amount say, K, from a bank. Households staying out of the production sector do not need to borrow, and receive some fixed outside income. Households also incur several non-input costs of running a legal business but can engage in bribery to avoid such costs. Inspectors are supposed to ensure compliance by the firms, but they can collude with the firm and avoid reporting. Similar to the literature on 'state capture', we view corruption as collusion between officials and agents, where both parties benefit. This collusive feature of corruption is key to the present paper.

2.2 Inspectors

Inspectors are in charge of monitoring compliance by the firms. 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.[6] Hence, q stands for the scope of corruption or corruptibility of the system.

2.3 The Banks

The banks 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.

[5] This assumption is not restrictive and introduction of wealth constrained b-types does not affect our main result. Both these b-types behave exactly the same way in all the equilibria that we study.

[6] We do not model the anti-corruption measures, hence q is taken as given. However, increase (or decrease) in q does not effect the main thrust of the results. It is possible to model inspector's decision to be corrupt and determine q endogenously, but we have avoided doing this to keep the analysis simple and tractable.

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

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

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 (probability of a borrower being type i), the bank maximizes

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

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.

2.4 Production

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 and we assume that all households have wealth to meet these costs.[7] While some components are likely to be

[7] This is similar to the models of informality where firms choose to place some of their production in the informal sector to avoid these costs (see Dabla-Norris et al, 2008, Mishra and Ray, 2010).

incurred after output is realized, we assume that firms have to invest T before output is realised. 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 production 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 of evading T, which includes bribes and fines, and V_{ij}^0 is the outside option available to the j^{th}-household of type-i. Note when households undertakes production activities $V_{ij} = V_i$, $\forall j \in i$. Also note that legitimate cost T is paid ex-ante but the cost of evasion is borne ex-post. This is an important distinction since the cost of evasion is borne ex-post, wealth constraints would not be a deterrent for corruption.

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 Equilibrium

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 prodcution 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). Once the output is realized, firm repays the bank according to the agreed contract.

5. Inspection is carried out by the inspectors. Corrupt inspectors can collude with the firm.

6. 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 4-6 as the bribe game. Since these are inter-linked, 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 2-7 will induce a unique outcome on household's entry decisions. 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. 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 N_i refers to the number of type$-i$ households in the population, $i = g$, 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.

3 Results and Analysis

3.1 Bribe Game

For the purpose of tracking how wealth inequality transmits from the credit market through to corruption in the product market, we shall intentionally keep our bribe game simple. We assume that all firms are inspected. If a firm decides not to incur the cost T, it can then be apprehended by an inspector and be subject a fine F. We shall assume that a non-compliant firm if caught has to forgo net output. Hence $F_i = (Y - r_i K)$. 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.

However, recall that q proportion of the inspectors are corrupt. 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 between the inspector and the firms. Without going in to the actual bribe determination process, we take bribe to be proportional to the fine. Denoting $(Y - r_i K)$ as Z_i, bribe $d_i = \alpha Z_i$.[8] We also assume limited liability which implies that fines can not be collected from non-successful firms. Hence, using (3) and (4), a firm will choose $l = 0$ if and only if

$$\mu_i.\,(q\alpha Z_i + (1-q)Z_i) \leq T \tag{5}$$

Or,

$$\mu_i < \frac{T}{(1 - q(1-\alpha)).Z_i} = \mu(T, q, Z_i) = \overline{\mu}_i. \tag{6}$$

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

Note that $\overline{\mu}$ is type specific because it depends on Z_i, which in turn will depend on the credit market outcome.[9] From (6) 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.

Since T is fixed and firms have limited liabilities, all firms have the same amount of benefit from evasion and are able to pay the required amount of bribes. This avoids any direct role of inequality in corruption as has been our intention in this paper. But, because fines or bribes are paid ex-post, the firm with a lower successful probability faces a lower expected cost (fines and bribes) and hence is more likely to be corrupt.[10]

[8] 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 $(1-\alpha)$.

[9] Our working paper considers various formulations. If F is fixed then the critical success rate is independent of Z_i. On the other hand the present formulation can be generalised to consider a lump sum tax T and a proportional tax on profits (tZ_i).

[10] In much of the analysis we use the number of firms that chooses $l = 0$ as a measure of

3.2 Credit Market

Before we discuss the credit market outcome, it is useful to consider the benchmark case where there is complete information about the type of projects. Recall that banks have no information about the wealth of the households, hence they can not distinguish between the rich good type (g-type) and poor good type (p-type). We shall assume that the level of wealth does not affect a household's need to borrow K or income streams Y.[11]

3.2.1 Complete Information Benchmark

Given positive collateral cost, $1 > \delta > 0$, it is easy to see that under complete information there is no need for collateral.

[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 households have a steeper indifference curve. The dotted lines show the zero profit lines for the bank. Since $1 > \delta > 0$, the household's indifference curve is steeper than the banks indifference curve.

Let superscript c denotes the outcome under complete information. The net income Z_i^c of the different types in the successful state would be $(Y - r_i^c K)$, where r_i^c is the interest rate the $i-$types pay in the complete information case. Clearly, $Z_b^c < Z_g^c$. Hence, from (6), one can show that for the bribe game, 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 the following condition holds. We shall assume that

$$\mu_b < \overline{\mu}_g^c < \overline{\mu}_b^c < \mu_g. \tag{7}$$

corruption. In earlier versions of the paper we have considered other indicators like size of bribes.

[11] 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.

We shall also assume that some g-types always enter. Participation rates are given by $\lambda_i^c = \frac{V_i^c - \underline{V}}{\Delta V}$, where $\Delta V = \overline{V} - \underline{V}$, $1 \geq \lambda_i \geq 0$. We assume that

$$V_g^c = \mu_g Z_g^c - T > \underline{V}. \tag{8}$$

Proposition 1 *In the complete information case,* $r_g^c = r_p^c < r_b^c$ *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 *and* p*-types.*

Proof. (Sketch only) It is clear from Figure 1 that contracts D and E will be offered in equilibrium. Firms with a good projects will be offered contract E (lower interest rate) and firms with a bad projects will be offered D (higher interest rate). Bank's zero-proft condition is satisfied. Since D does not require any collateral, wealth constraints do not matter and $\lambda_g^c = \lambda_p^c > 0$. Condition (7) guranatees that b-types will evade T and engage in bribery whenever apprehended by an honest inspector. 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

$$V_b^c = \mu_b[Z_b^c - \{(1-q)Z_b^c + q\alpha Z_b^c\}] > \underline{V}. \tag{9}$$

Moreover, it can be verified that $V_b^c < V_g^c$ implying $\lambda_g^c = \lambda_p^c > \lambda_b^c$.

Suppose $V_b^c = \underline{V}$ and $\overline{\mu}_b^c > \mu_b$, then a rise in the number of corrupt inspectors (rise in q) would facilitate entry by the b-types by raising V_b^c. The number of bribe paying firms will rise as the b-types are going to avoid T. Since V_g^c (or V_p^c) is unaffected, there is no change in particpation of the g-types. ∎

3.2.2 Incomplete Information

Next, we study the case where the bank can not identify the different types. A bank can use the two instruments, r and w, at its disposal to screen the different types. Due to the presence of p-type firms the standard screening outcome of the credit market, where all three different types are completely separated, is not feasible.[12] This is because in any separating outcome, the g-type will have to put up some collateral, but since the p-types are collateral constrained, the bank is forced to offer them a contract with no collateral.

[12] See Freixas and Rochet (1997) for various screening models in the credit market.

We have assumed the credit market to be competitive, even though we do not model the competition between banks in an explicit manner. The bank's zero profit condition is satisfied in equilibrium and there is no contract that the bank can deviate to and make positive profit. Using superscript s to denote the outcome under incomplete information, V_i^s represent the expected income of type-i and $\lambda_i^s = (V_i^s - \underline{V})/\Delta V$.

Recall that the probability that a borrower belongs to type-i household undertaking production is given by θ_i where

$$\theta_i = \frac{\lambda_i^s N_i}{\sum_i \lambda_i^s N_i}, \ i = g, p, b \tag{10}$$

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

$$\overline{r} = \frac{\pi_0}{\left[(\theta_g + \theta_p)\mu_g + \theta_b\mu_b\right] K}. \tag{11}$$

Point G in Figure 1 refers to this interest rate. Likewise, consider an outcome where the b and p-types pool but the g-types are seprated. In such a semi-separating equilibrium the pooled interest rate (partial pooling of) is given by

$$\overline{r}^* = \frac{\pi_0}{(\phi_p\mu_g + \phi_b\mu_b)K} \ , \tag{12}$$

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 (11) and (12), it is easy to see that $\overline{r}^* > \overline{r}$. Before we state the next Proposition, it would bee useful to consider the following two definitions.

Let μ_0 be the success probability of the b-type such that the b-type with lowest outside option is indifferent between entering production and not when offered the complete information interest rate.

$$\mu_0[Z_b - \{(1-q)Z_b + q\alpha Z_b\}] = \underline{V}, \text{ where } Z_b = Y - r_g^c K.$$

Likewise, let μ_1 is the success probability of the b-type which makes the $g-$type is indifferent between the grand pooling outcome (11) and the semi-separating outcome (12).

Proposition 2 *(i) Let $\mu_b < \mu_0$, credit market equilibrium is given by the complete information contract E, $\lambda_b^s = 0$, $\lambda_g^s = \lambda_p^s = \lambda_p^c = \lambda_g^c$. (ii) Let $\mu_1 > \mu_b > \mu_0$, 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 $\lambda_b^s > \lambda_b^c$, $\lambda_g^s \leq \lambda_g^c$, $\lambda_p^s \leq \lambda_p^c$, and $\lambda_g^s > \lambda_p^s$. (iii)Let $\mu_b > \mu_1$, the only equilibrium in the credit market is the pooling equilibrium $\overline{r}$ where all three types are pooled and $\lambda_b^s > \lambda_b^c$, $\lambda_g^s = \lambda_p^s \leq \lambda_g^c$.*

Proof. (Sketch only) It is clear from Figure 1, that in the incomplete information case the contract pair (D, E) is not incentive compatible and all types would choose E. However, if $\mu_b < \mu_0$, the b-types still find it non-profitable to enter. Hence in equilibrium contract E is offered, $\lambda_b^s = 0$.

For $\mu_b > \mu_0$, b-types will find it profitable to enter. Now, a semi-separating equilibrium is possible, where the g-types are separated out and the b and p-types pool. Contract pair (r_g^*, w_g^*) and $(\overline{r}^*, 0)$ (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. It is easy to show that (r_g^*, w_g^*) is given by the incentive compatible condition for b-type,

$$w_g^* = \frac{\mu_b(\overline{r}^* - r_g^*)K}{1 - \mu_b}, \tag{13}$$

and the zero profit condition of the bank,

$$\mu_g r_g^* K + (1 - \mu_g)\delta w_g^* = \pi_0. \tag{14}$$

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.[13] 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. Comparing with the complete information case, the b-types are better off and their participation increases. For the $g-$types $V_b^s > V_b^c$ and $V_g^s < V_g^c$. It can be shown 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

[13] 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.

g-types. More b-types will enter the market at the cost of mostly p-types. The weak inequalities in the participation rates follow from the possibility that 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 $\lambda_g^s = \lambda_p^s = 1$.

For higher values of μ_b(as $\mu_b$approaches μ_g) the pooled interest rate given by point G moves closer to E. Let $\mu_1$be the value of μ_b such that $G = H$. Clearly, for $\mu_b > \mu_1$,the semi-seprating outcome ceases to be an equilibrium. The pooled outcome given by $\overline{r}$ (11) and denoted by G is the only equilibrium. This is where the b-types are subsidized the most and $\lambda_b^s > \lambda_b^c$. In this equilibrium wealth constraints do not matter as all types pay the same interest rate. ■

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 g-types, since $Z_g^s > Z_g^c$, we have $\overline{\mu}_g^s < \overline{\mu}_g^c$ and they will not engage in corruption since they were not doing so in the complete information case. On the other hand, for the p-types since $Z_p^s < Z_p^c$, (6) 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, $\overline{\mu}_p^s > \mu_p > \overline{\mu}_p^c$. This condition, however, will fail to hold in presence of (7), which is $\mu_b < \overline{\mu}_g^c < \overline{\mu}_b^c < \mu_g$. 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 using (6) leads to $\overline{\mu}_b^c > \overline{\mu}_p^s > \overline{\mu}_g^s$. Given (7), 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, from (6), 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 (7) holds. We know that since Z_g^c, the g-types income under the complete information scenario, is the highest possible income that firms in this economy can achieve, therefore $Z_b^s < Z_g^c$. Hence, using (6), 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 will be higher. We summarize the previous discussion in the following.

Corollary 1 *Suppose* $\mu_b < \overline{\mu}_g^c < \overline{\mu}_b^c < \mu_g$ *and* $\mu_b > \mu_0$*. Under incomplete information and wealth inequality, corruption is higher in equilibrium as a larger fraction of the total firms will engage in bribery.*

Example Consider an economy with $N_b = 6000$, $N_p = 1200$, $N_g = 517$. 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 $q = 1/2$, $\alpha = 1/7$. For simplicity consider penalty to be fixed $F = 77$. Using (6) it is clear that $\overline{\mu}_b = \overline{\mu}_g = \overline{\mu}_p = 0.45$, hence only b-types will find it profitable to evade T. The expected payments (bribe with probability q and fine F with probability $(1-q)$) is 41.25. 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), and (9) 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, 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 participation rates $\lambda_g^s = (5.8/6)$, $\lambda_p^s = 5/6$ and $\lambda_b^s = 1/6$. As expected, the p-type's participation rate falls by $1/6$. Using (10)-(14), it can be checked that this constitutes an equilibrium. Given the participation rates we can solve for the following distribution of types $\theta_p = \theta_b = 2/5$ and $\theta_g = 1/5$ (since $\theta_i = (\lambda_i N_i)/\sum \lambda_i N_i$). The zero profit condition (2), and (14) 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 rate (11) will be 5/2. However, at this interest rate, 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

Changes in inequality matters in our model to the extent it affects the proportion of wealth constrained households N_p relative to other households N_b,

N_g.[14] Since total number of households and total wealth remain same, all changes in inequality can be seen as resulting from mean preserving spreads.[15] Consider a redistribution such that N_b stays the same, N_g falls and N_p rises with $N_g + N_p$ remaining same.[16] This change in type distribution of households ($g-$type and $p-$type) will affect the equilibrium outcome and participation rates of different types of households. Given that households differ in terms of bribing behaviour, level of corruption will also be affected.

The effect of redistribution will also depend on the nature of credit market equilibrium. If g-types and p-types are being treated in identical fasion (Cases (i) and (iii) in Proposition 2) then the redistribution described above will have no impact. In both cases ((i) and (iii)) the equilibrium depends on the total number good households, not their distribution in terms of constrained (p-type) or unconstrained ($g-$type). However, in the semi-seprating equilibrium, the p-types have a lower participation than the $g-$type and the equilibrium configuration depends on the distribution of households. It is clear that following a redistribution of the kind described above, the equilibrium interest rate $\overline{r}^*$ will fall and the separating contract for the g-type (r_g^*, w_g^*) will also change. Before we state the proposition, let us consider the numerical example.

Example (contd.) Consider the previous example and the semi-separating equilibrium. Now consider a redistribution of wealth so that the number of wealth constrained households goes up. Let $N_b = 6000$, $N_p = 1717$, $N_g = 0$. Since only wealth constrained p-types and unconstrained b-types are present, the new equilibrium will be a simple pooling equilibrium with $\overline{r}^* = 5/2$. The participation rates will be higher for both types; $\lambda_p^s = 5.2/6$ and $\lambda_b^s = 3/16$. Comparing the number of firms before and after the redistribution, the number of b-types engaged in production goes up from 1000 to 1125 and the number p-types and g-types engaged in production falls from 1500 to 1488. Since, by assumption, the b-types engage in corruption the level of corruption goes up following the redistribution. The following Proposition formalizes this idea.

[14] This feature is likely to be present whenever cash or wealth constraints are the main drivers of imperfections (see Banerjee,1997).

[15] We thank a referee for pointing this out.

[16] This can be achieved in several ways. We could (i) redistribute wealth from some wealthy g-types to b-types or (ii) redistribute wealth from some wealthy g-types to other wealthy g-types. Our results do not depend on the underlying distribution process.

Proposition 3 *Consider the semi-seprating equilibrium described in Proposition 2. 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. This leads to a rise in the proportion of corrupt firms in the market.*

Proof. First, given 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 (12)) $\overline{r}^*$ 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

$$\frac{dV_i^s}{d\overline{r}^*} < 0, \ i = g, \ p, \ b \text{ and } \left|\frac{dV_g^s}{d\overline{r}^*}\right| < \left|\frac{dV_b^s}{d\overline{r}^*}\right|. \tag{15}$$

So there will be an increase in the participation rates for each type (whenever feasible).

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 households with good projects and only the number of bad projects increases in equilibrium.

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

$$\Delta n_g + \Delta n_p = (\widetilde{N}_g)(\widetilde{\lambda}_g - \lambda_g^s) + (N_p)(\widetilde{\lambda}_p - \lambda_p^s) - \Delta n(\lambda_g^s - \widetilde{\lambda}_p), \tag{16}$$

where the first term (in the right hand side) shows the increase in the number of g-types who remained rich; the second term indicates the increase in the number of p-types and the last term accounts for the g-types who had exited once they became poor. It can be shown that $\Delta n_g + \Delta n_p < 0$. [17]

Hence there will be more b-types. Given (7) and the arguments preceding Corrollary 1, there will be more bribe paying and fewer abiding households in the production sector. ■

Remark 2 *Note that b-type households and bribe paying households or extent*

[17] The details are in our working paper version, available upon request.

of corruption are identical in much of the analysis. As Z_b (or more precisely V_b) increases following a fall in the pooled rate, $\overline{\mu}_b$ also falls and $\mu_b < \overline{\mu}_g < \overline{\mu}_b$ may not hold any more. Following a rise in Z_b, the b-types might choose to abide and corruption will reduce to zero. It can be shown that if we raise the Z or V of all types, corruption can be reduced. This might suggest that our model of the link between inequality and corruption relates experience of low income countries (with lower Z or V)

Remark 3 *We have considered only the proportion of corrupt firms as a measure of corruption. As mentioned earlier, we could use 'the total amount of bribes paid' as another measure. To the extent (7) holds and only b-type firms are always corrupt, both the measures move in the same direction in all the previous propositions. Since the participation of b-types can only increase following a rise in Z_b, and the size of bribe is given by $d_i = \alpha Z_i$, this implies that the total amount of bribes paid also goes up.*

4 Conclusion

Our objective was to provide a rationale for the causal link from inequality to corruption. We have done that using a multi-market framework where the presence of wealth inequality in the credit market prevents the screening of the efficient firms from the inefficient firms, thus allowing inefficient firms to enter the market, bringing corruption in its wake. We do not wish to claim that our approach provides the only explanation linking inequality to corruption. Although there may exist other possibilities, our approach, provides a plausible explanation of how corruption is affected by wealth inequality even when an individual's ability and willingness to engage in corruption is not directly affected by the person's wealth. Since bribe are paid ex post (after the project returns are realized) a poor household can also afford to pay bribes and the benefit from corruption to the household depends on its efficiency type but not the level of wealth. We feel that this makes our analysis more interesting since there is no obvious reason why wealth inequality should matter so far as corruption is concerned.

Our model can be extended in couple of other directions. First, an obvious question is how the poor households are affected by the presence of corruption. Even though poor households can benefit and can engage in corruption to the same extent as the rich, our model shows that some of these poor households (the wealth constrained households with good projects) are adversely affected because of credit market imperfections. Recall that as more households with bad projects enter – the more these poor households are adversely affected. Second, one can also address the issue of the link between corruption and competition in the presence of wealth inequality and market imperfections.[18] We have left these issues for future research.

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 related markets: for instance, intervention in the credit market, will depend on the extent of corruption. 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 or the fine, and reduce the incentive for inspectors to be corrupt. 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.

[18] See Ades and Di Tella (1999), Bliss and di Tella (1997), Laffont and N'Guessan (1999) for studies focusing on this issue.

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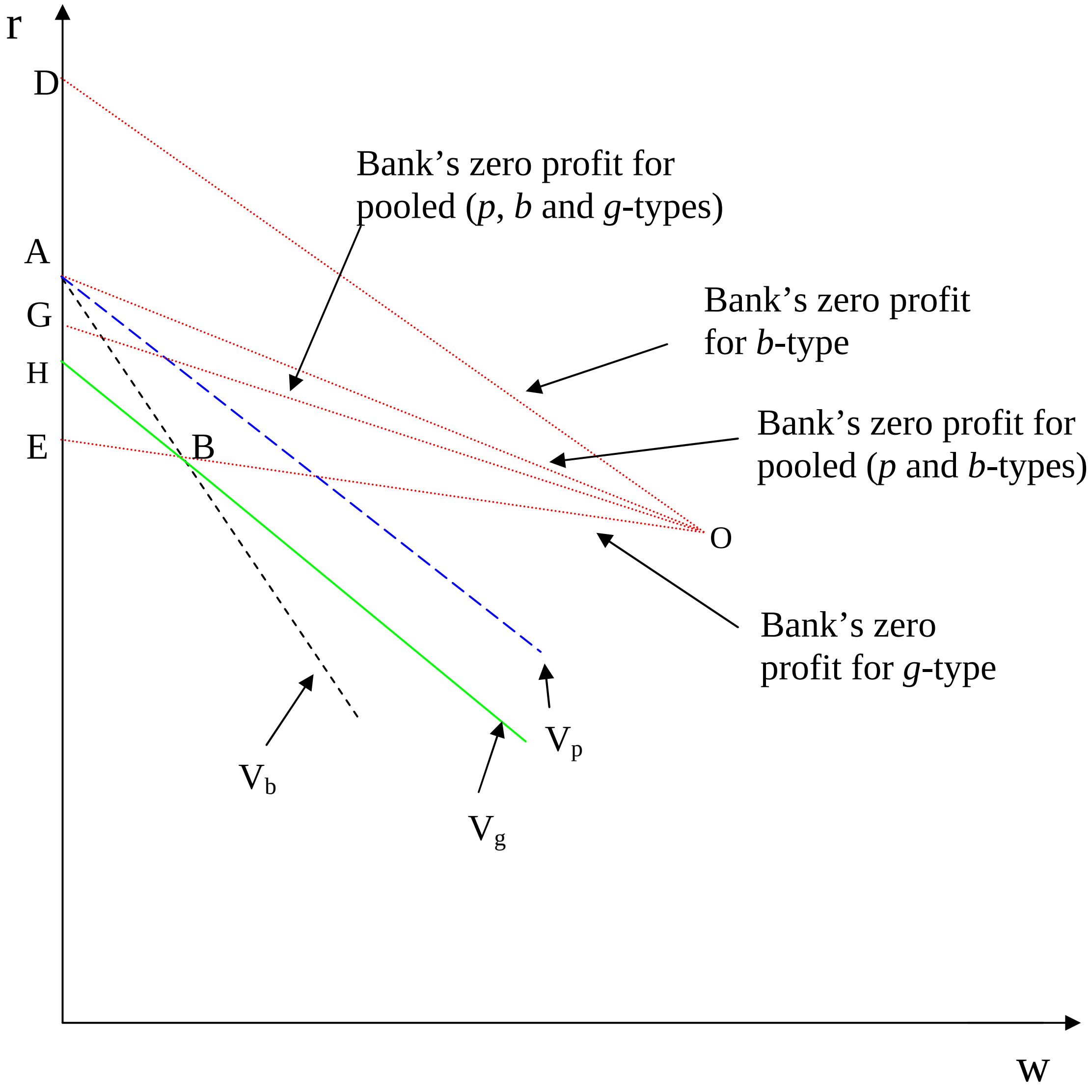

Figure 1: Equilibria in the credit market with *g*, *p, and b*-types