

WHO GAINS FROM NON-COLLUSIVE CORRUPTION?

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Abstract

We explore the impact of non-collusive corruption on factor rewards and on the wealth distribution. We show that the distributional consequences depend crucially on the degree of capital market imperfections. With perfect capital markets, corruption does not redistribute wealth within the private sector. However, if borrowing is limited, members of the "middle class" suffer most since bribery drives them out of the capital market. This in turn makes access to credit easier for relatively wealthy individuals such that a group of them even wins. So, the interest of the latter in overcoming a corrupt regime may be very limited. In the empirical section, we provide cross-country evidence showing that a high level of corruption and a polarization in the income distribution go indeed hand in hand.

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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.

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, p. 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.² In Section 2 we show that this kind of corruption is pervasive throughout the less developed world.

The aim of this paper is to shed light on the forces behind persistent corruption *without theft* from a theoretical point of view. We explore distributional consequences of this kind of corruption in an economy where individuals are heterogeneous with respect to their wealth but are otherwise identical. In par-

¹Corruption *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.

²For instance, in St. Petersburg in 1992 firms had to pay USD 200 in irregular "additional payments" for a telephone installation (Webster and Charap, 1993).

ticular, we analyse the impact of bribery on individual investment opportunities and on aggregate variables such as the equilibrium interest rate and the wealth distribution. So far, the literature has neglected the distributional consequences of corruption via its impact on factor rewards. However, in our view, it is central to analyse who has to back the costs of corruption after taking into account the general equilibrium effects. If the burden of corruption is unequally distributed, individuals or groups in society face different incentives to fight against corruption.

Our model focuses on non-collusive corruption taking place between firms and lower-level bureaucracy. We assume that an entrepreneur has to pay bribes to set up a business whereas poorer individuals who engage in a "backyard project" or deposit their money on a savings account are not subject to bribery. The total bribe to be paid by an entrepreneur increases absolutely in the project size but decreases relatively to the project size. Indeed, empirical evidence suggests that the *direct* burden of corruption is rather unequally distributed and falls disproportionately on entrepreneurs belonging to the "middle class". Recent studies (Clarke and Xu, 2002; Kaufmann et al., 2000; European Bank for Reconstruction and Development, 1999) have found that bribe costs as a share of firms' revenues are falling in the firm size.

After having paid the bribes, an entrepreneur is free to invest. We assume that minimum investment is required to set up a business. It is obvious that, under these conditions, unequally wealthy individuals may be affected differently from a dishonest bureaucracy when credit markets are imperfect and, consequently, initial wealth serves as collateral determining how much can be borrowed. We allow for credit market imperfections as arising from imperfect enforcement of credit contracts.³

Our analysis provides two main results. First, the distributional consequences depend crucially on imperfections in the capital market. If the capital market is perfect, corruption does not adversely affect the wealth distribution.

³The implication that one can borrow more with a higher collateral does not depend on the exact microfoundations of the credit market imperfection (see Piketty, 1997).

Corruption lowers the return on all investment opportunities to the same extent and, consequently, each individual bears the same relative burden. However, things change substantially if individual borrowing is limited due to imperfect enforcement of credit contracts. We show that poorer individuals and especially the "middle class" bear a big share of the burden imposed by dishonest officials. Thus, the distributional pattern mentioned above is enforced once we take into account macroeconomic effects. Second, we identify a group of individuals other than the bureaucrats that even win from a higher degree of corruption because the benefits emerging through macroeconomic channels overcompensate the direct costs of paying a bribe. This group consists of the wealthy entrepreneurs.

The results are driven by the fact that corruption reduces the ex ante wealth of potential entrepreneurs. If capital markets are imperfect, wealth serves as a collateral determining how much can be borrowed in the capital market. Thus, a higher level of bribery reduces the wealth that can serve as collateral and hence limits the access to the capital market. Some members of the "middle class" are no longer able to finance the minimum investment required to set up a business. Hence, capital demand decreases which in turn lowers the interest rate. Whereas the poor and the "middle class" lose, the lower interest rate favours the wealthy entrepreneurs despite the fact that each member of this group faces a direct adverse effect of corruption on his investment return.

If the privileged class governs both the private and the public sector, we may interpret corruption without theft as a particular form of rent-seeking. Li, Squire, and Zou (1998) provide evidence that in countries with weak democratic institutions the government is indeed "captured" by the rich.⁴ Thus, focusing on the interaction between weak democratic institutions and weak market institutions, this paper identifies another mechanism by which inequality may promote redistribution and affect efficiency. In this sense, our work is linked to Perotti (1993), Alesina and Rodrik (1994), and Persson and Tabellini (1994) who investigate the effects of inequality on the demand for fiscal redistribu-

⁴Bénabou (2000) argues that even in democratic societies *effective* political power is correlated with wealth.

tion, and to Benhabib and Rustichini (1996) and Alesina and Perotti (1996), who argue that high inequality - by triggering social unrest, mass violence, and civil wars - endangers property rights and discourages investment by the rich. In our model, however, rent-seeking takes place in exactly the opposite way. The rich redistribute from the poor on condition that political and economic power are positively associated. Thus, our work is most closely related to Glaeser, Scheinkman, and Shleifer (2002) who argue that high inequality allows the wealthy to subvert legal institutions for their own benefit.

At a broader level, this paper is related to a literature underlining that existing powerful groups may block the introduction of new technologies because they fear the loss of political power (Acemoglu and Robinson, 2000, 2002) or of economic rents (e.g. Olson, 1982, or Krusell and Rios-Rull, 1996).

The organization of the paper is as follows. In Section 2 we discuss shortly different types of corruption and provide evidence showing that non-collusive corruption is pervasive in the less developed world. In addition, we argue that the perception of corruption is strongly influenced by the level of non-collusive corruption. Section 3 sets up the basic model and examines the static market equilibrium. The distributional consequences of corruption are explored in Section 4. We distinguish explicitly the cases of perfect and imperfect capital markets and state our two main results. In Section 5 we briefly discuss an extension of the static model in which both aggregate savings and the dynamics of the wealth distribution are endogenous. We argue that corruption hampers growth and polarizes the wealth distribution. In Section 6, we present cross-country correlations between the change in inequality and the level of corruption. Section 7 concludes.

2 Types of Corruption

Shleifer and Vishny (1993) distinguish between 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 - if there is

one - to the government but charges something extra for himself. This means that the official imposes additional costs on the private agent. A well-known and striking example for corruption without theft is Peru in the early eighties. As described by De Soto (1989), there were eleven requirements for setting up a small industry. In an experiment, a potential entrepreneur was asked for additional, irregular payments on ten occasions. On two of these occasions, the entrepreneur was forced to pay the bribe since there was no other way to complete the procedure and to continue. Second, in the case *with theft*, the official does not turn over anything to the government at all, and hides the transaction. This kind of corruption is mutually beneficial as long as the bribes demanded are smaller than the price required by the government.

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 than non-collusive since in the case with theft the interests of the official and the private agent are aligned and neither the briber nor the bribee has an incentive to protest. In addition, collusive corruption often benefits an influential group in society. For instance, evidence for Gambia, Mozambique, and Ghana suggests that corruption with theft permits the rich to avoid taxes (Dia, 1996).

What does the data say with respect to the persistence of non-collusive corruption? There are essentially two problems in answering this question. First, we have to rely on the *perception* of corruption since there is no *objective* data on the extent of any kind of corruption. This gives rise to our second problem. Leading corruption perceptions indices (e.g. the Transparency International Corruption Perception Index [TI-CPI]) do not explicitly deal with collusive or non-collusive corruption.⁵ Hence, we are not able to make a sound judgement about the persistence of non-collusive corruption from an empirical point of

⁵For instance, the TI-CPI 2001 is constructed from seven component surveys. The subjects asked about in these component surveys vary considerably. They 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.

view.

However, there exists some evidence for the extent of non-collusive corruption for the time being. In its attempt to measure "Conditions for Business Operation and Growth", the World Bank (2002) recently asked over 10,000 firms in 80 countries questions about corruption. Beside the general question about the impact of corruption on the "operation and growth of the business" ("no obstacle", "minor obstacle", "moderate obstacle", "major obstacle"), more detailed questions were asked. Inter alia, firm managers were asked first whether it is common for firms in their line of business to have to pay some irregular "additional payments" to get things done, and second, after having done the "additional payment", whether another governmental official will subsequently require an "additional payment" for the same service. As a third question, firm 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 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", "frequently", "sometimes", "seldom", "never") to these questions mirror the extent of non-collusive corruption. In contrast, the responses to the third question ("zero", "up to 5 %", "6 to 10 %", "11 to 15 %", "16 to 20 %", "more than 20 %") predict something about the level of corruption with theft. It is well known that corruption in the awarding of major contracts inflates the costs of public projects. Therefore, it seems convenient to subsume this type of corruption under corruption with theft. As a plausible measure for non-collusive (collusive) corruption in a given country we propose the share of firms responding "never" or "seldom" ("zero" or "up to 5 %").⁶ To construct a measure for the impact of corruption on the "operation and growth of the business", World Bank attaches 1 to "no obstacle", 2 to "minor obstacle", and so on, and then takes the average. As can be seen from Table 1,

⁶The range of both of these measures is [0,1], with 1 indicating least corruption.

non-collusive corruption is pervasive in the less developed regions of the world. In addition, countries with a high level of non-collusive corruption are also those in which firm managers indicate that corruption is an obstacle to the operation and growth of their business: Spearman's rank correlation between the measure for the impact of corruption on the "operation and growth of the business" and our measure for non-collusive corruption is about 0.78. The correlation between the measure for the general impact of corruption and our measure for collusive corruption is significantly smaller: 0.69.

Table 1

It is also worth noting that the correlation between our simple measure of non-collusive corruption and TI-CPI 2001, which measures the perception of "extensive corruption", is extremely high. Spearman's rank correlation is about 0.82 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 TI-CPI 2001 as the 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. A one standard deviation increase in the measure for non-collusive corruption increases the TI-CPI by 1.35 points whereas the same figure for collusive corruption is only about 0.37 (see Table 2). Additional correlations are given in Table 3. These correlations are evidence supporting the view that there is a close relationship between the perception of corruption as, for instance, reported in the TI-CPI and the extent of non-collusive corruption.

Table 2, Table 3

We conclude that in a huge number of countries throughout the developing world non-collusive corruption is on a *persistent* high level. In addition, the perception of corruption seems to be highly influenced by the extent of this kind of corruption. The empirical evidence for the negative impact of perceived corruption on investment and growth in mind (Section 1), we hypothesize that

primarily non-collusive corruption imposes strong restrictions on economic activity and development.

In what follows we argue that the persistence of non-collusive corruption may be rooted in its distributional properties. We show that, beside the officials, corruption without theft also favours non-officials on condition that bribery follows the regressive pattern reported by Clarke and Xu (2002) and that capital markets are poorly developed. Thus, corruption without theft may be interpreted as rent-seeking leading to redistribution from the relatively poor to the rich. However, the winners of corruption are not rewarded directly, as it is the case with collusive corruption, but through general equilibrium channels.

3 The model

3.1 The Basic Assumptions

We consider a closed economy that is populated by a large number (a continuum) of individuals. The individuals are heterogeneous with respect to their initial wealth endowment w but otherwise identical. The utility function of the individuals is assumed to be linear. This implies that each agent seeks to maximize his wealth. Initial wealth is distributed according the continuous distribution function $G(w)$, which gives the measure of the population with wealth less than w . The population size is normalized to one.

An agent has two different *physical* investment opportunities. First, he may invest his wealth endowment into a "backyard project". This yields a return (output per unit of capital invested) of $r \geq 1$. Second, he may become an entrepreneur and may invest k units consisting of his own wealth and, possibly, borrowed funds into an "investment project" which yields a return of $R > r \geq 1$. Beside these physical investment opportunities, an agent may become a lender on an economy-wide capital market. The endogenously determined interest rate is ρ . Note that, in equilibrium, ρ must be at least as high as r because of the existence of the "backyard project".

To succeed, an entrepreneur has to invest an amount that is higher than some specific threshold level. In addition, he has to undertake bureaucratic procedures that can only be completed by paying bribes to lower-level officials. In particular, we take the following two assumptions: First, there is a minimum requirement of one unit of capital to start an "investment project". With a lower level of input, the project will not generate any returns. Second, the entrepreneur has to pay corruption fees. These corruption fees serve only to get a *de iure* costless business licence. They do not favour a particular investor compared to another investor who pays the fees as well. That is, we focus on corruption without theft in the terminology of Shleifer and Vishny (1993). To summarize, after having paid the bribes to the officials, the entrepreneur is free to invest. If he invests an amount of $k \geq 1$ into the "investment project", the gross output is Rk . If he invests less than one unit, the project output is zero. Neither a minimum investment nor a "business licence" is required in the case of the low yield "backyard project".⁷

The total bribe to be paid depends on the project size k and is given by $\beta b(k)$, with $b' \geq 0, b'' \leq 0$, and $R \geq r(1 + \lim_{k \rightarrow \infty} \beta b'(k))$. The assumptions concerning the derivatives of $\beta b(k)$ imply that the bribe costs relative to the project size are nonincreasing in the project size. This assumption is consistent with the empirical findings mentioned above. The last inequality makes sure that entrepreneurship is attractive. Intuitively, this condition states that an increase in the "investment project" size by one unit (which requires $1 + \beta b'(k)$ additional units of capital) yields a higher return than the same investment into a "backyard project" - at least for large project sizes. The multiplicative parameter $\beta > 0$ reflects the level of corruption given the specific pattern of bribery. To close the model, we assume that all bribe collecting officials are lenders and do not act as entrepreneurs.

If an agent with initial wealth $w < k$ desires to invest k units of capital, he has to borrow on the economy-wide capital market. The capital market is

⁷Thus, our "backyard project" ("investment project") corresponds - in some sense - to the "subsistence" ("cash-crop") production in Murphy et al. (1993).

competitive in the sense that the individuals take the equilibrium interest rate ρ as given. However, there is a capital market imperfection due to imperfect enforcement of credit contracts.⁸ An entrepreneur may refuse to honour his payment obligation. We assume that an entrepreneur can seize a fraction $1 - \lambda$ of the project output if he avoids the payment obligation. The parameter $\lambda \leq 1$ can be interpreted as a measure for the capital market efficiency. In our simple model, capital market efficiency depends directly on the effectiveness of the legal system. For example, a λ of zero means that default is never followed by a sanction whereas in the case $\lambda = 1$ the enforcement of credit contracts is perfect and the capital market is as well. Taking into account the entrepreneurial incentives, the lenders will give additional credit to an entrepreneur (that is to an individual who invests into the "investment project") as long as it is in the entrepreneur's own interest to repay the debt. This will be the case if the payment obligation ρc , where c is the total amount of credit, does not exceed the cost of default λRk for the entrepreneur. Hence, an entrepreneur investing k units of capital gets a maximum credit c^{\max} of $\frac{\lambda R}{\rho}k$ capital units. Note that in equilibrium default will not occur. The capital market is imperfect because it is *possible* to default.

3.2 The Static Equilibrium

The existence of the capital market imperfection implies that the maximum project size depends positively on the wealth endowment w . Suppose that an entrepreneur wants to invest k units of capital into an "investment project". Since the entrepreneur has to pay the bribes first, the own capital $w(k)$ required is determined by

$$w(k) = k + \beta b(k) - c^{\max}.$$

Taking $c^{\max} = \frac{\lambda R}{\rho}k$ into account, we get

$$w(k) = \beta b(k) + \left(1 - \frac{\lambda R}{\rho}\right)k. \quad (1)$$

⁸In modelling the capital market imperfection we follow Matsuyama (2000).

It is clear that $w'(k) = \beta b'(k) + 1 - \frac{\lambda R}{\rho}$, $k \in [1, \infty)$, must be greater than zero in equilibrium. Suppose the opposite were true. In this case, $w(k)$ is equal to zero (if $w' = 0$) or becomes negative if k grows large (if $w' < 0$). This means that every individual has unlimited access to the capital market. Given the assumption $w'(k) \leq 0$, ρ must be smaller than $\lambda R < R$. This means that everyone seeks to invest an infinite sum and, as a consequence, capital demand exceeds capital supply. This cannot be an equilibrium. We conclude that $w'(k) > 0$, and that own capital plays the role of collateral in our model.

Equation (1) allows us to determine the minimum wealth level $w(1) \equiv \tilde{w}_1$ that enables an individual to invest *exactly* one unit of capital:

$$\tilde{w}_1 = \beta b(1) + 1 - \frac{\lambda R}{\rho} > 0 \quad (2)$$

All individuals with initial wealth $w > \tilde{w}_1$ are able to become an entrepreneur. The intuition of (2) is easy to grasp. The amount that an entrepreneur can borrow is given by $c^{\max} = \frac{\lambda R}{\rho} k$. A higher interest rate ρ , a lower capital market efficiency λ , and a lower project return R reduce c^{\max} . Thus, the cutoff-level to become an entrepreneur must rise in ρ and fall in λ and in R . A higher total bribe $\beta b(1)$ translates one-to-one in an increase of \tilde{w}_1 since the bribes must be paid before the project starts.

It remains to determine, however, whether an individual with wealth \tilde{w}_1 wants to become an entrepreneur at all. An individual with $w \geq \tilde{w}_1$ chooses the "occupation" entrepreneur if both of the two alternative opportunities, that are (i) investing into a "backyard project" or (ii) acting as a lender, are less attractive in terms of the investment return or, equivalently, in terms of the resulting ex post wealth. The resulting ex post wealth of *not* choosing entrepreneurship is given by $w \max\{\rho, r\} = w\rho$ since $\rho \geq r$ in an equilibrium. An entrepreneur who borrows the maximum amount of credit earns the gross return Rk and has to repay $\rho c^{\max} = \rho \frac{\lambda R}{\rho} k$. From (1) we know that $k(w, \rho, \beta)$ is implicitly determined by $k = \left(1 - \frac{\lambda R}{\rho}\right)^{-1} \{w - \beta b(k)\}$. Note that k is strictly increasing and convex in w and strictly decreasing in ρ (see Appendix). The ex post wealth

$W^E(w, \rho, \beta)$ of an entrepreneur is then given by

$$\begin{aligned} W^E(w, \rho, \beta) &= (1 - \lambda)Rk(w, \rho, \beta) \\ &= \frac{(1 - \lambda)R}{1 - \frac{\lambda R}{\rho}} \{w - \beta b(k)\} \end{aligned} \quad (3)$$

and is also strictly increasing and convex in w . Now, we are ready to determine the critical wealth level \tilde{w}_2 where an individual is exactly indifferent between an "investment project" and one of the two alternatives. If we solve $W^E(\tilde{w}_2, \rho, \beta) = \rho\tilde{w}_2$, we get

$$\tilde{w}_2 = \frac{(1 - \lambda)R}{R - \rho} \beta b(k(\tilde{w}_2, \rho)). \quad (4)$$

Intuitively, a higher ρ , an upward shift of the bribe function, or a lower R make entrepreneurship less favourable. As a consequence, \tilde{w}_2 must rise. If λ , our measure for capital market efficiency, rises an entrepreneur can borrow more capital and therefore manage larger project sizes. This makes entrepreneurship more attractive as long as $R > \rho$. Thus, \tilde{w}_2 falls in λ .

The following lemma shows that $\partial W^E(w, \rho, \beta)/\partial w \geq \rho$ if w exceeds $\max\{\tilde{w}_1, \tilde{w}_2\}$. This implies that (for individuals with initial wealth $w \geq \max\{\tilde{w}_1, \tilde{w}_2\}$) it is indeed optimal to invest the whole initial wealth endowment plus the maximum amount of credit into an "investment project". The other agents will become lenders (if $\rho > r$) or are indifferent between investing into a "backyard project" or becoming lenders (if $\rho = r$).

Lemma 1 *Additional wealth is more valuable for an entrepreneur than for a lender: $\partial W^E(w, \rho, \beta)/\partial w \geq \rho$ with strict inequality if $b'' < 0$.*

Proof. We show first that $W^E(w, \rho, \beta)$ is strictly increasing and convex in w . Note that $\partial W^E(w)/\partial w = \frac{(1 - \lambda)R}{1 - \frac{\lambda R}{\rho} + \beta b'(k(w))} > 0$ since the denominator is positive for $k \in [1, \infty)$ and $\lambda < 1$. Since $b'' \leq 0$, the ex post wealth W^E of an entrepreneur is convex in w and strictly convex in w , if $b'' < 0$.

Let us consider first the case where $\tilde{w}_1 \geq \tilde{w}_2$. In that case $W^E(\tilde{w}_1) \geq \rho\tilde{w}_1$ holds. Using (2) and (3) this condition can be rewritten: $(1 - \lambda)R \geq$

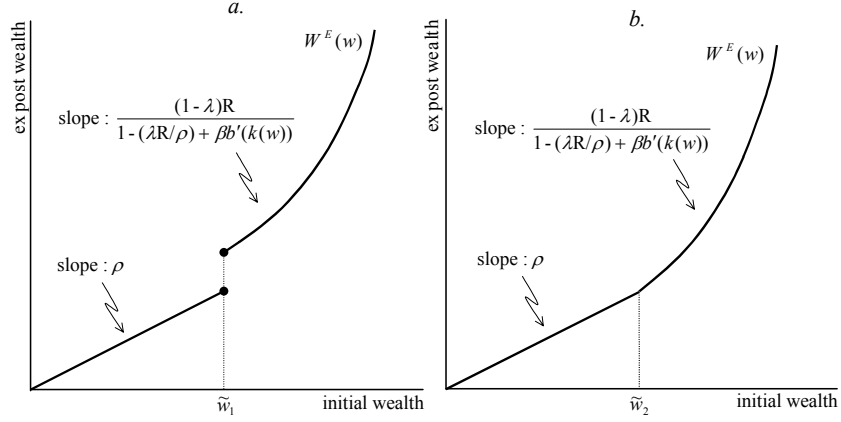


Figure 1: The resulting wealth inequality

$\rho \left(\beta b(1) + 1 - \frac{\lambda R}{\rho} \right)$. With this result we get: $\frac{\partial W^E(w)}{\partial w} \Big|_{w > \tilde{w}_1} \geq \frac{\partial W^E(w)}{\partial w} \Big|_{w = \tilde{w}_1} = \frac{(1-\lambda)R}{1 - \frac{\lambda R}{\rho} + \beta b'(1)} \geq \frac{\rho(\beta b(1) + 1 - \frac{\lambda R}{\rho})}{1 - \frac{\lambda R}{\rho} + \beta b'(1)} \geq \rho$ since $b(1) \geq b'(1)$.

Now, let us consider the case $\tilde{w}_2 > \tilde{w}_1$. Since $W^E(w)$ is convex, it must cross the ρw -line from below at $w = \tilde{w}_2$. Thus, the claim of the lemma immediately follows. ■

Figure 1 below shows the relationship between the endowment w and the resulting ex post wealth of an individual. If $\tilde{w}_1 > \tilde{w}_2$, the borrowing constraint determines who is to become an entrepreneur. Figure 1a shows that the ex post wealth rises discontinuously at \tilde{w}_1 . In the case of $\tilde{w}_2 \geq \tilde{w}_1$ (Figure 1b), an agent with wealth \tilde{w}_2 is indifferent between the two "occupations" entrepreneur and lender. From Lemma 1 we know that an additional unit of initial wealth increases the ex post wealth of an entrepreneur to a larger extent than the ex post wealth of a lender: $\partial W^E(w)/\partial w > \rho$. The reason is that a higher wealth weakens the borrowing constraint and allows larger projects seized by "cheap" capital. Thus, under imperfect capital markets, each individual wants to invest an infinite sum into the entrepreneurial project. However, this is not possible due to the enforcement problems. To which extent an individual can take advantage of the favourable borrowing conditions depends on its own

wealth.

We complete our description of the static equilibrium by deriving the (gross) capital demand function and the (gross) capital supply function. Gross capital demand (K^D) is simply the sum of all entrepreneurial project sizes. Since the project size $k(w, \rho, \beta)$ of an entrepreneur with initial wealth w is implicitly determined by $k = \left(1 - \frac{\lambda R}{\rho}\right)^{-1} \{w - \beta b(k)\}$, the gross capital demand relation of the economy can be written as

$$K^D(\rho) = \frac{1}{1 - \frac{\lambda R}{\rho}} \int_{\max\{\tilde{w}_1, \tilde{w}_2\}}^{\infty} \{w - \beta b(k(w, \rho))\} g(w) dw \quad (5)$$

If $\lambda < 1$, K^D is uniformly falling in the interest rate ρ because the maximum project size k decreases in the interest rate. Gross capital supply K^S is equal to the aggregate wealth endowment $\int_0^{\infty} w g(w) dw =: \bar{K}$ as long as $\rho > r$. In the case of $\rho > r$, nobody will choose to invest into a "backyard project" and the economy-wide stock of capital is allocated to high yield "investment projects". In the case of $\rho = r$, a lender is indifferent between investing into a "backyard project" or putting the money on a savings account. Finally, if $\rho < r$, capital supply will, of course, be zero. Hence, the gross capital supply curve K^S is a horizontal line at $\rho = r$ and is vertical for $\rho > r$ at the capital level \bar{K} (see Figure 2).⁹ The intersection of the capital demand and capital supply curve in Figure 2 determines the unique equilibrium interest rate ρ^* of the economy.

It is also important to mention that capital market imperfections redistribute wealth from the lenders to the entrepreneurs even without the presence of corruption ($\beta = 0$). However, \tilde{w}_1 and k are determined solely by the minimum investment requirement and the capital supply. They do not depend on λ since a variation in λ leads to the same relative variation in ρ in the new equilibrium. This means, for example, that a fall in λ neither affect the number of the entrepreneurs nor the size of their projects. Redistribution takes place but only through the channel of lower capital costs for fixed project sizes.

⁹Remember that the bribes do not affect gross capital supply (and demand), because the officials are lenders.

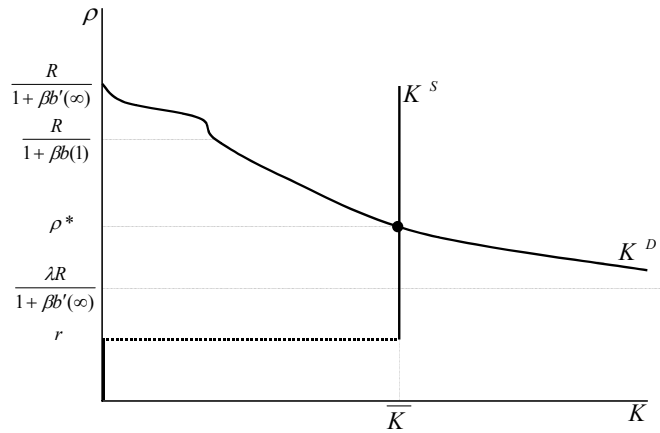


Figure 2: Capital Market Equilibrium

4 The effects of higher bribery

We now turn to the question of our primary interest. What are the distributional consequences of corruption? The aim is to identify winners and losers from an increase in the *level of corruption*, i.e. an increase in β . In what follows, $b(k)$ is taken as given. We explicitly distinguish the effects of corruption in economies with perfect and imperfect capital markets.

4.1 Perfect Capital Markets ($\lambda = 1$)

Under perfect capital markets we have to distinguish two cases. First, assume that $b(k)$ is regressive. In that case a single investment fund will collect the whole credit supply in order to minimize the bribes paid per capital unit. The fund invests the whole capital in the economy. Note that such a pooling institution cannot exist as long as $\lambda < 1$ because a single individual or a institution can borrow only up to a finite sum due to the enforcement problems. Since $b(k)$ is defined over individual project sizes (with mass zero) the fund has to pay an amount of $\lim_{k \rightarrow \infty} \beta b(k)$ in bribes. Its net profit per capital unit is given by $\lim_{k \rightarrow \infty} \frac{Rk - (k + \beta b(k))\rho}{k}$. Applying de l'Hôpital's rule we get $R - (1 + \lim_{k \rightarrow \infty} \beta b'(k))\rho$.

The equilibrium interest rate is readily determined. With $\rho^* > \frac{R}{1 + \lim_{k \rightarrow \infty} \beta b'(k)}$, the investment funds would incur infinite losses. With $\rho^* < \frac{R}{1 + \lim_{k \rightarrow \infty} \beta b'(k)}$, new pooling institutions would enter and offer a slightly higher interest rate to the lenders. We conclude that competition drives the interest rate up to the point where net profit per capital unit of the investment fund is zero, i.e. up to $\rho^* = \frac{R}{1 + \lim_{k \rightarrow \infty} \beta b'(k)}$. Thus, the lenders and the single entrepreneur running the fund earn the same rate of return on their wealth. Note that $R = \rho^*$ if $\lim_{k \rightarrow \infty} b'(k) = 0$. In this case, the pooling institution has to pay a bribe but this bribe is only of mass zero. Thus, pooling profits (which are of discrete nature) remain unaffected. In addition, this implies that the officials can only appropriate a zero mass of output.

Second, assume that $b'(k)$ is constant and equals \bar{b} . In that case, there may exist a large number of firms each investing at least an amount of 1. Firm size and number are indetermined as it is usually the case in perfect competition and constant returns to scale environments. As it is the case above, net profit of each firm equals zero due to perfect competition. Lenders and entrepreneurs face the same rate of return $\rho^* = \frac{R}{1 + \beta \bar{b}}$ on their wealth.

We see that the effects of bribery in the first and the second case are very similar. Corruption does not redistribute wealth within the group of non-officials. Each individual bears the same relative burden of corruption. The only difference lies in the firm number and in the potential for officials to generate bribes. In the linear case, corruption always redistributes wealth from the non-officials to the officials whereas in the regressive case redistribution between these two groups takes only place if $\lim_{k \rightarrow \infty} b'(k) > 0$. To summarize, our main findings are stated in the proposition below.

Proposition 1 *In the case of perfect capital markets ($\lambda = 1$), the equilibrium interest rate ρ^* equals $\frac{R}{1 + \lim_{k \rightarrow \infty} \beta b'(k)}$. Lenders and entrepreneurs face the same rate of return on their wealth. Corruption does not redistribute wealth within the group of non-officials.*

Note that an increase in β does not affect efficiency as long as corruption is

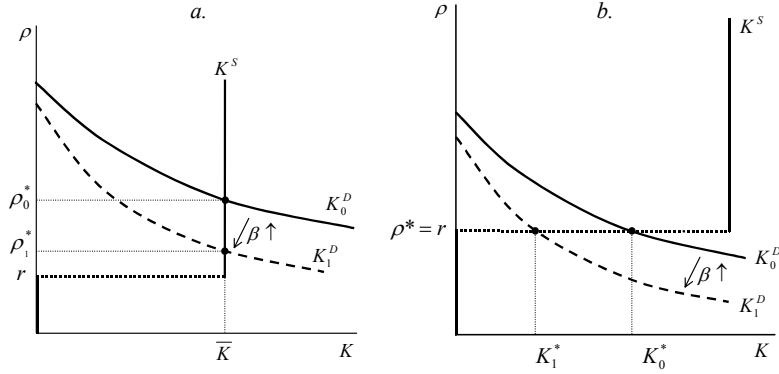


Figure 3: Impact of higher bribery on the interest rate

not at a "very high" level, i.e. as long as $\frac{R}{1 + \lim_{k \rightarrow \infty} \beta b'(k)} \geq r$ which means that the economy-wide capital stock is invested into high yield "investment projects".

4.2 Imperfect Capital Markets ($\lambda < 1$)

So far, we discussed briefly the distributional consequences of capital market imperfections (Section 3) and of corruption in an economy with perfect capital markets (Subsection 4.1). In this section, we explore the distributional consequences of corruption in an economy with *imperfect* capital markets. We show that in the case $\rho^* > r$ more corruption alters the number of entrepreneurs and, through its impact on the interest rate, redistributes also wealth within the group of non-officials. In contrast, if $\rho^* = r$ an increase in the level of corruption does no longer redistribute wealth within the private sector.

$\rho^* > r$. It is easy to see that the direct impact of corruption on the entrepreneurial wealth is adverse. But, as mentioned above, there is a second, *macroeconomic* channel operating through the interest rate. Figure 3a shows the effect of a higher β on the interest rate.

Proposition 2 *If $\lambda < 1$ and $\rho^* > r$, the equilibrium interest rate falls in the level of corruption β .*

Proof. Formally, the effect of bribery on the interest rate ρ can be determined by computing $\frac{d\rho}{d\beta}$ from equation (5), taking into account that $K^D = \bar{K} = \text{const.}$ However, it is more convenient to prove the claim by contradiction.

Assume that $\frac{d\rho}{d\beta} \geq 0$. In this case, both \tilde{w}_1 and \tilde{w}_2 are increasing in β since more capital is needed to become an entrepreneur and the interest rate alters in favour of the lenders ($\frac{d\tilde{w}_1}{d\beta}$ and $\frac{d\tilde{w}_2}{d\beta}$ are given in the Appendix). This means that the number of entrepreneurs falls in β for sure. In addition, the project sizes of the remaining entrepreneurs decrease as well. But this cannot be an equilibrium because aggregate capital allocated to "investment projects" is constant as long as $\rho^* > r$. We conclude that $\frac{d\rho}{d\beta} < 0$. ■

The channel operating through the interest rate affects both the wealth of the lenders and the wealth of the entrepreneurs. It is clear that the lower interest rate hurts all lenders, i.e. all individuals with initial wealth below $\max\{\tilde{w}_1, \tilde{w}_2\}$ in the new equilibrium. This means that a general equilibrium effect shifts bribe costs partially to the lenders. At the same time, capital costs for the remaining entrepreneurs are going down. In contrast to the perfect capital market case, the macroeconomic effect works in favour of the remaining entrepreneurs. Consequently, only the impact of bribery on the ex post wealth of both the "new" and the "old" lenders is unambiguous. Figure 3a shows the effect of a higher β on the interest.

In the following exposition we explore the conditions under which an entrepreneur benefits from a higher level of corruption, i.e. the conditions under which the general equilibrium effect overcompensates the direct negative effect of higher bribery. We proceed in two steps. First, we show how the number of entrepreneurs depends on β . This is done in Lemma 2 below. Then, we are ready to state and prove our main results (Proposition 3).

Lemma 2 *A higher level of corruption β increases the critical wealth level to become an entrepreneur \tilde{w}_1 . In addition, \tilde{w}_2 increases in β if the bribe function is "enough" regressive.*

Proof. We first prove that $\frac{d\tilde{w}_1}{d\beta} > 0$. The proof is by contradiction. Assume

that $\frac{d\tilde{w}_1}{d\beta} = b(1) + \lambda R/\rho^2 \frac{d\rho}{d\beta} \leq 0$. This assumption immediately implies that $\frac{dk}{d\beta}\Big|_{w=\tilde{w}_1} \geq 0$. It remains to determine the sign of $\frac{dk}{d\beta}$ for wealth levels greater than \tilde{w}_1 . To do this, we put $dk/d\beta$ slightly different:

$$\frac{dk}{d\beta} = -\frac{\left(1 + \frac{\lambda R}{\rho^2} \frac{k}{b(k)} \frac{d\rho}{d\beta}\right) b(k)}{1 - \frac{\lambda R}{\rho} + \beta b'(k)}$$

A higher w increases k and, since $b'(k) \geq 0, b''(k) \leq 0$, the absolute value of the nominator of the above expression. At the same time, the denominator decreases or remains constant. This means that $\frac{dk}{d\beta}\Big|_{w>\tilde{w}_1} > \frac{dk}{d\beta}\Big|_{w=\tilde{w}_1} \geq 0$. In addition, if $\tilde{w}_1 < \tilde{w}_2$, our argument implies that $\frac{dk}{d\beta}\Big|_{w=\tilde{w}_2} > 0$. So, it must be that the ex post wealth at the initial \tilde{w}_2 is now strictly higher. Therefore, \tilde{w}_2 must decrease in β as well. Thus, if $\frac{d\tilde{w}_1}{d\beta} \leq 0$, not only the project sizes are greater in the new equilibrium but also the number of entrepreneurs increases, no matter whether \tilde{w}_1 is smaller or greater than \tilde{w}_2 . Since capital supply is fixed, this cannot be an equilibrium. We conclude that $\frac{d\tilde{w}_1}{d\beta} > 0$.

We now turn to the sign of $\frac{d\tilde{w}_2}{d\beta}$. Since the denominator of the expression for $\frac{d\tilde{w}_2}{d\beta}$ is always positive at $w = \tilde{w}_2$ (see Appendix), \tilde{w}_2 increases in β if $\frac{\beta b(k)/k}{(1+\beta b'(k))} > \left|\frac{d\rho}{d\beta}\right| \frac{\beta}{\rho}$. ■

Note that the inequality at the end of the above proof is likely to be fulfilled if (i) the marginal bribe at $k(\tilde{w}_2^{old}, \cdot)$ is relatively small compared to the average bribe and (ii) the interest rate does not decrease to a large extent in β . The intuition is as follows. Since $k(\tilde{w}_2^{old}, \cdot)$ falls for sure in the new equilibrium, the marginal bribe determines how much the total bribe decreases due to this reduction in the project size. On the other hand, the higher the average bribe costs are, the stronger is the absolute increase in the bribe costs due to a higher β . So, in case of an increase in β , the combination of a high average bribe and a small marginal bribe reduces the attractiveness of the entrepreneurial project strongly. This reduction must be compared to the reduction in the interest rate, i.e. to the reduction in the return of the alternative investment opportunity. If ρ does not fall to a great extent, the individual with initial

wealth \tilde{w}_2^{old} switches from the "occupation" entrepreneur to the "occupation" lender and $\tilde{w}_2^{new} > \tilde{w}_2^{old}$. In addition, note that \tilde{w}_2 may only decrease *locally* in β . Since \tilde{w}_1 rises as β increases, the threshold level \tilde{w}_2 cannot steadily decrease because otherwise the condition $\tilde{w}_1 < \tilde{w}_2$ will be violated eventually.

Proposition 3 (i). *If $\tilde{w}_1 \geq \tilde{w}_2$ or $\tilde{w}_1 < \tilde{w}_2$ and $\frac{d\tilde{w}_2}{d\beta} \geq 0$, there exists a group of entrepreneurs with wealth level $w > \hat{w}$ such that $\left. \frac{dW^E}{d\beta} \right|_{w > \hat{w}} > 0$.*

(ii). *In the case of $\tilde{w}_1 < \tilde{w}_2$ and $\frac{d\tilde{w}_2}{d\beta} < 0$, there exists a wealth level \bar{w} such that $\left. \frac{dW^E}{d\beta} \right|_{w > \bar{w}} > 0$ if $\lim_{k \rightarrow \infty} b'(k)$ is bounded from above.*

Proof. (i). In that case, both \tilde{w}_1 and \tilde{w}_2 are increasing in β . This means that a rise in the level of corruption leads to a smaller class of entrepreneurs. Because total investment is fixed and $\frac{dk}{d\beta}$ is positively associated with w , a non-zero mass of rich agents with $w > \hat{w}$ will invest more. But this implies that their ex post wealth increases because $W^E(w) = (1 - \lambda)Rk$ (see equation (3)).

(ii). The expression for $\frac{dk}{d\beta}$ can be rewritten as $\frac{\partial k}{\partial w} \frac{\lambda R}{\rho^2} k \left[\left. \frac{d\rho}{d\beta} \right| - \frac{b(k)}{k} \frac{\rho^2}{\lambda R} \right]$. Applying de l'Hôpital's rule we get $\lim_{k \rightarrow \infty} \frac{dk}{d\beta} = \left[\left. \frac{d\rho}{d\beta} \right| - \lim_{k \rightarrow \infty} b'(k) \frac{\rho^2}{\lambda R} \right] \lim_{k \rightarrow \infty} \frac{\partial k}{\partial w} \frac{\lambda R}{\rho^2} k$. Since the sign of the second factor is unambiguous, it remains to determine the sign of the first one. Note that $\frac{d\tilde{w}_2}{d\beta} < 0$ implies that $\left. \frac{d\rho}{d\beta} \right| > \frac{\rho b(k)}{k(1 + \beta b'(k))}$. Therefore, $\lim_{k \rightarrow \infty} \frac{dk}{d\beta}$ is positive if $\lim_{k \rightarrow \infty} b'(k) < \frac{\lambda R}{\rho} \frac{b(k(\tilde{w}_2))}{k(\tilde{w}_2)(1 + \beta b'(k(\tilde{w}_2)))}$. To get a more intuitive expression note that $\frac{\lambda R}{\rho} \frac{b(k)}{k(1 + \beta b'(k))} > \lambda \frac{b(k)}{k} > \lambda b'(k)$. The former inequality stems from the fact that $R - \rho(1 + \beta b'(k)) > 0$ (see Appendix). Therefore we can state the following sufficient condition: $\lim_{k \rightarrow \infty} \frac{dk}{d\beta}$ is positive if $\lim_{k \rightarrow \infty} b'(k) \leq \lambda b'(k(\tilde{w}_2))$. ■

It is worth noting that our analysis applies for a marginal increase in the corruption level from every starting level $\beta \geq 0$. If we restrict our attention to the case in which corruption rises marginally from zero to some positive level, $\tilde{w}_2 < \tilde{w}_1$ always holds. This means that the introduction of regressive bribery in lower-level bureaucracy reduces the number of entrepreneurs and favours a non-zero mass of wealthy entrepreneurs for sure. But even in the case where \tilde{w}_2 is binding and locally decreasing in β , there exists a wealth level \bar{w} such that all

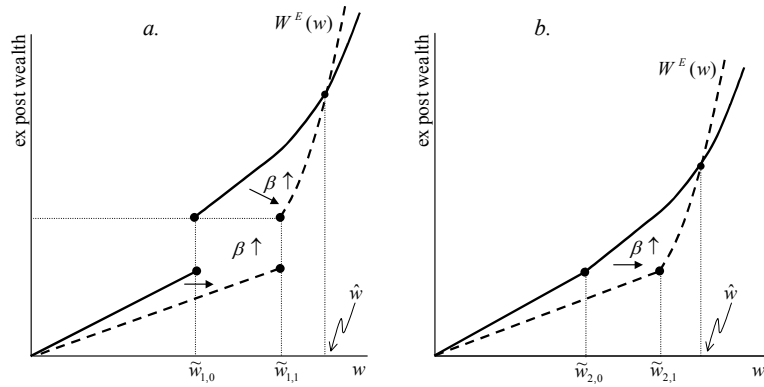


Figure 4: Impact of higher bribery on the wealth distribution

individuals with $w > \bar{w}$ are favoured by the increase in beta if the bribe function is "enough" regressive.

So far, we analysed the impact of corruption on the ex post wealth of the poor and the rich individuals. But how are the individuals between these two groups (the "middle class") affected? This can be shown most evidently in Figure 4 where we assume that $\tilde{w}_1 > \tilde{w}_2$ (Figure 4a) or $\tilde{w}_2 > \tilde{w}_1$ and $\frac{d\tilde{w}_2}{d\beta} > 0$ (Figure 4b). An increase in β hurts (indirectly and only moderately) all individuals that have already been lenders before the rise in β . The wealthy entrepreneurs with wealth levels above \hat{w}_1 (\hat{w}_2) in Figure 4a (figure 4b) are favoured. In contrast, the group consisting of individuals with initial wealth between $\tilde{w}_{1,0}$ and $\tilde{w}_{1,1}$ ($\tilde{w}_{2,0}$ and $\tilde{w}_{2,1}$) in Figure 4a (Figure 4b) loses substantially. These individuals have been entrepreneurs before but act as lenders now. In Figure 4a ($\tilde{w}_1 > \tilde{w}_2$) the borrowing constraint becomes binding for members of the "middle class" whereas in Figure 4b ($\tilde{w}_2 \geq \tilde{w}_1$) it does no longer pay to become an entrepreneur. In addition, the remaining entrepreneurs incur substantial losses if their wealth is only slightly above \tilde{w}_1 or \tilde{w}_2 , respectively.

$\rho^* = \mathbf{r}$. The equilibrium interest rate equals its lower bound r if corruption is at a very high level. As β grows, the capital demand is shifting to the left and eventually crosses the capital supply curve in its flat region (figure 3b).

There are two main differences compared to the case discussed above. First, the distributional consequences of higher corruption change. If β rises, the interest rate is unaffected, hence the lenders do not suffer from higher corruption. The costs are fully borne by the entrepreneurs' class. The members of this class have to pay higher total bribes but the interest rate does no longer change in their favour. This means that their access to the capital market has worsened and that the project sizes are generally reduced. Thus, each remaining entrepreneur experiences a loss irrespective of his wealth. Since the poor lenders gain in relative terms, overall inequality tends to fall. So, our model predicts that there is a hump-shaped relationship between the level of corruption and inequality.

Second, the capital invested in the modern sector decreases since \tilde{w}_1 and \tilde{w}_2 increase in β , i.e. the number of entrepreneurs is smaller than before, and the project size is in general reduced. Thus, bribery negatively affects output. In the case discussed above, the total amount of capital allocated in the high return projects is constant because capital supply is inelastic for $\rho^* > r$ (see figure 3a). With $\rho^* = r$, higher corruption crowds out investments from the high yield "investment sector" to the low yield "backyard sector" (see Figure 3b).

The discussion so far was close to our basic model that includes two polar cases with respect to capital supply. Either gross capital supply is vertical or horizontal. However, we may also shortly and only informally consider a situation where capital supply is positively sloped due to, for instance, imperfect international capital mobility. The distributional consequences in this case lie in between the two polar cases. For a given increase in the level of corruption, the interest rate falls *ceteris paribus* less when capital supply is elastic. In addition, aggregate investment into the high return investment project falls but only to a relatively small extent compared to the case with perfectly elastic supply. Exactly this impact of elastic supply not only makes it less likely that rich individuals win from more corruption but also protects the poor from backing a large part of the additional bribe costs.

5 Endogenous Savings

In this Section we extend our model to analyse the impact of corruption on both the dynamics of the output and the wealth distribution. For ease of exposition, we consider a two-period model. In their first period of life, individuals (exogenously) inherit a wealth endowment and have simultaneously to take two decisions. First, individuals have to choose between becoming an entrepreneur (E) or staying a lender (L). Second, they have to decide on how much to save out of their ex post wealth. The savings of the first period will be the initial wealth in the following period. In this second period, the agents are again forced to choose their "occupation". However, there is no longer savings-decision. The entire ex post wealth is consumed. Note that, in the aggregate, higher savings translate directly into a higher growth rate since the technology was assumed to exhibit constant returns to scale with respect to capital.

We assume that all individuals have the same logarithmic utility function

$$U = \ln c_t + \theta \ln c_{t+1},$$

where c_t stands for consumption at date t . The parameter $\theta < 1$ denotes the discount factor. Since the individuals may change their "occupation" in the second period, there are four different "career paths". To determine which path an individual selects, we have to state the intertemporal budget constraint for each possible case. For simplicity, we assume that the total bribe is a fixed amount, i. e. that the bribes do not vary with project size. Denote by b_t and b_{t+1} the total bribe in period t and $t+1$, respectively.¹⁰ For ease of notation, the interest rate for entrepreneurs in t is defined by $\rho_t^E \equiv \partial W_t^E(w)/\partial w = \frac{(1-\lambda)R}{1-\frac{\lambda R}{\rho_t}}$. Note that this rate of return does not vary across entrepreneurs (as it was the case above) since the marginal bribe is zero. The budget constraints associated with the four different "career paths" are given in equation (6). An individual who has, for instance, chosen to become an entrepreneur (E) in the first period

¹⁰So, bribes not only must be paid to set-up a business but also to operate a business (the business licence must be renewed every year).

and to become a lender (L) in the second period faces the budget constraint denoted by (EL).

$$\begin{aligned}
c_t + \frac{c_{t+1}}{\rho_{t+1}^E} &= \rho_t^E (w_t - b_t) - b_{t+1} & (EE) \\
c_t + \frac{c_{t+1}}{\rho_{t+1}} &= \rho_t^E (w_t - b_t) & (EL) \\
c_t + \frac{c_{t+1}}{\rho_{t+1}^E} &= \rho_t w_t - b_{t+1} & (LE) \\
c_t + \frac{c_{t+1}}{\rho_{t+1}} &= \rho_t w_t & (LL)
\end{aligned} \tag{6}$$

Figure 5 below depicts the consumption decision problem of an (first-period) entrepreneur at the end of period one. In Figure 5a (Figure 5b), the minimum investment restriction (incentive restriction) is binding. We focus on Figure 5a first. The amount to be divided between consumption today and savings is given by $\rho_t^E (w_t - b_t)$. If an entrepreneur saves at least \tilde{w}_1^{t+1} he will be able to become an entrepreneur also in the second period of live. The fact that $\rho_{t+1}^E > \rho_{t+1}$ introduces a non-convexity into the problem, and - because of $\tilde{w}_1^{t+1} > \tilde{w}_2^{t+1}$ - the budget constraint exhibits a jump at the point where savings exactly equal \tilde{w}_1^{t+1} . An individual will decide in favour of E if $\rho_t^E (w_t - b_t)$ is large enough such that the marginal utility out of consumption today is not "much larger" than marginal utility out of consumption tomorrow. In Figure 5a, the decision problem for an individual exactly indifferent between E and L in the second period ($w = w_t^*$) is shown. The indifference curve crosses the budget constraint in the point where *savings* = \tilde{w}_1^{t+1} , and is tangent to the budget constraint in another point where *savings* < \tilde{w}_1^{t+1} . Note that the income expansion path (IEP) follows a very unusual pattern because of the non-convexity of the budget set. In particular, there exists a wealth range in which the IEP is horizontal. If w_t equals w_t^* or is slightly above w_t^* , every additional unit of ex post wealth (due to an increase in w_t) is spent on consumption today because, in a corner solution, marginal utility of consumption today is higher than optimal consumption smoothing would imply: $u'(c_t) > \theta \rho_{t+1}^E u'(c_{t+1})$. In Figure 5b, where the incentive restriction is binding, a corner solution may not occur because the budget constraint does not jump. Consequently, the income

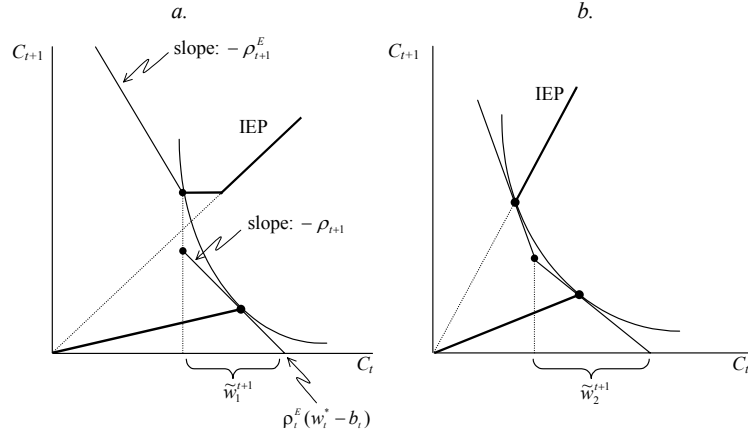


Figure 5: Optimal intertemporal choice

expansion path has always a positive slope.

The whole discussion implies that the wealthier individuals are more likely to become an entrepreneur in the second period. In particular, we can conclude that, if there are first-period entrepreneurs who choose L in the second period, all first-period lenders will also stay lender in the second period. Our discussion is summarized in the following proposition.

Proposition 4 W^* is defined as the ex post wealth level that makes an individual indifferent between E and L in the second period. Only individuals with initial wealth $W^i(w_t) \geq W^*$, where $i \in \{L, E\}$, choose to become entrepreneurs in the second period. If there are first-period entrepreneurs choosing L in the second period, all first-period lenders choose again L in their second period of life.

From Proposition 4 we conclude that the equilibrium "occupation structure" may take three forms. First, there may be a *full segregation* equilibrium, i.e. only (EE) and (LL) arise. This means that the number of entrepreneurs (lenders) does not change from the first to the second period since nobody

changes the "occupation". This equilibrium can only occur if $\tilde{w}_1^t > \tilde{w}_2^t$,¹¹ and is more likely if ρ_t^E is high compared to ρ_t . Second, there may be an equilibrium in which a positive mass of agents switches from L to E in the second period. Hence, there are more entrepreneurs in the second period than in the first one. In the third possible equilibrium, some agents choose (EL) such that there are less entrepreneurs in the second period. For each of the possible equilibria, the impact of corruption on aggregate savings is now discussed.

Full segregation. We start with the case in which only the "career-paths" (LL) and (EE) may emerge in equilibrium. As mentioned above, this is only possible if corruption is on a relatively low level and, consequently, the minimum investment restriction is binding. Let's also assume for a short time that every entrepreneur is in an interior optimum, i.e. that nobody consumes on the horizontal part of the income expansion path. This regime serves us as a baseline case. If all entrepreneurs are in an interior optimum, their consumption growth is given by the Euler equation $\frac{c_{t+1}}{c_t} = \rho_{t+1}^E \theta$. For lenders and officials, consumption growth is given by $\frac{c_{t+1}}{c_t} = \rho_{t+1} \theta$. Inserting the Euler equations into the budget constraints (6) allows us to solve for the first-period consumption:

$$\begin{aligned} c_t &= \frac{1}{1+\theta} (\rho_t^E (w_t - b_t) - b_{t+1}) && (EE) \\ c_t &= \frac{1}{1+\theta} \rho_t w_t && (LL) \\ c_t &= \frac{1}{1+\theta} (\rho_t b_t + b_{t+1}) && (Officials) \end{aligned} \tag{7}$$

Note that the interest rate in the second period does not enter since income and substitution effects cancel out each other due to logarithmic instantaneous utility. Aggregate output, which is equal to the sum of the income going to the entrepreneurs, to the officials, and to the lenders, is given by

$$Y_t = R\bar{K} = \int_{\tilde{w}^t}^{\infty} \rho_t^E (w_t - b_t) g(w) dw + \rho_t b_t \int_{\tilde{w}^t}^{\infty} g(w) dw + \int_0^{\tilde{w}^t} \rho_t w_t g(w) dw,$$

¹¹If $\tilde{w}_1^t < \tilde{w}_2^t$, the separation equilibrium occurs also if $\rho \tilde{w}_2^t$ happens to equal $\max\{\tilde{w}_1^{t+1}, \tilde{w}_2^{t+1}\}$. However, we abstract from this very unlikely case.

where $\tilde{w}^t \equiv \max\{\tilde{w}_1^t, \tilde{w}_2^t\}$. Thus, aggregate consumption is given by

$$C_t = \frac{1}{1+\theta} Y_t = \frac{1}{1+\theta} R\bar{K}. \quad (8)$$

In a two-period setting, aggregate consumption does not depend on the level of corruption. Higher bribery (at date t or $t+1$) increases consumption of the officials but decreases at the same time consumption of the entrepreneurs. Since consumers have logarithmic instantaneous utility, the change in interest rates *per se* does not affect present savings and present consumption since income and substitution effects cancel each other. However, higher corruption implies a negative (positive) wealth effect for the entrepreneurs (the officials). On the one hand, the entrepreneurs will reduce their consumption because they have to pay higher bribes. On the other hand, the officials will increase consumption. In a two period setting, the two effects exactly cancel out each other. If individuals live for more than two periods, for instance three periods, the wealth effect of more corruption will be *smaller* for entrepreneurs than for officials in absolute terms. To see this formally, compare the intertemporal budget constraint for the entrepreneurs and the officials, respectively.

$$\begin{aligned} c_t + \frac{c_{t+1}}{\rho_{t+1}^E} + \frac{c_{t+2}}{\rho_{t+2}^E \rho_{t+1}^E} &= \rho_t^E (w_t - b_t) - b_{t+1} - \frac{b_{t+2}}{\rho_{t+1}^E} & (\text{Entrepreneurs}) \\ c_t + \frac{c_{t+1}}{\rho_{t+1}} + \frac{c_{t+2}}{\rho_{t+2} \rho_{t+1}} &= \rho_t b_t + b_{t+1} + \frac{b_{t+2}}{\rho_{t+1}} & (\text{Officials}) \end{aligned}$$

Since the interest rate is higher for entrepreneurs than for officials, the change in the discounted value of future bribes is lower for entrepreneurs than for the officials: $b_{t+1} + \frac{b_{t+2}}{\rho_{t+1}^E} < b_{t+1} + \frac{b_{t+2}}{\rho_{t+1}}$. Hence, the officials increase their consumption stronger than the entrepreneurs their savings.

We now relax the assumption that all entrepreneurs are in their interior optimum and allow for individuals finding themselves on the flat part of the income expansion path (IEP) in Figure 5a above. These entrepreneurs save exactly the amount \tilde{w}_1^{t+1} that is needed to maintain the "occupation" in period $t+1$.¹² As long as they do not choose L in the second period, these entrepreneurs

¹²Their first period consumption is given by $c_t = \rho_t^E (w_t - b_t) - \left(1 - \frac{\lambda R}{\rho_{t+1}}\right) - b_{t+1}$ (if entrepreneur in first period) or $c_t = \rho_t w_t - \left(1 - \frac{\lambda R}{\rho_{t+1}}\right) - b_{t+1}$ (if lender in first period), respectively. The minimum project size is one in both periods.

strongly reduce consumption in order to keep the savings constant at \tilde{w}_1^{t+1} if b_{t+1} increases. Hence, they decrease consumption much more than the officials increase their consumption. Thus, this "threshold effect" induces more corruption to increase savings.

Changes in class sizes. We now turn to the regime where, in equilibrium, some agents do not choose the same "occupation" in the second period. In this case, there exist individuals who are indifferent between the "occupations" E and L in the second period. In contrast to the discussion above, a change in the level of corruption tomorrow will induce agents to switch from L to E (less corruption) or vice versa (more corruption).

Assume that a higher b_{t+1} unambiguously increases \tilde{w}_2^{t+1} . In this case, more corruption decreases the number of entrepreneurs in the second period for sure. This has an important impact on aggregate savings. Consider the agents who would have chosen E before but now, under a higher level of corruption, prefer being lender in the second period. This class of individuals decreases savings and increases first period consumption although bribes are no longer paid. This effect unambiguously decreases aggregate savings. So, the "crowding-out effect" points exactly in the opposite direction than the "threshold effect".

We see that, from a theoretical point of view, it is a priori not clear whether corruption reduces growth if capital markets are imperfect and the technology is characterized by non-convexities. If there is little corruption and, consequently, the minimum investment restriction is binding, an increase in the level of bribery generates two competing effects. On the one hand, more corruption reduces savings because individuals, who would have saved a lot to become entrepreneurs before, are crowded out. In a multi-period setting, savings are reduced even more because the remaining entrepreneurs discount the future bribes stronger than the officials. On the other hand, a "middle-class entrepreneur" who saves exactly \tilde{w}_1^{t+1} to become an entrepreneur in the second period (and still does so even after the increase in b_{t+1}) will reduce his first period consumption strongly as bribery increases. This "threshold effect" tends to increase aggregate savings.

However, if there is much corruption in a country, i.e. if the incentive restriction is binding, the "threshold effect" cannot occur and the positive influence of corruption on growth vanishes. This means that corruption unambiguously hampers growth if it is above some level.

Proposition 5 *More corruption decreases aggregate savings and growth if $\tilde{w}_2^{t+1} \geq \tilde{w}_1^{t+1}$. For low levels of corruption ($\tilde{w}_1^{t+1} > \tilde{w}_2^{t+1}$), the relationship is ambiguous.*

Evolution of the wealth distribution. The fact that the individuals face different marginal interest rates on their wealth has important implications for the dynamics of the wealth distribution. Since $\rho^E \geq \rho$, the entrepreneurs experience a higher interest rate than lenders. The Euler equations then directly imply that the entrepreneurs follow a steeper consumption path. As a result, the wealth distribution polarizes. Since the lenders and entrepreneurs have different consumption growth rates, their consumption levels diverge as well.

6 Cross-Country Evidence

Our model makes no general prediction about the relationship between the level of corruption and a measure for the inequality of the subsequent wealth distribution, e.g. the Gini-Coefficient. Corruption leads to more equality in the low-income part of the distribution but, at the same time, increases the difference between poor and rich. However, our model predicts that a higher level of corruption increases the income share of the richest individuals and, in this sense, results in a more polarized ex post wealth distribution. The aim of this section is to verify whether such a correlation can be found in cross-country data. In particular, we regress the change in the income share of the richest 20 % of the population on a measure for corruption (CORRUPT) and some further independent variables.

To deal with the problem of mutual causation, the level of corruption is measured (as an average) over the 1980-85 period whereas the change in the income share is measured from the second half of the eighties (first observation)

to the first half of the nineties (second observation). The gap between the two distribution observations is on average five years.

The country-sample is, in a first step, defined by the availability of detailed income distribution data in the late eighties and early nineties. To the best of our knowledge, there exist two data sets providing detail distribution data based on nationally-representative household surveys only. This are the Deininger and Squire (1996) data set from which we take the vast majority of our observations and the Milanovic (1999) data set. See Table 4 below for a detailed exposition on how our sample is constructed and also for some descriptive statistics. Running all the regression presented below based only on the Deininger and Squire data set leads to virtually the same results (not reported).

Table 4

Using two sources for the level of corruption (that include to a large part the same countries) allows us to collect corruption data for 53 of the 64 countries included in the inequality data set. Our basic measure is the *Transparency International* (TI) historical corruption perception index. Data from the *Business International* (BI) corruption perception index is only used if there is no TI data. Data is available (average scores) for the periods 1980-85 (TI) and 1980-83 (BI). Both indices range form 0 to 10 with 10 indicating least corruption. The rank correlation between the two indices is 0.96. Note that all results presented below remain qualitatively and quantitatively unchanged if we use the BI index in the first place and the TI index in the second place (not reported). Further descriptive statistics is presented in Table 5. Figure 6 plots the corruption level against the log of the per capita GDP. Table 6 provides information on the number of countries by regions.

Table 5, Table 6, Figure 6

The further independent variables included in some of the OLS-regressions are (i) the average growth rate of the per capita GDP between the first and second observation (GROWTH), (ii) a measure for capital market imperfections

(FINANCIAL), and (iii) a dummy variable (EXP) which is assumed to be 1 if inequality is measured based on expenditures rather than on income.

The growth of the per capita GDP may influence the income distribution through two different channels. First, there is a long-run effect. If we exclude the 9 poorest countries from the sample of the non-socialist countries, the income share of the richest part of the population decreases uniformly in the per capita GDP. We may hypothesize that a good deal of the countries included in our sample are on the decreasing part of the Kuznets-Curve.¹³ However, this long-run effect must be quantitatively small since the average period is only five years. Second, there are also "good reasons" to expect a relationship between short-run fluctuations and the income distribution. The discussion has largely reached a consensus that the markups (price minus marginal costs) are countercyclical (Rotemberg and Woodford, 1999). In addition, low-skilled workers are more likely to lose their jobs during recession than high-skilled workers. We conclude that both the long-run and the short-run effect of growth tends to decrease the income share of the very rich in society. The growth data is based on Heston, Summers, and Aten (2002).

The second control variable on which a huge literature exists is the level of financial development. This literature underlines that persistent inequality or even an increasing polarization can be explained by the theory of imperfect credit. As a measure for the functioning of the financial system we use the variable "Credit to private sector (% of GDP)" provided by the World Bank (World Development Indicators, 2000). This measure was introduced by King and Levine (1993) and accounts for the influence of capital market imperfections on the income distribution.¹⁴ The data is averaged over 1980-85 period. The

¹³In the sample consisting only of non-socialist countries, there is a strong Kuznets-type relationship between the log of the per capita GDP and the income share of the richest part of the population, even if we include a "Latin Dummy". Of course, this relationship can also be found in the whole sample if a "Socialist Dummy" is included. The countries to the left of the peak of the Kuznets-Curve are: Bangladesh, Cote d'Ivoire, Ghana, India, Nigeria, Pakistan, Sri Lanka, Uganda, and Senegal.

¹⁴For a detailed discussion of the advantages and drawbacks of this measure compared to

literature on inequality and capital market imperfections and the implications of our model in mind, we expect to find a non-positive correlation between the functioning of the financial system and inequality.

Finally, the measurement dummy is included since, in a cross-section of individuals, measured (change in) inequality is higher using income as the measure than using expenditure due to consumption smoothing (Deininger and Squire, 1996).

Table 7 presents our main empirical findings. We run four regressions for both the full sample and a sample containing only non-socialist countries. In regression (1), we present the basic relationship between the change in the income share (p.a.) of the richest 20 % of the population and the level of perceived corruption. The correlation is both quantitatively and statistically significant. In our full sample, a one standard deviation increase in the level of corruption (0.26) is associated with a 0.25 percentage points increase (p.a.) of the income share of the richest 20 % of the population. This means that an increase in the level of corruption by the difference between, for instance, the US and Morocco leads in the subsequent five year period to an 1.25 percentage point increase in the income share of the rich. Including the growth variable (regression 2) does not change this correlation. The growth-coefficient is negative as expected but insignificant. If we exclude (from both the whole sample or the non-socialist sample) those countries that are on the increasing part of the Kuznets-Curve, the growth variable becomes marginally significant at the 5 percent level.

In regression (3), CORRUPT is dropped but the measure for the capital market efficiency is included. The change in the income share of the richest part of the population is negatively related to the level of financial development. Interestingly, if both CORRUPT and FINANCIAL are included (regression 4), the impact of the financial system is no longer significant whereas CORRUPT remains qualitatively and statistically significant. We conclude that the correlation between the level of financial development and the income share is mainly driven by the correlation between the level of corruption and the level of financial

other ones see King and Levine (1993), De Gregorio and Guidotti (1995), and Levine (1997).

development.

Table 7

From our specification, one could infer that corruption leads to an ever increasing income share of the rich. However, one must take into account that the level of corruption will not necessarily be constant over time. In particular, the level may adjust endogenously to changes in the income share. Consequently, our results predict only that more corruption today may increase the inequality tomorrow.

7 Conclusions

Persistent non-collusive corruption is observed in many of the low-income countries. Empirical evidence suggests that this kind of corruption imposes huge costs on economic activity and redistributes wealth towards officials mainly serving in the lower-level bureaucracy. This distributional pattern seems puzzling at least for two reasons. First, it is hard to argue that non-collusive corruption benefits the politically powerful, e.g. government members or high-level officials, to a large extent. At the same time, economically powerful groups have to bear the direct costs. Second, recent history shows that governments are able to reduce corruption substantially by taking a major effort. So, why is there little reformist pressure from the private sector in many of the high-corruption countries?

We show that imperfections in the capital market may be key to understand this phenomenon. In our model, corruption without theft redistributes wealth also within the group of non-officials on condition that capital markets are imperfect. In particular, we find that each member of the "middle class" is hurt substantially whereas a poor individual loses little in relative terms. The rich entrepreneurs even win despite the fact that they bear a huge part of the direct costs of corruption.

We suggest that this distributional pattern helps to explain why there are

only weak forces in society that fight for the installation of a honest bureaucracy. Poor people are adversely affected but only moderately and through an indirect channel. Put slightly different, a reduction in corruption does not improve the position of the poor much since they are restricted by the capital market imperfection anyway. On the other hand, the rich understand that corruption without theft acts as a barrier to entry. Its reduction leads to more competition for credits on the capital market and increases the costs of capital. Only members of the "middle class" can gain a lot from a reduction in bribery. Lower bribes improve their access to the capital market and allow for entrepreneurship or make entrepreneurship more attractive for them. Given these distributional consequences, we expect the pressure on democratic governments as well as on authoritarian rulers to be smaller in societies characterized by a polarized wealth distribution and a small "middle class". In addition, attempts in this direction may be hindered or stopped by a coalition of wealthy individuals. Of course, this is more likely if economical power also means political power.

Our analysis focusses on the distributional consequence of corruption if capital markets are imperfect. However, there is a more general relationship between market imperfections, redistribution, and incentives to fight against corruption. Suppose that the goods market is imperfect and that this goods market imperfection creates rents for the incumbents. If corruption acts as a barrier to entry such that more corruption restricts (endogenously) the number of competitors in a market, more corruption is also likely to redistribute wealth from the excluded entrepreneurs to the incumbents. Again, it may not be advantageous to powerful incumbents to remove this barrier to entry.

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Appendix

PARTIAL DERIVATIVES

$k(w, \rho, \beta)$ is implicitly determined by $k = \left(1 - \frac{\lambda R}{\rho}\right)^{-1} (w - \beta b(k))$. The partial derivatives are

$$\frac{\partial k}{\partial w} = \frac{1}{1 - \frac{\lambda R}{\rho} + \beta b'(k)} > 0$$

$$\frac{\partial k}{\partial \rho} = -k \frac{\lambda R / \rho^2}{1 - \frac{\lambda R}{\rho} + \beta b'(k)} < 0$$

$$\frac{\partial k}{\partial \beta} = -\frac{b(k)}{1 - \frac{\lambda R}{\rho} + \beta b'(k)} < 0$$

DERIVATIVES

The derivatives of \tilde{w}_1 and \tilde{w}_2 with respect to β are given by

$$\frac{d\tilde{w}_1}{d\beta} = b(1) + \lambda R / \rho^2 \frac{d\rho}{d\beta}$$

and

$$\frac{d\tilde{w}_2}{d\beta} = \frac{k \frac{d\rho}{d\beta} [1 + \beta b'(k)] + \rho b(k)}{k (R - \rho [1 + \beta b'(k)])},$$

respectively. Note that the denominator of $\frac{d\tilde{w}_2}{d\beta}$ is positive since, at $w = \tilde{w}_2$, the return R on an additional capital unit exceeds the costs $\rho [1 + \beta b'(k)]$ of an additional unit. The (maximal) project size of an entrepreneur $k(w, \rho(\beta), \beta)$ depends both directly and indirectly on β . Its derivative (for a constant w) with respect to β is

$$\frac{dk}{d\beta} = -\frac{\left(b(k) + \frac{\lambda R}{\rho^2} k \frac{d\rho}{d\beta}\right)}{1 - \frac{\lambda R}{\rho} + \beta b'(k)}$$

Tables Section 2

Table 1 – Level of non-collusive corruption

	measure for non-collusive corruption	lowest level		highest level		measure for “obstacle to operation and growth”
East and South Asia	0.30	0.97/Singapore	0.02/Bangladesh			2.78
- without Singapore	0.22					2.97
Sub-Saharan Africa	0.32	0.78 /Namibia	0.05/Madagascar			2.83
- without Namibia & Botswana	0.25					3.00
Eastern Europe, Central Asia	0.47	0.80/Slovenia	0.28/Turkey			2.47
Latin America	0.53	0.89/Chile	0.21/Haiti			2.74
OECD	0.71	0.93/Sweden	0.43/France			1.63

Sources: Measure for non-collusive corruption: own calculations based on World Bank (2002); Measure for corruption as an obstacle to “operation and growth of the business”: World Bank (2002).

Table 2

Dependent Variable: TI 2001 CPI

	Coef	Std. Err.	95% Conf. Interval
Constant	0.41	(0.37)	[-0.33, 1.16]
measure for non-collusive corruption	5.95	(0.76)	[4.43, 7.48]
measure for collusive corruption	1.47	(0.73)	[0.02, 2.92]

Sources: TI 2001 CPI: Transparency International Press Release June 27, 2001; Measures for collusive and non-collusive corruption: own calculations based on World Bank (2002).

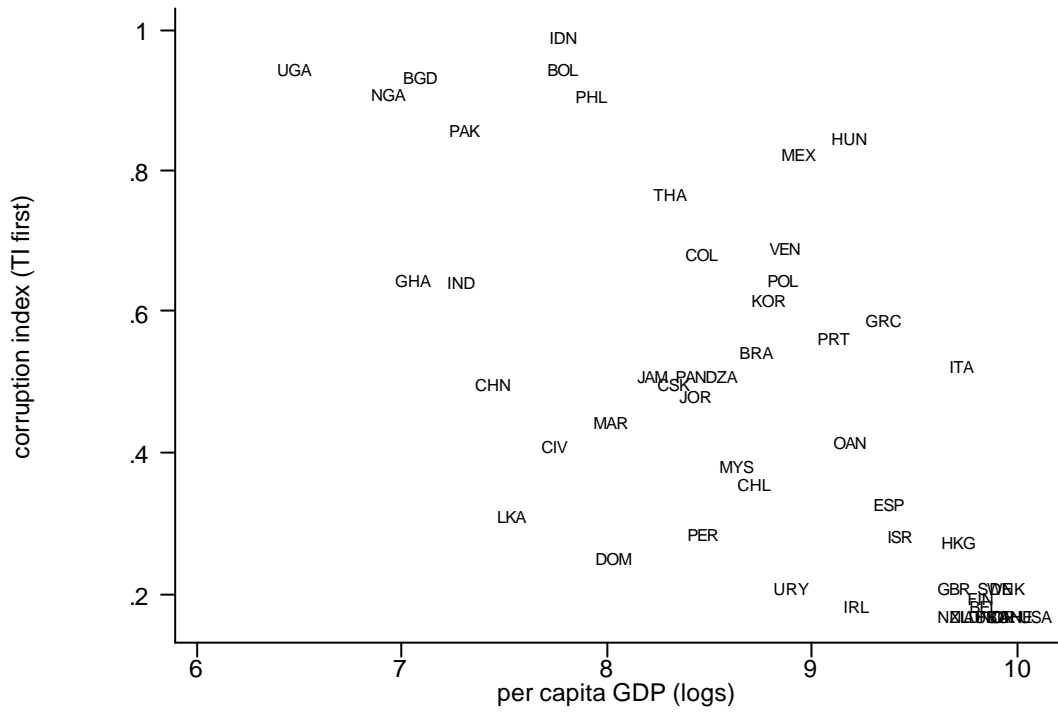
Table 3 – Rank correlations between different measures of corruption

	measure for non-collusive corruption	measure for collusive corruption	measure for “obstacle to operation and growth”	TI 2001	TI 88-91 (average)	TI 80-85 (average)
measure for non-collusive corruption	1					
measure for collusive corruption	0.56	1				
measure for “obstacle to operation and growth”	-0.78	-0.69	1			
TI 2001	0.82	0.58	-0.8	1		
TI 88-91 (average)	0.82	0.58	-8.84	0.87	1	
TI 80-85 (average)	0.8	0.57	-0.78	0.82	0.87	1

Sources: TI indices: Transparency International Press Release June 27, 2001 and Transparency International and Göttingen University, www.gwdg.de/~uww/histor.htm (historical data); Measures for collusive and non-collusive corruption: own calculations based on World Bank (2002); Measure for corruption as an obstacle to “operation and growth of the business”: World Bank (2002).

Figures Section 6

Figure 6 – Correlation between corruption and the per capita GDP



Tables Section 6

Table 4 – Descriptive statistics (Income inequality)

	Whole sample	DS only	Milanovic only
- Number of observations	64	54	10
- average time period (years)	5.05	5.02	5.2
First observation (late eighties)			
- Mean	0.441	0.439	0.455
- Highest	0.645	0.645	0.588
- Lowest	0.288	0.288	0.37
- Standard Deviation	0.078	0.081	0.066
Second observation (early nineties)			
- Mean	0.453	0.454	0.445
- Highest	0.652	0.652	0.579
- Lowest	0.338	0.338	0.366
- Standard Deviation	0.08	0.082	0.076

Sources: Deininger and Squire (1996) and Milanovic (1999);

Note: The year of the second observation is in general the most recent year for which detailed inequality data is available in the DS data set. The year of the first observation is then calculated by subtracting five years. If there is no DS data for this point in time, the closest year for which DS data is available is chosen. Only if there is no DS data for the late eighties and the early nineties, observations from the Milanovic data base are included.

Table 5 – Descriptive statistics (Corruption indices)

	TI first	BI first	TI only	BI only
- Number of observations	53	53	43	46
- Mean	0.463	0.355	0.477	0.304
- Highest	0.98	0.933	0.98	0.85
- Lowest	0.159	0	0.159	0
- Standard Deviation	0.261	0.274	0.281	0.247
- Overlap	-	-		36
- Rank correlation	-	-		0.964

Sources: Transparency International and Göttingen University, www.gwdg.de/~uwww/histor.htm and Mauro (1995);

Note: The indices are rescaled from 0 to 1 with 0 indicating least corruption.

Table 6 – Countries by Region

	Number	Socialist countries
- Western Europe, North America, and Oceania	18	0
- East and South Asia, China	12	1
- Latin America and the Caribbean	11	0
- Central and Eastern Europe	4	4
- Sub-Saharan Africa	4	0
- Middle East and Northern Africa	4	0

Note: The socialist countries are China, Czechoslovakia, Hungary, Poland, Soviet Union

Table 7
Dependent Variable: Δ Income share of the richest 20 %

	full sample				without socialist countries			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CORRUPT	0.0101** (0.0037)	0.0108** (0.0037)		0.0090* (0.0043)	0.01** (0.004)	0.0111** (0.0041)		0.0096* (0.0047)
GROWTH		-0.0464 (0.0312)	-0.0253 (0.0331)	-0.040 (0.0341)		-0.0532 (0.035)	-0.0288 (0.0357)	-0.0504 (0.0377)
FINANCIAL			-0.0082* (0.0035)	-0.0035 (0.0042)			-0.0082* (0.0036)	-0.0034 (0.0044)
EXP	-0.0050* (0.0021)	-0.0056* (0.0021)	-0.0053* (0.0021)	-0.0058* (0.0023)	-0.0046* (0.0023)	-0.0056* (0.0024)	-0.0051* (0.0022)	-0.005* (0.0025)
Observations	53	52	55	49	48	48	52	46
Adjusted R-squared	0.1238	0.1423	0.1067	0.1202	0.0905	0.1167	0.0888	0.1024

Standard errors in parentheses.

* Significant at the 5 percent level.

** Significant at the 1 percent level.