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WHO GAINS FROM NON-COLLUSIVE CORRUPTION?

Reto Foellmi* and Manuel Oechslin†‡

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Non-collusive corruption, i.e., corruption that imposes an additional burden on business activity, is particularly widespread in low-income countries. We build a macroeconomic model with credit market imperfections and heterogeneous agents to explore the roots and consequences of this type of corruption. We find that credit market imperfections, by generating rents for the incumbent entrepreneurs, create strong incentives for corrupt behavior by state officials. However, non-collusive corruption not only redistributes income from non-officials towards officials but also within the group of potential entrepreneurs. If borrowing is limited, bribes prevent poorer but talented individuals from starting a business. But this is likely to benefit those who may enter anyway; the cost of capital is lower and there is less competition on the goods markets.

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*University of Zurich, Institute for Empirical Research in Economics, Bluemlisalpstrasse 10, CH-8006 Zürich, Tel: +41 44 634 37 26; e-mail: rfoellmi@iew.unizh.ch.
†University of Zurich, Institute for Empirical Research in Economics, Bluemlisalpstrasse 10, CH-8006 Zürich, Tel: +41 44 634 36 09; e-mail: oechslin@iew.unizh.ch.
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1 Introduction

In its recent World Development Report on poverty the World Bank emphasizes that corruption is one of the major obstacles in the fight against poverty in the developing world. Indeed, recent empirical work by Li et al. (2000) has found that corruption hampers growth and increases inequality. Mauro (1995) has found a negative association between corruption and investment. Friedman et al. (2000) provide evidence that greater corruption and a large unofficial economy go hand in hand. Despite the fact that there exist theoretical arguments suggesting that corruption improves welfare (e.g., Leff, 1964), the academic discussion has largely reached a consensus that, in practice, a dishonest bureaucracy deteriorates efficiency.

In the light of its adverse effects on economic performance and poverty reduction in the developing world it is astonishing that extensive corruption is so persistent in many of the low-income countries. Why is a corrupt bureaucracy not fought by a government exactly appointed to do so? There might be a simple reason if corruption is mutually beneficial between the official and his client. As Bardhan (1997) underlines, neither the official nor the private agent has an incentive to report or protest in that case. This means that collusive corruption is insidious and difficult to detect and therefore likely to be persistent. However, corruption is often not mutually beneficial between the official and the private agent but imposes additional costs in particular on firms. Rose-Ackerman (1999, pp. 15-7) reviews anecdotal evidence showing that non-collusive corruption, i.e., corruption that benefits only the dishonest officials,\(^1\) increases the costs of engaging in economic activity dramatically. In Section 2 we show that this kind of corruption is pervasive throughout the less developed world.

The aim of the theoretical part of this paper is to shed light on the forces behind persistent corruption without theft. We explore its distributional consequences in a macroeconomic model with market imperfections and heterogeneous agents. In particular, we analyze the impact of bribery on individual investment opportunities and on aggregate variables such as the equilibrium interest rate in presence of imperfections on the credit and on the goods markets. In poorer countries especially, such market imperfections are widespread (e.g., Levine, 1997; Rodrik, 1988). So far, the theoretical literature has largely neglected the distributional effects of corruption via its impact on factor rewards or on goods prices. However, it turns out that

\(^1\)Corruption without theft (from the government) in the terminology of Shleifer and Vishny (1993). Henceforth "corruption without theft" and "non-collusive corruption" are treated as synonyms.
taking into account these general equilibrium effects is important for understanding how the costs and benefits of corruption are distributed among the economic groups in society.\footnote{Using a reduced-form (and partial-analytic) approach, Bliss and Di Tella (1997) discuss the impact of more competition on goods prices, firm profits, and corrupt payments. However, consistent with the set-up of their model, they do not address distributional consequences of corruption within the group of (potential) entrepreneurs.}

Our model focuses on non-collusive corruption taking place between firms and lower-level bureaucracy. We assume that a potential entrepreneur has to complete bureaucratic procedures to set up a business and, crucially, that the officials have some discretion over the government good (e.g., a "business license") associated with the procedures. Specifically, we assume that expected punishment in case of demanding bribes is comparatively low and that there is only a single official per jurisdiction to provide the business license. As a result, a potential entrepreneur may be forced to bribe the official in order to complete the procedures and to get the license. After having received the license, an entrepreneur is free to invest. The technology - which is identical across agents - is non-convex in the sense that a minimum investment is required to produce output. Provided that the minimum scale requirement is satisfied, the technology exhibits constant returns to scale in capital. Further, there exists an economy-wide capital market that may be imperfect because of imperfect enforcement of credit contracts. In that case, the initial capital endowment serves as collateral determining how much can be borrowed and, eventually, who runs an enterprise and who becomes a lender.

Our analysis provides two main results. First, the credit market imperfection guarantees supra-normal profits to the entrepreneurs who may enter the markets, and the existence of such rents induces the officials to demand bribes. By contrast, with a well-functioning financial system, the rents are low or entirely absent; from an official’s viewpoint, it is optimal to demand only moderate bribes or not to commit corrupt acts at all under these circumstances. Interestingly, however, the relationship between contract enforcement and the equilibrium bribe is not unambiguous. If enforcement improves from a low level, the bribe may rise in the first place. Afterwards it stays constant and then starts falling.

The second result is that non-collusive corruption not only redistributes income from non-officials towards officials but may also lead to redistribution among non-officials. In particular, the "middle class" suffers most from (more) corruption whereas the wealthiest entrepreneurs are less affected or even win. These distributional consequences are driven by the fact that,
under imperfect credit, wealth serves as a collateral determining how much can be borrowed on the credit market. Paying bribes reduces this collateral so that a potential entrepreneur may borrow less if the bureaucrats demand higher bribes. More severe credit restrictions are especially harmful for individuals that have to rely on external funds to finance a plant of minimal size. For some of the members of this "middle class" - the poorest among them - entrepreneurship will no longer be viable option. This crowding-out effect, in turn, benefits the entrepreneurs who stay in the market. Aggregate capital demand falls so that the cost of capital of the remaining entrepreneurs goes down. Lower capital costs benefit the large borrowers strongest. The group of the largest borrowers even wins because this general equilibrium effect is strong enough to more than compensate for the higher bribe costs. Under imperfect credit, the largest borrowers are the most affluent individuals because ex ante wealth plays the role of a collateral. The distributional consequences among non-officials are amplified if the crowding-out effect reduces the extent of competition on the product markets.

We suggest that our results may add to a better understanding of persistent non-collusive corruption. The argumentation evolves along two separate but related lines. First, we point to the fact that credit market imperfections create rents for the incumbent entrepreneurs. These rents may be partially extracted by corruptible officials if the sanctions against bribery are imperfect. Since the rents tend to be the lower the better the credit market works, we find that the bribe payments are lower in financially advanced economies - even if less and more advanced countries prosecuted corruption with the same rigor. Put differently, (near-)perfect enforcement of credit contracts erodes the official’s power to extract rents. Second, the analysis highlights that non-collusive corruption acts as a barrier to entry if credit contracts are poorly enforced; it points to the fact that these barriers may benefit the most affluent entrepreneurs via a general equilibrium channel. Hence, it may be that this group has an incentive to oppose an effective reform of the state bureaucracy or the legal system.\(^3\) Clearly, reducing corruption is a difficult task, a fact that is mirrored by the vast literature on that subject (for a survey see Bardhan, 1997). Controlling collusive corruption is particularly non-trivial because of its secret nature.\(^4\) The argument here is that even if a well-intentioned government perfectly knew

\(^3\) Li, Squire, and Zou (1998), among others, provide evidence that in countries with weak democratic institutions the government is indeed "captured" by the rich.

\(^4\) For instance, Mookherjee and Png (1995) show that a more severe punishment on an inspector who colludes with a private firm against the regulator may even raise the bribes.
how to reduce the most visible and non-collusive forms of corruption, it might have difficulties to do so because of political economy reasons.

Our work is part of the literature on the macro-determinates of corruption (e.g., Ades and Di Tella, 1997, 1999; Treisman, 2000; Acemoglu and Verdier, 2000; Fisman and Gatti, 2002). It is most closely related to the contributions by Ades and Di Tella who emphasize that the existence of rents, created, e.g., by product market imperfections, may foster corruption. Rents are also crucial for the existence of corruption in the present paper. We depart from Ades and Di Tella’s work, however, by stressing that credit market imperfections may be an important source of rents. Moreover, we analyze the impact of bribery on equilibrium factor prices and goods prices. This, in turn, allows us to assess the distributional consequences of corruption within the group of potential entrepreneurs. There is also a close link to Bliss and Di Tella (1997). As in their model, corruption may alter the extent of competition on the goods market in the present framework. An important difference lies again in the emphasis we put on the interaction between corruption and credit market imperfections.

The organization of the paper is as follows. In Section 2 we shortly discuss different types of corruption and provide some evidence suggesting that non-collusive corruption is pervasive in the less developed world. Section 3 sets up the model and examines the static equilibrium. The distributional consequences of corruption under imperfect credit are explored in Section 4. In Section 5 we discuss an extension of the basic model in which more corruption lowers the extent of competition on the goods markets. Section 6 concludes.

2 Types of Corruption

Shleifer and Vishny (1993) distinguish two types of corruption. First, in the case without theft (from the government), the official does not hide the transaction with a private agent and passes the transaction’s price to the government but charges something extra for himself. This means that the official imposes additional costs on the private agent. A well-known example of corruption without theft is provided by De Soto’s (1989) study of entry regulation in Peru in the early 1980s. At that time, there were eleven requirements for setting up a small industry. In an experiment, a potential entrepreneur was asked for additional payments on ten occasions. Refusing to pay the bribes resulted in administrative delays of considerable length or made it simply impossible to get the government good associated with the procedures. Second, in the
case *with theft*, the official sells the government good for private gain (usually at a price lower than the government price) and hides the transaction. Further examples of corruption *with theft* (i.e., *collusive corruption*) include the case of bribing officials to circumvent pollution control laws or, of course, cases of bribing bureaucrats to win profitable contracts with the government. In sharing a rent at the expense of the public, corruption *with theft* is beneficial for the official *and* the private individual.

Many authors, among them Shleifer and Vishny (1993, p. 604) and Bardhan (1997, p. 1334), argue that we should expect collusive corruption to be more persistent and widespread than non-collusive since in the case with theft the interests of the official and the private agent are aligned and there are no incentives to protest. Although there is a lot of anecdotal evidence suggesting that non-collusive corruption is also widespread and persistent, it is difficult to make a sound judgment from an empirical point of view. The problem is the availability of reliable cross-country and time-series data. Corruption perception indices which are available for a large cross-section of countries (and for two decades) do not explicitly deal with collusive or non-collusive corruption. However, there exists some cross-country data allowing us to construct proxies for both non-collusive and collusive corruption in early 2000.

In its attempt to measure "Conditions for Business Operation and Growth", the World Bank (World Business Environment Survey [WBES], 2000) recently asked over 10,000 firms in 80 countries questions about corruption. Inter alia, firm managers were asked whether it is common for firms in their line of business to have to pay some irregular "additional payments" to get things done, and, after having done the "additional payment", whether another governmental official will subsequently require an "additional payments" for the same service. As a third question, the managers had to specify, when doing business with the government, how much of the contract value a firm in their industry would typically offer in additional or unofficial payments to secure the contract.

In pursuing corruption along the lines of the first and the second question, an official steals from private firms and not from the government because he asks for irregular "additional payments" to provide a governmental service. Thus, the responses ("always", "mostly", "fre-

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5 For instance, the Transparency International Corruption Perception Index (TI-CPI) is constructed from seven component surveys. The subjects asked about in these component surveys range from "How do you rate corruption in terms of its quality or contribution to the overall living/working environment?" to the "frequency of bribing" in various contexts.
quently”, “sometimes”, “seldom”, “never”) to these questions are likely to mirror the extent of non-collusive corruption. As a plausible measure for non-collusive corruption we propose the share of firms responding ”never” or ”seldom” to the first question. The range of the measures is [0,1], with 1 indicating least corruption. It may be, of course, that paying such additional fees (illegally) reduces red tape or makes an inspector overlook some violation of regulations. Then, corruption may be beneficial to the entrepreneur as well. To assess whether this concern constitutes a severe problem, we construct a measure for ”multiple bribing” using the second question. The measure gives the fraction of firms responding ”never” or ”seldom” when asked whether multiple bribing is common. The two measures turn out to be highly correlated (Spearman’s rank correlation is 0.81). Hence, in countries where irregular additional payments are common, an entrepreneur often has to deal with two or even more corrupt officials. We take this as evidence that paying corrupt fees indeed imposes additional costs on entrepreneurs.

The responses to the third question (”zero”, ”up to 5 %”, ”6 to 10 %”, ”11 to 15 %”, ”16 to 20 %”, ”more than 20 %”), by contrast, may serve as a measure for the level of collusive corruption. It is well known that corruption in the awarding of major contracts inflates the costs of public projects. Therefore, it appears reasonable to subsume this type of corruption under corruption with theft. As a plausible measure we propose the share of firms responding ”zero” or ”up to 5 %”. Again, the range of the measures is [0,1], with 1 indicating least corruption.

*Tables 1 and 2 here.*

Table 1 shows rank correlations between different measures of corruption. The correlation between our simple measure of non-collusive corruption and the Transparency International Corruption Perception Index (TI-CPI) 2001 is extremely high. Spearman’s rank correlation is about 0.81 whereas the correlation between the measure for collusive corruption and the TI-CPI 2001 is only about 0.58. In addition, running a regression with the TI-CPI 2001 as dependent variable and our measures for both collusive and non-collusive corruption as independent variables shows that non-collusive corruption explains a large share of the variance in the TI-CPI 2001 (see Table 2). A one standard deviation increase in the measure for non-collusive corruption increases the TI-CPI by 1.35 points (78 % of a standard deviation) whereas the same figure for collusive corruption is only about 0.37 points (19 % of a standard deviation). These results suggest that there is a close relationship between the contemporaneous perception
of corruption as, for instance, reported in the TI-CPI and the extent of non-collusive corruption. Note that the correlations qualitatively persist even if we use average TI scores for earlier periods, in particular for the 1988-91 and the 1980-85 spells (see Table 1). This is not surprising because the rankings based on perceived corruption are strongly correlated across time.6

All in all, from the evidence presented here it appears that persistent non-collusive corruption is an important part of the whole corruption problem in a given country. Everyday corruption - by inflating the cost of engaging in economic activity - seems to shape strongly whether a country is perceived to be more or less corrupt.

Many authors have found a close negative relationship between economic development and the level of perceived corruption. Given the strong correlation between our measure for non-collusive corruption and the TI-CPI 2001 it comes not as a surprise that this correlation prevails when we plot log GDP per capita (as a measure for economic development) on the horizontal axis and our measure for non-collusive corruption on the vertical axis (Figure 1).

In what follows we argue that differences in the extents of non-collusive corruption between poor and rich countries may reflect differences in how well (credit) markets work.

3 The Model

3.1 Basic Assumptions

Individuals. We consider a closed economy that is populated by a continuum of individuals of measure 2. Utility is linear so that the individuals seek to maximize their ex post wealth. The population consists of two groups of equal size, the potential entrepreneurs and the officials. The potential entrepreneurs (which are of measure 1) are heterogeneous with respect to their ex ante wealth endowment w but otherwise identical. The endowments are distributed according to the continuous distribution function G(w). The officials (which are also of measure 1) do not receive an ex ante wealth endowment.

Technology. A potential entrepreneur may invest k units consisting of his own wealth and, possibly, borrowed funds into an "investment project". Each capital unit is then transformed into R units of the homogenous good. However, the technology is characterized by

6See also Treisman (2000), pp. 407-412, on that issue.
a non-convexity in the sense that a potential entrepreneur has to invest an amount that is higher than some specific threshold level. In particular, there is a minimum requirement of $\kappa$ capital units to start an investment project. With a lower level of input, the project does not generate any returns. Hence, provided that the minimum scale requirement is satisfied, the technology exhibits constant returns to scale. There is also a second technology, call it "backyard project", that is convex and stands open to all individuals. However, backyard projects are less productive than ordinary investment projects. One capital unit produces only $r < R$ units of the homogenous good. The homogenous good is sold on a competitive goods market. Its price is normalized to unity.

From now onwards, we use the following terminology. A potential entrepreneur becomes an entrepreneur if he manages an investment project. Moreover, the expressions investment project and firm are treated synonymously.

**Credit Market.** Beside the two physical investment opportunities, all agents may become lenders on an economy-wide credit market. The endogenously determined interest rate is $\rho$. In equilibrium, $\rho$ must be at least as high as $r$ because of the existence of the backyard project. Hence, only entrepreneurs may find it attractive to borrow.

The credit market is competitive in the sense that the individuals take the interest rate $\rho$ as given. However, there may be a credit market imperfection due to imperfect enforcement of credit contracts. In particular, an entrepreneur can renge on the credit contract that specifies a repayment obligation (which is given by the amount of credit times $\rho$) by incurring some costs. In case of default, the entrepreneur loses a fraction $\lambda \in (0, 1]$ of his revenue. A $\lambda$ close to 0 stands for a very efficient expropriation technology. By contrast, a value close to 1 indicates strong creditor protection.\(^7\) We further assume that a borrower will default if he is strictly better off by doing so. Taking into account the borrowers’ incentives, the lenders will give credit only up to the point where a specific borrower is exactly indifferent between fulfilling the contract and reneging on the contract. This is the case if the repayment obligation equals the cost of default, $\lambda Rk$. Hence, an entrepreneur investing $k$ units of capital gets a maximum credit of $\frac{\lambda Rk}{\rho}$ capital units. Note that in equilibrium default will not occur. The capital market is imperfect because it is possible to default.

**Corruption.** The backyard projects are not subject to regulation, while the high-return

\(^7\)In modelling the capital market imperfection we follow Matsuyama (2000).
investment projects are. In order to start an investment project, an entrepreneur has to undertake bureaucratic procedures to get a *de iure* costless business license. However, the officials have some effective property rights over the licenses so that - as described in De Soto’s (1989) study on business regulation - an official may deny an entrepreneur the licences if the latter refuses to pay bribes. Note that we model corruption as of the non-collusive type. The bribes simply impose an additional burden on the entrepreneurs.

To fix ideas, let us assume that there is exactly one potential entrepreneur and one official per jurisdiction so that each official is a monopoly supplier of the license. Let us further assume that each official knows the wealth distribution $G(w)$ and the interest rate $\rho$ but, just like in Bliss and Di Tella (1997), that he cannot observe individual variables such as the wealth endowment of his particular entrepreneur. Accordingly, all potential entrepreneurs are offered the license at the same price $b \geq 0$. Each potential entrepreneur either accepts or refuses to pay the bribe. To refuse means definitively not managing a high-yield investment project.

With respect to the prosecution of corruption, we follow the approach taken by Rose-Ackerman (1975) and assume that the officials face an expected punishment which increases in the level of the bribe demanded. More formally, a corrupt official is detected and punished *ex post* with an exogenous probability $\pi > 0$. In case of detection, the punishment is given by $\rho \cdot \mu(b)$ with $\mu'(b) > 0$ and $\mu''(b) > 0$. Note that both $\pi$ and $\mu(b)$ are independent of whether the bribe has been paid or not. All what matters is whether a bribe has been demanded or not. The proceeds of the punishments are equally distributed among the population.

Each official is assumed to choose $b$ in order to maximize his expected ex post wealth. Since an official may not run an own firm, he invests the earned bribe payment on the credit market such that the ex post wealth function is given by $\rho$ times the expected bribe payment minus the expected punishment.\(^8\) Note, finally, that a *single official’s* action may not affect aggregate capital demand. Demanding bribes clearly influences the investment decision of

\[^8\]The relationship between the potential entrepreneurs and the officials is designed in a rather simple way so that the (bribe/revenue)-ratio decreases strongly in the firm size. However, this is not to claim that there is no room for bargaining over the level of the bribe in reality. In the previous version of the paper (Foellmi and Oechslin, 2003), we discuss a "bribe tariff" that is increasing but concave in the entrepreneur’s wealth (which seems to be consistent with the empirical findings; see, e.g., Clarke and Xu, 2002). Yet, the distributional consequences in this more general case are qualitatively similar to those in the simpler case discussed here.

\[^9\]Obviously, with this type of punishment, the ex post wealth of an official may become negative. However, this is unproblematic because of the linear utility function.
the single entrepreneur that is under the official’s control. However, since the entrepreneur is only of measure zero with respect to the whole economy, his response to corruption leaves aggregate capital demand unchanged. From this, we conclude that a single official’s action is also irrelevant with respect to the equilibrium cost of capital.

3.2 Static Equilibrium

This subsection characterizes the equilibrium. We consider the case of an imperfect credit market first.

$\lambda < 1$. The description of the equilibrium under imperfect credit involves three steps. In step one, we discuss the entrepreneurs’ optimal behavior for a given bribe. Step two solves the officials’ optimization problem. In determining the optimal bribe, an official takes into account the behavior of the entrepreneurs as derived in step one. Finally, in step three, the existence and uniqueness of the equilibrium is established.

Consider an entrepreneur investing $k \geq \kappa$ units into an investment project. Assume further that the entrepreneur faces bribe costs of $b \geq 0$ and that $\lambda R < \rho \leq R$. Then, the minimum amount of own capital required to do such an investment is determined by $w^{\text{min}} = k + b - \frac{\lambda R}{\rho} k$ where $\frac{\lambda R}{\rho} k$ is the maximum amount of credit the entrepreneur gets. Hence, we have

$$w^{\text{min}}(k) = b + \left(1 - \frac{\lambda R}{\rho}\right) k > 0.$$  

Denote by $k^{\text{max}}(w)$ the inverse function of $w^{\text{min}}(k)$, i.e., $k^{\text{max}}(w)$ relates an entrepreneur’s maximum investment to his wealth endowment. By manipulating equation (1) we get

$$k^{\text{max}}(w) = \left(1 - \frac{\lambda R}{\rho}\right)^{-1} (w - b) > 0.$$  

Note that an additional unit of (net) ex ante wealth, $(w - b)$, rises $k^{\text{max}}$ by more than one unit since $\rho > \lambda R$. Hence, the net capital stock owned by the entrepreneur himself plays the role of a collateral in the sense that a higher wealth endowment allows for higher borrowing. This is due to the assumption that credit contracts are imperfectly enforced. Equation (2) also reveals the role of non-collusive corruption under imperfect credit markets. Paying bribes hampers access to credit by reducing the value of the entrepreneur’s ”collateral”.

Which individuals choose to run a firm? Entrepreneurship is a viable option for all potential entrepreneurs who are able to invest at least $\kappa$ capital units. Using equation (1), we can
determine the wealth level, denote it by \( \tilde{w}_1 \), that enables an individual to invest \( \textit{exactly} \) \( \kappa \) unit of capital:

\[
\tilde{w}_1 \equiv w^\text{min}(\kappa) = b + \left( 1 - \frac{\lambda R}{\rho} \right) \kappa. 
\] (3)

The intuition of equation (3) is easy to grasp. The maximum amount that an entrepreneur can borrow is given by \( \frac{\lambda R}{\rho} k \). A higher interest rate, a less severe punishment in case of default, and a lower productivity reduce the maximum amount of credit. Thus, the cutoff-level must rise in \( \rho \) and fall in \( \lambda \) and in \( R \). A higher total bribe \( b \) translates one-to-one into an increase of \( \tilde{w}_1 \) since the bribes must be paid ex ante.

It remains, however, to determine whether all individuals with wealth \( w \geq \tilde{w}_1 \) choose to manage a firm in equilibrium. It is clear that all entrepreneurs will fully exploit their credit opportunities since, apart from the limiting case \( \rho = R \), the rate at which they can borrow lies below the marginal productivity of capital. Consequently, the ex post wealth of an entrepreneur, i.e., the entrepreneur’s wealth after the market interactions have taken place, is given by \( W^E = Rk^\text{max} - \rho \frac{\lambda R}{\rho} k \). Simplifying results in

\[
W^E(w) = (1 - \lambda)Rk^\text{max} 
\]

\[
= \left( \frac{1 - \lambda}{1 - \frac{\lambda R}{\rho}} \right) (w - b).
\] (4)

The alternative occupational choice, that is acting as a lender and/or investing into a backyard project, yields an ex post wealth of \( W^L(w) = w \max\{\rho, r\} = w\rho \).

Denote by \( \tilde{w}_2 \) the wealth level at which an individual is exactly indifferent between entrepreneurship and the alternative occupation. This threshold level is determined by \( W^E(\tilde{w}_2) = W^L(\tilde{w}_2) \). Solving for \( \tilde{w}_2 \) yields

\[
\tilde{w}_2 = \frac{(1 - \lambda)R}{R - \rho}b.
\] (5)

Other things equal, a higher borrowing rate and a higher bribe make entrepreneurship less attractive. Since entrepreneurs with a low initial wealth endowment are very restricted in taking advantage of the gap between the productivity of capital and the credit costs, the poorest of them will find it advantageous to change occupation in response to such a worsening. Hence, \( \tilde{w}_2 \) must rise in those two arguments. Finally, in case of \( R = \rho \), we see that entrepreneurship will only be chosen if \( b = 0 \) so that the potential entrepreneurs are exactly indifferent between running a firm or become a lender. To summarize (proof in the text),

\[\text{A non-entrepreneur is never forced to lend at a rate below } r \text{ because of the existence of the backyard project.}\]
Lemma 1 Let $\lambda R < \rho \leq R$. Then, all individuals with $w \geq \tilde{w} \equiv \max\{\tilde{w}_1, \tilde{w}_2\}$ are entrepreneurs. Each entrepreneur invests the maximum possible amount, $k_{\text{max}}(w)$.

We are now able to solve the officials' optimization problem. Since an official cannot observe the wealth endowment of the entrepreneur that is located in his jurisdiction, the expected return from demanding a bribe $b$ is $\rho \cdot [1 - G(\tilde{w}(b))] b$. The expected cost is given by $\rho \cdot \pi \mu(b)$. Note further that - as pointed out above - the interest rate $\rho$ is a constant from the perspective of a single official. Hence, the (among officials identical) optimization problem can be written as

$$\max_b \{[1 - G(\tilde{w}(b))] b - \pi \mu(b)\}.$$  

A sufficient (but not necessary) condition for the officials' objective function to be quasi-concave is that the hazard rate of the distribution function $G$ is non-decreasing (see Lemma 2 below). To avoid multiple equilibria, we assume that this condition holds. Then, the optimal bribe, denote it by $b(\rho)$, is 0 if $1 - G\left(\left[1 - \frac{\lambda R}{\rho}\right] \kappa - \pi \mu'(0)\right) \leq 0$. Otherwise, the above maximization problem has an interior solution and the first order condition is given by

$$1 - G(\tilde{w}) = G'(\tilde{w}) \frac{\partial \tilde{w}}{\partial b} b + \pi \mu'(b).$$  

Condition (6) can be easily interpreted. The left-hand side shows the expected gain of a marginal increase in bribes. The right-hand side denotes the expected loss. It contains two components. The first component mirrors the fact that a higher bribe may drive a potential entrepreneur out of business. In that case, the official loses the whole bribe $b$. The second component indicates the rise in the expected punishment.

Lemma 2 Let $\lambda R < \rho \leq R$. Then, if the hazard rate of $G$ is non-decreasing in $\tilde{w}$, the above maximization problem has a unique solution $b(\rho)$.

Proof. See Appendix.

We complete our description of the equilibrium by deriving gross capital demand and gross capital supply. The former variable, $K_D$, equals the sum over all entrepreneurial firm sizes. Remembering equation (2) and Lemma (1), gross capital demand can be written as

$$K_D(\rho) = \frac{1}{1 - \frac{\lambda R}{\rho}} \int_{\max\{\tilde{w}_1, \tilde{w}_2\}}^{\infty} [w - b(\rho)] G'(w) dw.$$  

11 The Gamma distribution, for instance, that has been used in the study of the income or wealth distribution satisfies this condition under certain restrictions.
In the remainder of this paper we restrict our attention to parameter constellations under which the case $\tilde{w}_2 > \tilde{w}_1$ may never occur. Intuitively, this requires the optimal bribe to be 0 if $\rho$ is close to $R$ and the minimum investment $\kappa$ to be large enough such that the bribe has a relatively low weight once one can take advantage of entrepreneurship. Note, however, that ruling out the possibility of $\tilde{w}_2 > \tilde{w}_1$ is not critical to the major implications of our model. Yet, it simplifies the further exposition to a large extent.

**Lemma 3** Suppose that (i) $\lambda < 1$, (ii) $1 - G(\kappa \{1 - \lambda\}) - \pi\mu'(0) < 0$, and (iii) $\kappa > \kappa_\ast$, where $\kappa_\ast$ is defined in the proof. Then, $K^D$ is infinite if $\rho \leq \lambda R$ and decreases in $\rho$ for $\lambda R < \rho < R$. At $\rho = R$, the $K^D$-curve is horizontal. If $\rho > R$, $K^D$ equals zero. Finally, the optimal bribe decreases in $\rho$ and reaches 0 at $\rho_0 \in [\lambda R, R)$, where $\rho_0$ is defined in the proof.

**Proof.** See Appendix.

The intuition behind the above Lemma is as follows. Given the bribe, a rise in the cost of capital increases $\tilde{w}_1$ and decreases $k^{\text{max}}(w)$ since the incentives to default are stronger with a higher $\rho$. Each of these adjustments lowers gross capital demand. However, the adverse effect on capital demand is softened by the fact that the officials demand lower bribes. Why is that the case? A higher interest rate means that the probability of selling a license decreases when the bribe is kept unchanged. Hence, it is optimal to lower the bribe in order to soften this decline and to reduce the expected punishment. Moreover, since $\tilde{w}_1 < \tilde{w}_2$ always holds, we know that the optimal bribe is zero before the interest rate reaches $R$.

*Figure 2 here.*

It remains to discuss gross capital supply, $K^S$. In case of $\rho > r$, we have $K^S = \bar{K} = \int_0^\infty wG'(w)dw$ since nobody will invest into a backyard project. If $\rho = r$, a potential lender is indifferent between investing into a backyard project or lending. Finally, in case of $\rho < r$, there are no lenders at all since the backyard project yields a strictly higher return. The credit market equilibrium is now immediately characterized. If the $K^D(\rho)$-schedule intersects with the vertical part of the gross capital supply schedule, as it is depicted in Figure 2, we have $\rho^* > r$ (where $\rho^*$ denotes the equilibrium borrowing rate), and the economy-wide capital stock is allocated to high-yield investment projects. Otherwise, we have $\rho^* = r$, and gross capital supply is determined by $K^D(r) \leq \bar{K}$. To conclude (proof in the text),
Proposition 1 Suppose that the conditions stated in Lemma 3 hold. Then, there exists a unique equilibrium interest rate $\rho^*$. In addition, the officials demand a positive bribe in equilibrium if $\rho^* < \rho_0$.

It is further interesting to discuss how the non-officials’ ex post wealth depends on ex ante wealth in an equilibrium with $\rho^* < R$. As illustrated in Figure 3, the non-officials are lenders up to a wealth endowment of $\tilde{w}_1((\rho^*, b(\rho^*)))$, and their ex post wealth is given by $\rho^* \cdot w$.

Figure 3 here.

Then, at $w = \tilde{w}_1((\rho^*, b(\rho^*)))$, the ex post wealth jumps to $(1 - \lambda)R\kappa$ and is from now on given by $W^E(w) = (1 - \lambda)Rk_{\text{max}}(w)$. It is easy to check that $\frac{\partial W^E(w)}{\partial w} > R$. The reason for the high entrepreneurial return is that the equilibrium borrowing rate lies below the marginal product of capital. Then, since own wealth weakens the borrowing constraint, one more unit of own capital leads to an extra net return that is equal to the additional amount of credit times $(R - \rho^*)$. The existence of rents is the reason why the officials may demand bribes in equilibrium without inducing all potential entrepreneurs to choose the alternative occupation.

$\lambda = 1$. Consider now the benchmark case of perfect enforcement of credit contracts. Under these circumstances, it never pays for a borrower to default and the capital endowment no longer serves as a collateral. Consequently, every potential entrepreneur can borrow up to an infinitely large amount of capital. This fact has important implications for the production structure and for the equilibrium extent of corruption. To see this, suppose that a potential entrepreneur (investing $k$ capital units) faces a finite cost $b \geq 0$ in order to obtain the business license. Then, the net profit per capital unit is given by $Rk - \rho k - b$. This expression approaches $R - \rho$ as $k$ goes to infinity. Hence, in case of $R - \rho > 0$, such an entrepreneur could generate an infinitely high ex post wealth by borrowing very large sums. But since every potential entrepreneur has the possibility to do so, competition would drive the interest rate up to $R$. Hence, in an equilibrium, each operating firm borrows up to a positive fraction of the economy-wide capital endowment and faces an interest rate of $R$. Further, as the mass of individuals to buy a business license is of measure zero with respect to the whole population of potential

\[\text{In a sample of small and medium-sized firms in India, Banerjee and Duflo (2004) find indeed a large gap between the marginal product and the interest rate paid on the marginal capital unit. This highlights the importance of credit constraints in a developing country setting.}\]
entrepreneurs, the probability of selling a license is zero from the perspective of a particular official. But then, the optimal bribe is also zero since offering a license at a positive price is associated with a positive expected punishment. Perfect contract enforcement erodes the officials power to extract bribes.

3.3 Corruption and Financial Development

Knowing that perfect enforcement eradicates corruption, it is interesting to ask whether improving enforcement (without going all the way to a perfect market) is an appropriate measure to fight bribery. Interestingly, the relationship turns out to be ambiguous.

**Proposition 2** The relationship between the optimal bribe $b$ and the level of financial development $\lambda$ is hump-shaped.

**Proof.** See Appendix. ■

The intuition is as follows. Initially, at low levels of $\lambda$ (i.e., with $\rho = r$), better enforcement unambiguously softens the entrepreneurs’ borrowing constraint. The reason is that the interest rate does not respond to higher capital demand since capital supply is perfectly elastic. As a result, the officials face a higher probability of being matched with a prospective entrepreneur and hence are induced to demand higher bribes, other things equal. Later on (i.e., with $\rho > r$), improving contract enforcement does no longer create new entrepreneurs because the borrowing constraint is unchanged; better enforcement induces the interest rate to rise, and the two effects are exactly offsetting with respect to the entrepreneurs’ borrowing capacity. Consequently, the officials keep the level of graft unchanged. Finally, for $\lambda$ close to 1, the probability of facing a prospective entrepreneur and hence the optimal bribe decrease because becoming a lender is attractive for more and more individuals ($\bar{w}_2$ is relevant). Intuitively, strong creditor protection allows individuals to take advantage of high-yield investment opportunities outside their own firm. Hence, demanding bribes easily induces them to invest somewhere else. In the limit case, the probability of being matched with an entrepreneur who is willing to pay a bribe approaches zero so that it is optimal not to demand bribes at all when contract enforcement is perfect. Note that there is some empirical support for a negative relationship between bribe payments and the return to outside investment opportunities. Svensson (2003) finds that a firm’s ”refusal power”, measured by the alternative return to capital, is an important determinant of how
much a firm has to pay.

4 Corruption and Redistribution

This section analyzes the impact of a more severe prosecution of corruption (i.e., a rise in $\pi$) on the equilibrium bribe and on the ex post wealth of the non-officials under imperfect credit. Throughout the following analysis, we look only at equilibria with a positive optimal bribe.

Consider the officials’ reaction to a marginal increase in $\pi$. Keeping $\rho$ constant and differentiating the first order condition (6) with respect to $\pi$ yields

$$\frac{\partial b}{\partial \pi} = -\frac{\mu'(b)}{2G'(\tilde{w}_1) + G''(\tilde{w}_1)b + \pi \mu''(b)} < 0.$$ 

Note that the denominator of the above expression is strictly positive (such that $\frac{\partial b}{\partial \pi}$ is negative) as a result of the monotone hazard rate condition. Hence, for a given $\rho$, $\tilde{w}_1$ declines and $k_{\text{max}}(w)$ rises as $\pi$ goes up. Accordingly, the $K^D$-curve shifts to the right. We conclude that the equilibrium interest rate rises if $\rho^* > r$ (as shown in Figure 4) or stays constant if the $K^D$-curve intersects the gross capital supply schedule in the horizontal part (i.e., if $\rho^* = r$).

Intuitively, a more severe prosecution of corruption lowers the optimal bribe so that the net ex ante wealth endowment, $(w - b)$, increases. But since $(w - b)$ plays the role of a collateral, gross capital demand rises. Hence, unless gross capital supply is perfectly elastic, the interest rate must rise as well. Note finally that the direct effect of a rise in $\pi$ is enforced through an indirect effect operating through the equilibrium interest rate in case of $\rho^* > r$. From Lemma 3 we know that a higher interest rate induces the officials to lower the bribes even further. To summarize (proof in the text),

**Proposition 3** Consider an equilibrium with $b(\rho^*) > 0$. Then, a rise in $\pi$ reduces the equilibrium bribe. In addition, the interest rate increases unless capital supply is perfectly elastic.

In what follows we analyze the distributional consequences of decreasing corruption (i.e., of a rise in $\pi$).

$\rho^* > r$. Consider the case of perfectly inelastic capital supply first. The Lemma below shows that reducing corruption - despite leading to higher capital costs - softens the credit restrictions for potential entrepreneurs with an ex ante wealth endowment close to $\tilde{w}_1$. 

**Figure 4 here.**
Lemma 4 Consider an equilibrium with \( b(\rho^*) > 0 \) and \( \rho^* > r \). Then, \( \frac{d\hat{w}_1}{d\pi} < 0 \). In addition, there exists a \( \hat{w} > \hat{w}_1 \) such that \( \frac{dk^\text{max}(w)}{d\pi} > 0 \) for \( w < \hat{w} \) and \( \frac{dk^\text{max}(w)}{d\pi} < 0 \) for \( w > \hat{w} \).

Proof. See Appendix.

The distributional consequences of a higher \( \pi \) are now most easily discussed by use of Figure 5 which combines the information from Proposition 3 and Lemma 4. The figure shows the ex post wealth function before and after the change. As a consequence of the rise in \( \rho \), the graph becomes steeper for lenders (whose ex post wealth equals \( \rho w \)) and flatter for entrepreneurs (whose ex post wealth is given by equation 4). Note, however, that the two graphs intersect at an ex ante wealth level \( \hat{w} \) that exceeds \( \hat{w}^\text{old}_1 \) since \( k^\text{max}(\hat{w}^\text{old}) \) is higher in the new situation. According to Figure 5, all initial lenders are better off. Most of them (those in the interval \((0, \hat{w}^\text{new}_1)\)) win moderately and only indirectly because the equilibrium interest rate rises. However, some of them (those in the interval \([\hat{w}^\text{new}_1, \hat{w}^\text{old}_1]\)) experience a large gain because the lower bribe allows them to take advantage of entrepreneurship.

Figure 5 here.

The group of initial entrepreneurs is divided into two fractions. Entrepreneurs with a wealth endowment close to \( \hat{w}^\text{old}_1 \) win. As they can borrow relatively little anyway, the reduction of the bribe has a strong positive impact on their borrowing opportunities so that the negative impact of higher capital costs is more than compensated. Since their ex post wealth is given by \((1 - \lambda)Rk^\text{max}\), they are definitively better off. By contrast, entrepreneurs with a wealth endowment above \( \hat{w} \) lose. Unlike the individuals belonging to the "middle class", the affluent entrepreneurs borrow a lot so that the reduction of the bribe is small relative to the rise in the costs of borrowing. Consequently, their access to credit worsens. Moreover, it is not only possible that the most affluent individuals lose but it is certain. Since there are more entrepreneurs than before and some of the poorer original entrepreneurs invest more, a positive mass of the wealthiest entrepreneurs must invest less to restore the equality of capital demand and (inelastic) capital supply. To summarize (proof in the text),

Proposition 4 Consider an equilibrium with \( b(\rho^*) > 0 \) and \( \rho^* > r \). Then, a rise in \( \pi \) benefits all initial lenders and all entrepreneurs running relatively small firms. In contrast, the most affluent entrepreneurs in the economy lose.
These distributional effects would remain largely intact if we considered a gross capital supply schedule that is not vertical but has a positive slope.\textsuperscript{13} In such a situation again, a rise in $\pi$ shifts the $K^D$-curve to the right and raises the interest rate so that all initial lenders win. Moreover, parallel reasoning as in the proof of Lemma 4 shows that the initial entrepreneurs belonging to the ”middle class” fare better as well. Finally, again, entrepreneurs with a wealth endowment above some threshold level $\tilde{w}$ lose because they can invest less. However, since a higher interest rate increases capital supply, it is no longer certain that a positive mass of the richest entrepreneurs invests (and therefore earns) less in the new equilibrium.

$\rho^* = r$. Suppose now that the interest rate equals $r$ such that gross capital supply is perfectly elastic. This situation is likely to arise if the expected penalty for corruption is ceteris paribus low and so that the optimal bribe is high. High bribes, in turn, go together with low gross capital demand. Since a marginal rise of $\pi$ leaves the interest rate unchanged but decreases the optimal bribe, it is immediately clear that the fraction of entrepreneurs increases $\left(\frac{dw}{d\pi} < 0\right)$ and that all original entrepreneurs invest more in the new equilibrium $\left(\frac{dK_{\text{max}}}{d\pi} > 0 \forall w \in [\tilde{w}_1, \infty)\right)$. The distributional consequences of these adjustments are different from those discussed above. A large share of initial lenders is unaffected because of the constant interest rate. Only those with a wealth endowment close to $\tilde{w}_1$ win as they can change occupation. Most notably, however, there is no longer a distributional conflict between the entrepreneurs belonging to the ”middle class” and the most affluent entrepreneurs. They all win the same in absolute terms because of the absence of indirect effects of lower corruption. Note further that lowering corruption in the ($\rho^* = r$)--case increases aggregate output since additional capital units are allocated to high-yield investment projects. To summarize (proof in the text),

**Proposition 5** Consider an equilibrium with $b(\rho^*) > 0$ and $\rho^* = r$. Then, a rise in $\pi$ leaves the initial lenders who may not change occupation unaffected. Those initial lenders who change occupation and all initial entrepreneurs are better off.

Common to all cases treated so far is that the non-officials in the middle of the wealth distribution (the ”middle class”) may lose a lot from a less severe prosecution of corruption (i.e., a lower $\pi$). The poor cannot win from more corruption either. The situation is different for the most affluent individuals. They win in absolute terms unless large sums of savings

\textsuperscript{13}We could generate such a curve by, for instance, allowing for imperfect international capital mobility such that a higher interest rate induces some capital inflows.
are directed towards backyard projects and, consequently, credit supply decreases strongly. According to the model, this reallocation of capital is more likely to take place at high levels of corruption. Hence, the model predicts a hump-shaped relationship between the average ex post wealth (i.e., the average income) of the richest part of the population and non-collusive corruption. Increasing corruption from low levels is beneficial to the rich initially but may reduce their ex post wealth beyond some point. This distributional pattern suggests a hump-shaped relationship between the extent of (non-collusive) corruption and income inequality which matches the empirical regularities found by Li et al. (2000).

5 Imperfect Goods Markets

Acting as a barrier to entry if access to credit is limited, corruption could have even stronger distributive effects for a reason that has previously been kept out of the analysis. In preventing the poor from running a firm, higher corruption may alter the nature of competition on the goods markets. In what follows we extend our basic model to formalize this idea.

To make the argument as simple as possible, we assume that there are only “poor” and “rich” potential entrepreneurs. The poor are endowed with \( w_P = \theta K \) capital units, where \( \theta < 1 \), and the rich with \( w_R = (2 - \theta)K \) units so that - as above - aggregate capital is given by \( K \). The two groups are of equal size, \( \frac{1}{2} \). Further, there exists a measure \( \frac{1}{2} \) of differentiated goods from which the individuals derive utility according to the CES utility function

\[
U = \left[ \frac{1}{2} \int_{c_j^l}^{c_j^u} \frac{\sigma - 1}{\sigma} \left( \frac{c_j}{p} \right) \right]^{\frac{\sigma}{\sigma - 1}}, \quad \sigma > 1, \quad \text{(8)}
\]

where \( c_j \) is consumption of good \( j \).

Each good \( j \in [0, \frac{1}{2}] \) can be produced by exactly one poor and one rich individual. We assume Cournot competition if both individuals enter a particular market. Otherwise, if only the rich agent runs a firm, he may set monopoly prices. The technology is similar to that in the previous sections except that we normalize \( R \) to 1 for ease of exposition. For the same reason, we do no longer assume the existence of backyard projects. Further, we impose \( \kappa < K \).

The market demand for good \( j \) can be calculated as

\[
c_j(p_j) = \left( \frac{p_j}{\bar{p}} \right)^{-\sigma} Y / \bar{p},
\]

20
where $p_j$ is the price of good $j$, $P = \left[ p_j^{1/\sigma} \right]^{1/(1-\sigma)}$ is the CES price index, and $Y$ denotes aggregate output. The price elasticity of demand is given by $\sigma > 1$. We normalize the price index to $2^{1/(\sigma-1)}$ such that all prices equal 1 in a symmetric equilibrium. Thus, we have

$$c_j (p_j) = 2Y p_j^{-\sigma}. \quad (9)$$

The equilibrium on a particular goods market $j$ requires $c_j$ to be equal to $k_jR + k_jP$, the sum of the quantities produced by the rich and the poor entrepreneur, respectively.

The ex post wealth of an entrepreneur is given by

$$p_j k_{ji} - \rho (k_{ji} - (w_i - b)) \quad (10)$$

where $k_{ji}$ denotes the investment of entrepreneur $i \in \{P, R\}$ in market $j$. The entrepreneurs maximize their ex post wealth function subject to the borrowing constraint

$$k_{ji} \leq w_i - b + \frac{\lambda}{\rho} p_j k_{ji}, \quad (11)$$

where $\frac{\lambda}{\rho} p_j k_{ji}$ denotes the maximum amount of credit, and subject to the minimum investment constraint $k_{ji} \geq \kappa$. Given that these two restrictions do not bind, the quantities are determined by the first order condition

$$p_j - \frac{1}{\sigma} p_j (k_jR + k_jP)^{-1} k_{ji} - \rho = 0. \quad (12)$$

Equation (12) can be obtained by using the inverse demand function in the objective function (10) and then differentiating with respect to $k_jR$ holding $k_jP$ constant, and vice versa.

We now consider two polar equilibria. First, we characterize the symmetric duopoly equilibrium (i.e., the equilibrium in which the poor and the rich produce the same quantities) with absent corruption due to a high probability of being detected and punished. Second, we analyze a monopoly equilibrium in which $\pi$ is lower (but all other parameters are unchanged) such that the optimal bribe is positive and large enough to prevent the poor from entering the markets. We are then ready to assess the change in incomes as we move from the second (high-corruption) equilibrium to the first (low-corruption) equilibrium.

**Symmetric Duopoly** (with $b = 0$). Suppose that the poor and the rich have entered the markets and that all entrepreneurs are unconstrained in equilibrium such that the quantities are

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14 As in the previous sections, the maximum amount of credit can be calculated by setting the repayment obligation equal to the cost of default, $\lambda p_j k_{ji}$. 21
entirely determined by equation (12). Then, it follows from the symmetry in preferences and technology that the equilibrium is symmetric across goods markets $j$ and that $k_{jR} = k_{jP} = K$. In addition, since the price index has been normalized to $2^{1/(\sigma - 1)}$, all goods prices equal 1. Using this symmetry result in equation (12) yields

$$1 - \frac{1}{2\sigma} = \rho.$$  

(13)

It remains to check under which condition the symmetric duopoly will be the equilibrium outcome. The necessary condition for the symmetric duopoly to arise is that the poor can afford to invest $K$ capital units. Inserting $k_{jP} = K$ and $\rho = 1 - \frac{1}{2\sigma}$ into the borrowing constraint (11) results in

$$1 - \lambda \frac{2\sigma}{2\sigma - 1} \leq \theta.$$  

(14)

Obviously, the poor are more likely to invest $K$ capital units if the credit contracts are well enforced (high $\lambda$), if there is low inequality (high $\theta$), or if the mark-ups are high (low $\sigma$).

How must the expected punishment function look like in order to have $b = 0$? An official will never demand a positive bribe if the probability of being detected is high and/or the punishment (in case of detection) increases strongly in the bribe right from the beginning. More formally, a sufficient condition for the optimal bribe to be zero is that $\pi > \frac{1}{\mu(0)}$, and the symmetric duopoly case is the equilibrium outcome as long condition (14) holds.

Note that the poor borrow from the rich in this equilibrium and that - since the interest rate lies below the goods prices - the former can appropriate a rent on each unit borrowed.

**Monopoly** (with $b > 0$). Let us now consider the monopoly case in which only the rich run a firm ($k_{jP} = 0$) and in which the officials demand a positive bribe in equilibrium. Provided that the rich are not credit rationed, the first order condition (12) holds with equality. Using the same symmetry argument as above and remembering that - in a symmetric equilibrium - all goods prices equal 1, equation (12) reduces to

$$1 - \frac{1}{\sigma} = \rho.$$  

(15)

Thus, the equilibrium interest rate is lower (so that the mark-up is higher) in the monopoly case. Obviously, the monopoly equilibrium is sustainable if the poor are not able to finance the

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15 A sufficient condition for the entrepreneurs not to be credit rationed is $b/K < 1 - \theta + \lambda$. 
minimum investment of $\kappa$ capital units in order to enter the markets. To check under which condition entry is not feasible for the poor, suppose that a poor individual enters the market $j$ by investing exactly an amount of $\kappa$. Then, given the behavior of the incumbent, the price of good $j$ would be given by $\left(\frac{2K+\kappa}{2K}\right)^{-1/\sigma}$. Inserting this expression into the borrowing constraint (11), we get that the monopolistic industry structure is indeed the equilibrium if the condition

$$\kappa \left(1 - \lambda \frac{\sigma}{\sigma - 1} \left(\frac{2K}{2K + \kappa}\right)^{1/\sigma}\right) > \theta K - b$$

holds. Condition (16) is more likely to be satisfied if the bribe $b$ is high, if the credit contracts are not well enforced (low $\lambda$), and if the relative wealth of the poor is small (low $\theta$). Hence, it is the combination of non-collusive corruption and limited access to credit that may hinder poor (but talented) individuals from undertaking high-yield investment projects.

With a monopolistic industry structure, the probability that a particular jurisdiction "harbors" a rich entrepreneur is $\frac{1}{2}$. Then, in an equilibrium with corruption, the optimal bribe is determined by $\frac{1}{2} - \pi\mu'(b) = 0$. Hence, the inequality $\pi < \frac{1}{2\mu'(0)}$ must hold, and we conclude that - for a given punishment function $\mu(b)$ and with all other parameters unchanged - the probability of being detected and punished must be lower than in the case discussed above.

In contrast to the symmetric duopoly regime, the rich borrow from the poor in this type of equilibrium. Moreover, since the interest rate is even lower with monopolies, the rich can appropriate a comparatively high rent on each capital unit they borrow.

**Distributional Consequences of Corruption.** How does the ex post wealth of the rich change if $b$ falls from a positive level to 0 so that the economy switches from the monopoly equilibrium to the symmetric duopoly equilibrium? As discussed above, we may think of such a switch as induced by a sharp rise in $\pi$.

We use the objective function (10) and the equations (15) and (13), respectively, to calculate the rich individuals’ ex post wealth in the monopoly case ($M$) and in the duopoly case ($D$):

$$W^E(w_R)|_M = 2K - \left(1 - \frac{1}{\sigma}\right) \cdot (\theta K + b)$$
$$W^E(w_R)|_D = K + \left(1 - \frac{1}{2\sigma}\right) \cdot (1 - \theta)K.$$

Disregarding the bribe payment for the moment, it is clear that the rich are better off in the monopoly case. The reason is that they borrow at a very low rate in the former case whereas they are in the unfavorable position of a lender in the latter case. Moreover, the difference
between $W^E(w_R)\big|_M$ and $W^E(w_R)\big|_D$ increases as $\sigma$ falls. Hence, a rich individual’s loss is the larger the less the differentiated goods can be substituted against each other.

Of course, whether the rich lose from the switch in the end depends on the level of the bribe in the monopoly case. If $\pi$ is very low such that the officials appropriate a large part of the rents, the switch may also be beneficial to the rich. However, if the optimal bribe is comparatively low and suffices just to prevent the poor from entering, the rich may lose a lot. So, very similar to the result obtained in the previous section, we receive that the rich may win if corruption decreases from some very high level but lose otherwise. The losses are the higher, the higher the mark-up in the monopoly equilibrium has been.

6 Discussion and Conclusions

We provide suggestive evidence that persistent non-collusive corruption is widespread in low-income countries but less prevalent in richer economies. Moreover, it seems that non-collusive corruption imposes a substantial cost on economic activity. The puzzle then is why this type of corruption is so common in the poorer parts of the world. The purpose of the present paper is to address this question from a macroeconomic perspective. We consider a general equilibrium model with credit market imperfections and heterogeneous agents. It appears that both an unequal wealth distribution and market imperfections, chiefly on the credit market, are important characteristics of poor economies.

Our analysis provides two main results. First, credit market imperfections generate rents for the incumbent entrepreneurs. The existence of such rents allows an official with discretionary authority to extract bribes since the return to the incumbent’s alternative investment opportunity is much lower. In an economy with (nearly) perfect markets, however, the returns are equalized across investment opportunities, and asking for bribes easily induces a particular entrepreneur not to enter the market. As a consequence, a dishonest official will not demand bribes in such an environment even if he faces the same (perhaps low) probability of being detected and punished as in an economy suffering from strong market imperfections. Put differently, the model implies that economies with a less developed financial system tend to suffer from higher levels of non-collusive corruption (as measured by the frequency of bribing or by the average bribe) than countries with a near-perfect financial system - even if the countries attach the same priority to the prosecution of corruption. Interestingly, however, reducing
financial market imperfections does not unambiguously deplete the level of corruption. If contract enforcement starts improving from a low level, the situation may actually become worse. Only after contract enforcement has reached some threshold level, even better enforcement lowers the level of corruption.

The second result is that non-collusive corruption redistributes income not only from non-officials towards officials but also within the group of non-officials. We find that the members of the "middle class" are hurt substantially whereas the poor lose little. By contrast, the rich entrepreneurs may win despite the fact that they bear a large part of the direct costs. The reason is that own wealth plays the role of a collateral under imperfect credit. Higher bribes reduce the value of the collateral such that some potential entrepreneurs - most likely those in the middle of the wealth distribution - are no longer able to finance the set-up of a production plant. But this is to the benefit of those who may enter the market anyway. The cost of capital goes down and, probably, there is less competition on the product markets.

These distributional consequences offer a political-economy perspective on non-collusive corruption. The most affluent entrepreneurs probably understand that non-collusive corruption acts as a barrier preventing less affluent (but not very poor) individuals with high-return projects from entering the credit and the goods market; potentially, the rich are willing to accept persistent corruption or may even try to block a reform of the bureaucracy or the judiciary for this reason. Hence, even if a well-intentioned government perfectly knew the appropriate steps against corruption, it might have difficulties to start reforms if political power is concentrated in the hands of the economic elite.
Appendix

Proof of Lemma 2.

The second derivative of the objective function is given by

\[-\frac{\partial \tilde{w}}{\partial b} \left( 2G' + G'' \frac{\partial \tilde{w}}{\partial b} b \right) - \pi \mu'', \tag{A1}\]

where

\[
\frac{\partial \tilde{w}}{\partial b} = \begin{cases} 
1 & : \tilde{w}_1 \geq \tilde{w}_2 \\
\frac{(1-\lambda)R}{R-\rho} & : \tilde{w}_1 < \tilde{w}_2 
\end{cases}.
\]

In order to make sure that the officials’ maximization problem has a unique solution on the interval \([0, \infty)\) we have to check whether the second derivative of the objective function is negative whenever the first order condition has an interior solution. Hence, solving equation (6) for \(b\) and using this result in equation (A1) yields

\[-\frac{1}{G'} \left[ \frac{\partial \tilde{w}}{\partial b} \left( 2(G')^2 + G'' \cdot (1 - G - \pi \mu') \right) + \pi \mu'' G' \right] < 0.\]

Obviously, the above inequality holds if \(G'' \geq 0\) since \(1 - G - \pi \mu' > 0\) (equation 6) and \(\pi \mu(b)\) is a strictly convex function. But it might become positive if \(G''\) is smaller than zero. However, because of the assumption that the hazard rate \(G'/(1 - G)\) is non-decreasing in \(\tilde{w}\), we have \((G')^2 + G'' \cdot (1 - G) \geq 0.\) Accordingly, the second order condition is satisfied.

Proof of Lemma 3.

Note first that \(K^D\) goes to infinity as \(\rho\) approaches \(\lambda R\). To see this, let \(\rho = \lambda R\). Then, according to the equations (3) and (5), we have \(\tilde{w} = \tilde{w}_1 = \tilde{w}_2 = b(\lambda R)\). Moreover, by Lemma 2, a positive mass of individuals has a wealth endowment that exceeds the threshold level \(\tilde{w} = b(\lambda R)\). Hence, a positive fraction of the population is able to borrow infinitely large amounts of capital and is indeed induced to do so since \(R > \lambda R\). Completely parallel reasoning shows that capital demand is infinite in case of \(\rho < \lambda R\) as well. Note that, by equation (6) and Lemma 2, \(b(\lambda R)\) will be positive if the condition

\[1 - G(0) - \pi \mu'(0) = 1 - \pi \mu'(0) > 0. \tag{A2}\]

holds.
In order to derive a restriction on the exogenous parameters that ensures \( \tilde{w}_1 > \tilde{w}_2 \) in case of \( \rho > \lambda R \) we have to calculate the respective derivatives

\[
\frac{d\tilde{w}_1}{d\rho} = \frac{\kappa \lambda R}{\rho^2} + \frac{db}{d\rho} \quad \text{and} \quad \frac{d\tilde{w}_2}{d\rho} = \frac{(1 - \lambda)Rb}{(R - \rho)^2} + \frac{(1 - \lambda)R}{R - \rho} \frac{db}{d\rho},
\]

where

\[
\frac{db}{d\rho} = -\left[ G' + G'' \frac{\partial \tilde{w}}{\partial b} b \right] \frac{\partial \tilde{w}}{\partial p} + \frac{G' \partial^2 \tilde{w}}{\partial b \partial p} \quad < 0
\]

as long as the optimal bribe is positive. As in the proof of Lemma (2), the sign of \( \frac{db}{d\rho} \) can be determined by substituting for the optimal \( b \) in equation (A4) and then using the monotone hazard rate condition. Now, given condition (ii), there exists a \( \rho_0 \in (\lambda R, R) \) that solves

\[
1 - G \left( \kappa \left\{ 1 - \frac{\lambda R}{\rho} \right\} \right) - \pi \mu'(0) = 0 \quad \text{if condition (A2) holds.}
\]

To put it another way, \( \rho_0 \) is the interest rate that leads exactly to an optimal bribe of 0 in case of \( \tilde{w}_1 > \tilde{w}_2 \) - provided that condition (A2) is satisfied. Otherwise, if \( 1 - \pi \mu'(0) \leq 0 \), we take the following definition:

\[
\rho_0 \equiv \lambda R.
\]

Using the equations (17) and (A4) and the definition of \( \rho_0 \), we can immediately derive that

\[
\frac{(1 - \lambda)R}{(R - \rho_0)^2} b(\lambda R) < \frac{\kappa \lambda R}{(\rho_0)^2} \Rightarrow \frac{d\tilde{w}_2}{d\rho} < \frac{d\tilde{w}_1}{d\rho} \quad \text{for } \rho \in [\lambda R, \rho_0].
\]

Hence, we have \( \tilde{w} = \tilde{w}_1 \) as \( \rho \) rises from \( \lambda R \) to \( \rho_0 \). Then, if \( \rho \in [\rho_0, R] \), the optimal bribe is zero and we have \( \tilde{w} = \tilde{w}_1 \) in any event. Consequently, if the condition

\[
\kappa > \kappa_0 = \frac{(1 - \lambda)R}{(R - \rho_0)^2} \frac{\lambda R}{\rho_0^2} b(\lambda R)
\]

is met, we have \( \tilde{w} = \tilde{w}_1 > \tilde{w}_2 \) for \( \rho > \lambda R \).

Suppose now that \( \kappa > \kappa_0 \). Then,

\[
\frac{db}{d\rho} = \begin{cases} -\frac{G' + G'' b}{2G' + G'b + \pi \mu'} \frac{\lambda R}{\rho^2} \kappa & : \rho \in [\lambda R, \rho_0) \\ 0 & : \rho \in [\rho_0, R] \end{cases},
\]

and it follows immediately that \( \frac{d\tilde{w}_1}{d\rho} > 0 \) and that \( \frac{dk_{\max}}{d\rho} < 0 \). But this means that gross capital demand falls monotonically as \( \rho \) rises from \( \lambda R \) to \( R \). At \( \rho = R \), the potential entrepreneurs are indifferent between borrowing and lending since (i) the marginal product of capital equals capital costs and (ii) the optimal bribe is zero. Hence, the \( K^D \)-curve is horizontal. Finally, gross capital demand is zero for interest rates that exceed \( R \).
Proof of Lemma 4.

The derivatives of \( \hat{w}_1 \) and \( k^{\text{max}} \) with respect to \( \pi \) are given by

\[
\frac{d\hat{w}_1}{d\pi} = \left( \frac{\partial b}{\partial \rho} + \frac{\kappa \lambda R}{\rho^2} \right) \frac{d\rho}{d\pi} + \frac{\partial b}{\partial \pi} \quad \text{and} \quad \frac{dk^{\text{max}}}{d\pi} = -\left( \frac{\partial b}{\partial \rho} + \frac{k^{\text{max}} \lambda R}{\rho} \right) \frac{d\rho}{d\pi} + \frac{\partial b}{\partial \pi}.
\]

respectively. From above, we know that \( \frac{d\rho}{d\pi} > 0, \frac{\partial b}{\partial \rho} < 0, \) and \( \frac{\partial b}{\partial \pi} < 0. \) Suppose now that \( \frac{d\hat{w}_1}{d\pi} \geq 0 \) such that \( \frac{dk^{\text{max}}}{d\pi} < 0 \) for all \( k^{\text{max}} > \kappa. \) Then, gross capital demand must decrease in equilibrium since the fraction of entrepreneurs is smaller (or unchanged) and the remaining entrepreneurs invest less capital. However, this is a contradiction since gross capital demand is constant in equilibrium with \( \rho^* > r. \) We conclude that \( \frac{d\hat{w}_1}{d\pi} < 0 \).

Proof of Proposition 2.

At \( \lambda = 0, \) the capital demand equation equals \( f_{\text{max}}^{\infty}(\bar{w}_1, \bar{w}_2) \{ w - b(\rho) \} G'(w)dw < K \) because \( b(\rho) > 0. \) Hence, for low levels of \( \lambda, \) the equilibrium interest rate \( \rho \) equals \( r. \)

Case \( \rho = r. \) Consider an increase in \( \lambda. \) Denote the initial wealth to become entrepreneur by \( \tilde{w}. \) Then, given \( b, \tilde{w} \) decreases and gross capital demand (7) increases. Let us turn to the optimization problem of the official: The decrease in \( \tilde{w} \) implies that the optimal bribe \( b \) must rise. However, the official will increase the bribe \( b \) only to a level such that \( \tilde{w} < \tilde{w}. \) Otherwise, (6) would be violated: If \( b \) is set such that \( \tilde{w} < \tilde{w}, \) \( 1 - G(\tilde{w}) < G'(\tilde{w}) \frac{\partial \tilde{w}}{\partial \rho} b + \pi \mu'(b). \) Further, we know that the investment level \( k^{\text{max}} \) is monotonic in \( w. \) Hence \( k^{\text{max}}(\tilde{w}) > k^{\text{max}}(\tilde{w}) = \kappa. \)

Together with \( \frac{d^2 k^{\text{max}}}{d\lambda dw} > 0, \) this implies that all previous entrepreneurs increase their firm sizes, given \( \rho. \) Taken together, an increase in \( \lambda \) leads to an increase in the bribe level \( b, \) a decrease in \( \tilde{w}, \) and an increase in gross capital demand. Since \( \rho = r, \) the equilibrium amount of capital invested rises (until \( K \) is reached).

Case \( \rho > r \) and \( \tilde{w}_1 > \tilde{w}_2. \) If capital demand crosses capital supply in the vertical segment, the right shift of the capital demand schedule causes \( \rho \) to rise. Assume \( \tilde{w}_1 \) is relevant. From (2) and (3) we see that the investment level \( k^{\text{max}}(w) \) and the minimum wealth level \( \tilde{w}_1 \) to
become entrepreneur are functions of $\lambda/\rho$ only. In addition, $\lambda$ does not enter the first order condition of the official (6) separately. But this implies that the system (7) and (6) has only one solution for $\lambda/\rho$ and $b$. Hence, the bribe level remains constant as $\lambda$ increases.

Case $\rho > r$ and $\tilde{w}_2 > \tilde{w}_1$. By differentiating (5) we see that $\tilde{w}_2$ increases when $\lambda$ and $\rho$ increase proportionally. In particular, $\tilde{w}_2$ approaches infinity at $\lambda < 1$ if $\lambda/\rho$ is fixed. Hence, $\tilde{w}_2$ becomes eventually relevant as $\lambda$ approaches 1. In that case, a further increase of $\lambda$ will increase $\tilde{w}_2$. To show this, assume the contrary. For $\tilde{w}_2$ to decrease, $\rho$ must increase less than proportionally with $\lambda$. Hence $k^{\max}(w)$ increases, given $b$. The decrease in $\tilde{w}_2$ triggers an increase of the bribe $b$. However, the investment level of the critical entrepreneur must rise, since $(1 - \lambda)k^{\max}(\tilde{w}_2) = \rho\tilde{w}_2$ holds and $\rho$ has risen. Since $d^2k^{\max}/(d\lambda dw) > 0$ equilibrium investment of the richer entrepreneurs rises even more, hence this cannot be an equilibrium. We conclude that $\tilde{w}_2$ must increase and correspondingly $b$ decrease.
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Treisman, Daniel (2000); "The Causes of Corruption: A Cross-National Study," *Journal of 
Public Economics*, 76, 399-457.
### Table 1 – Rank correlations between different measures of corruption

<table>
<thead>
<tr>
<th>Measure for non-collusive corruption</th>
<th>Measure for collusive corruption</th>
<th>TI 2001</th>
<th>TI 88-91 (average)</th>
<th>TI 80-85 (average)</th>
</tr>
</thead>
<tbody>
<tr>
<td>measure for non-collusive corruption</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>measure for collusive corruption</td>
<td>0.56</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TI 2001</td>
<td>0.82</td>
<td>0.58</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>TI 88-91 (average)</td>
<td>0.82</td>
<td>0.58</td>
<td>0.87</td>
<td>1</td>
</tr>
<tr>
<td>TI 80-85 (average)</td>
<td>0.8</td>
<td>0.57</td>
<td>0.82</td>
<td>0.87</td>
</tr>
</tbody>
</table>

**Sources:** TI indices: Transparency International Global Corruption Report, 2001 and Transparency International and Göttingen University, [www.gwdg.de/~uwvw/histor.htm](http://www.gwdg.de/~uwvw/histor.htm) (historical data); Measures for collusive and non-collusive corruption: own calculations based on “The World Business Environment Survey (WBES) 2000.”

**Note:** Measure for non-collusive corruption: Share of firms responding “never” or “seldom” when asked whether it is common for firms in their line of business to have to pay some irregular additional payments to get things done; Measure for collusive corruption: Share of firms responding “0%” or “up to 5%” when asked how much of the contract value a firm in their line of business would typically offer in additional or unofficial payments to secure the contract when doing business with the government; the TI index measures the “perception of corruption” and ranges between 0 (highly corrupt) and 10 (highly clean).

### Table 2

**Dependent Variable:** TI 2001 CPI

<table>
<thead>
<tr>
<th>Constant</th>
<th>Measure for non-collusive corruption</th>
<th>Measure for collusive corruption</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.41</td>
<td>5.95*</td>
<td>1.48*</td>
</tr>
<tr>
<td>(0.34)</td>
<td>(0.65)</td>
<td>(0.55)</td>
</tr>
</tbody>
</table>

Robust standard errors in parentheses.

* Significant at the 1 percent level.
**Figure 1 – Economic Development and Non-Collusive Corruption**

Sources: Measures for collusive and non-collusive corruption: own calculations based on World Bank (2002); GDP data: Heston, Summers, and Aten (2002).

Note: The range of the measure for non-collusive corruption is [0,1], with 1 indicating least corruption. Log GDP per capita is measured in 1996 constant prices.
Figure 2 – Capital Market Equilibrium

Figure 3 – Ex Post Wealth
Figure 4 – Corruption and the Interest Rate

Figure 5 – Impact of Lower Corruption on the Ex Post Wealth