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Institutions and the Relation between Corruption and Economic Growth

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Abstract

We study the effects of bureaucratic corruption on economic growth in a framework that takes into account that corruption also affects growth through its impact on institutions. We use a formal growth framework in which corruption affects growth negatively because of individual rent-seeking and stealing of public goods, but where corruption may serve a positive role by taking over the role of institutions. We find that the overall effect of corruption on economic growth is highly dependent on the institutional setting of a country. Particularly in situations where institutions are not well developed corruption may be conducive to economic growth. We also find that the interaction among institutions themselves matters. This underscores the importance of taking into account the complete institutional setting when studying corruption, both in theory as well as empirically.

1. Introduction

The United Nations' top anti-crime official, Antonio Costa, estimates that Zaire and Nigeria have lost some $5 billion each in the last few years to corruption. In Pakistan, an estimated 30 percent of the price of all public works projects goes to kickbacks and bribes, while in Bangladesh corruption eats up about half of all foreign investments (Stevenson, 2003). Overall, a World Bank Institute study estimates the costs of corruption to be a $1000 billion a year world wide (World Bank, 2004). Other studies show the detrimental effects of corruption on growth, by lowering investments (Mauro, 1995; Wei, 2000), international trade (Lambsdorff, 1999), or the quality of public investment projects (Tanzi and Davoodi, 1997). Corruption may also create socio-political instability and uncertainty, lowering economic growth (Mo, 2001).

Empirically, there seems to be broad consensus that corruption is detrimental to countries' economic performance in the long term. This is in sharp contrast with the theoretical literature on corruption and growth. The standard view is that corruption is a distortion, reducing the efficient allocation of resources and growth. However, Leff (1964) argues that this view is based on bureaucracies working to promote economic development. When governments have other goals in mind (e.g. staying in control, self-enrichment), a re-evaluation of the effects of corruption is warranted. Then, bribery gives entrepreneurs access to decision-making, which reduces uncertainty and supports innovative activity. Huntington (1968) expresses a similar view, stressing the role of corruption in greasing the wheels of bureaucracy. Bribery may help to surmount laws or regulations that hamper economic activity, just as paying "speed money" might

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expedite bureaucratic decision-making. Finally, it has been argued that corruption enhances growth due to bribe bidding competition. More efficient entrepreneurs can afford higher bribes, facilitating that projects are assigned to the most efficient firms (e.g. Beck and Maher, 1986).

These views are not uncontested (e.g. Myrdal, 1968; Baumol, 1990), but a major drawback of the theoretical literature is also that it disregards that the relationship between corruption and growth depends on its institutional environment. It is well known that a close web of formal and informal institutions and distortions determine the way economies function (e.g. North, 1990). Removing one distortion, say corruption, alters this web and may leave the economy worse off. The effects of corruption in a particular society can therefore not be studied without taking into account (the rest of) its institutional framework. Corruption will have different effects in different institutional settings, and the economic effects of corruption will therefore differ from place to place and from time to time. Studying corruption without taking heed of corruption's interdependencies with other institutions, as the theoretical literature does, is therefore inappropriate and may lead to wrong inferences.

With this paper, we provide a theoretical framework that gives institutions a decisive role in determining the effects of corruption on economic growth. As we will show, this provides ample reason to expect ambiguous findings from the theoretical literature, be it for different reasons. In addition, it provides a theoretical underpinning for recent findings in the empirical literature that the impact of corruption cannot be explained without taking into account the institutional setting of countries.[1] Ignoring the interdependency between corruption and other institutions tends to downplay the cross-country variance in the relationship between corruption and growth.

The model we develop takes these vital interdependencies into account. To emphasize the decisive role of the institutional environment, including corruption, on the effects of corruption on growth, we construct a two-layer model.[2] The first layer models the way corruption affects the rate of growth in an institutional vacuum. The second layer adds institutions to assess how corruption affects economic growth through its impact on the institutional setting. To do this meaningfully, we dissect the institutional black box and model those elements of the institutional setting that are crucial for the (indirect) impact of corruption on growth. Our model thus captures the commonly acknowledged direct effect of corruption on growth (layer 1), while it also introduces a crucial indirect institutional effect of corruption (layer 2). This clearly distinguishes our model from other literature on the effects of corruption on economic growth. Including institutions as a distinct channel for corruption to have an impact differentiates our approach from the earlier theoretical contributions. The more recent theoretical literature either depicts the institutional framework as a black box or studies one particular institution in isolation, disabling the analysis of corruption in interplay with other institutions, as we do.[3]

For the remainder of this paper it is important to be clear about what we understand with corruption. We adopt the definition of Macrae (1982), who refers to corruption as "an arrangement that involves an exchange between two parties (the demander and the supplier) which (i) has an influence on the allocation of resources either immediately or in the future; and (ii) involves the use or abuse of public or collective responsibility for private ends" (Macrae, 1982, p. 678).[4] We focus therefore on bureaucratic corruption, involving both a public and a private party. We also note that we refrain from issues of morality and solely study the effects of corruption on economic growth.

2. Corruption and the Institutional Setting

In a purely neoclassical setting, transactions occur under the assumption of frictionless exchange, in which property rights are perfectly and costlessly specified and information is costless to acquire. Neoclassical theory has been a major contribution to economic knowledge, but when its stringent underlying assumptions are not satisfied, it fails to satisfactorily explain economic performance. What has been mainly missing is an understanding of the nature of human coordination and cooperation. When information is not perfect and when property rights are not well specified, cooperation is hard to realize. This is where institutions come in. When it is costly to transact, institutions matter.

Institutions are the rules of the game in a society or, more formally, the humanly devised constraints that shape human interaction (North, 1990). The major role of institutions is to reduce uncertainty by establishing a stable structure for human interaction.[5] They provide a framework for transactions and cooperation to occur, especially when conditions are highly disfavorable to transactions. Institutions can be both formal and informal. Formal rules function to facilitate socially desired kinds of exchange and to discourage the less desirable kinds (e.g. laws, contracts). These formal rules are typically supplemented by codes of conduct, norms of behavior and conventions. These informal institutions are endogenous, embedded in the culture of a society, and change very slowly. Because formal rules deal with specific problems only and can never be exhaustive, both formal and informal institutions are essential for the working of societies. Moreover, the institutional framework is a complex system of formal and informal constraints in which only incremental changes will alter the institutional framework over time.

Affecting the transaction costs of economic interactions, institutions are bound to influence economic performance of countries. Economic literature shows a wide array of studies on the issue of institutions and economic growth.[6] However, when studying the relationship between institutions and growth, authors generally follow the notion of North (1990) that institutions affect economic performance by their effect on the cost of exchange and production. Together with the technology employed, they determine the transaction and transformation costs that make up the total costs of production.[7] This last part depends on the institutional framework of a country. Good institutional settings promote economic growth by establishing an environment in which transactions occur under trust and order. Property rights are well established and people do not need to devote a lot of resources to measurement and enforcement. In such a setting, routines will be established. By contrast, bad institutions hamper economic growth because a large share of resources has to be used for accomplishing transactions, leaving fewer resources for the actual transformation process and discouraging individuals to undertake productive activities.

The relationship between institutions and economic growth has also been formalized and empirically examined. Fedderke (2001), for instance, constructs a growth model in which property rights are the institutional feature affecting economic growth, formalizing that improving institutions enhances economic growth. Rodrik et al. (2002) conclude that the quality of formal institutions is by far the most important determinant of differences in income levels between countries. Scully (1988) analyzes informal institutions, reporting that these are an important and statistically significant explanation for intercountry variations in growth rates of real per capita income.

However, the interplay between these institutional factors determines whether the institutional environment fosters or hampers growth. Removing a distortion will therefore not automatically increase growth. In line with the concept of second best (e.g. Bohm, 1967), removing one distortion may trigger other distortions, leaving the economy worse off. The effect of removing distortions thus depends on the way the total institutional framework changes.

This concept also applies to corruption. In a second-best setting, it is by no means certain that removing corruption promotes economic growth. The effect on growth also depends on the way the removal of corruption alters the institutional setting as a whole. Corruption may be a useful element in the institutional web, mending or precluding other distortions. Removing corruption may then affect the economy adversely. This notion is generally missing in economic theory concerning corruption and growth, while empirically it has recently been established as relevant (e.g. Méndez and Sepúlveda, 2006; Aidt et al., 2008; Heckelman and Powell, 2008). Economic literature does consider institutions, but always as an exogenous factor. It forgets that corruption itself, being a distortion, affects the relationship between institutions and growth. The total effect of corruption on growth should therefore consist of two separate effects. Apart from the obvious direct impact of corruption on growth (e.g. due to misallocation of resources), there is also an indirect effect through its impact on the institutional framework. This combination of a direct effect and an indirect institutional effect determines whether or not corruption depresses growth. By means of the direct effect, reducing corruption will be conducive to growth, but by the indirect institutional effect, reducing corruption may imply lower growth rates after all.

The difficulty with incorporating these notions in economic modeling is that the institutional web is a black box. While it is easy to acknowledge that the interplay between institutional factors determines the way institutions affect growth, it is much harder to make that tractable in economic modeling. In order to adequately model the effects of corruption on economic growth, one would have to open the black box, specifying interdependencies. This problem is also recognized by Bohm (1967), who argues that without specifying the policy restrictions that arise with second-best problems, it is impossible to argue how the allocation in a second-best framework is different compared to a first-best allocation. For our purposes, this implies that the aspects of the institutional setting that affect the relationship between corruption and growth should be acknowledged and specified. The model would then be able to elucidate in a meaningful manner the impact of corruption on the institutional environment, specifying the conditions under which the indirect institutional effect compensates the direct effect, making it possible to indicate which effects removing corruption has on economic growth.

Since the institutional web of a country is extremely complicated and specific, it is impossible to analyze all interdependencies that influence the relationship between corruption and growth. We therefore highlight three institutional features that we believe are crucial in studying the effects of corruption on growth, i.e. political stability, property rights, and the political system. We motivate our choice by the fact that these features have been acknowledged in several papers as being important determinants for growth.[8]

To illustrate that the institutional effect may be more than enough to compensate the direct effect, we imagine a situation in which society is plagued by either low political stability or the absence of a decent system of property rights. In such a setting, a corrupt system may be the least of all evils, particularly in countries where ethnic differences and violent rivalries are pervasive, so that the perceived alternative to corruption is not

Western-style political confrontation, but daily physical aggression (Colombatto, 2003). Efforts to eliminate corruption will then lead to political instability since corruption serves the positive function of holding society together. Also, when a decent system of property rights is missing, corruption may become a crucial element of the economic system. In such environment, corruption could reduce uncertainty and facilitate investments and production, thus providing an alternative system in which the indirect institutional effect of corruption more than compensates its negative direct effect.

For political systems, it particularly matters whether corruption exists in a democratic system or in a totalitarian system. The key characteristic of the neoclassical paradigm that it is socially optimal if individuals strive to maximize their own benefit applies to democratic systems. Corruption is a distortion, misusing resources and infecting economic agents' incentives. Of course, also modern democratic systems are far from the neoclassical ideal and welfare states have been designed to protect vulnerable groups. This creates room for corruption, also since politicians are subject to fairly loose controls. Corruption can then be a useful monitoring device, eliciting predictable behavior (Colombatto, 2003). This applies only in the short run, however, as in the long run bureaucrats will change their behavior in a way that will reduce efficiency (Myrdal, 1968). In democratically orientated systems, corruption is therefore detrimental to growth.

This is different in totalitarian systems, where economic and political freedoms are limited. In particular, the distinction between centralized and decentralized corruption is important. When corruption is decentralized, economic agents cannot be certain that bribing will be effective. Bribing one government official may not prevent that other officials have to be bribed as well. Uncoordinated corruption leads to high degrees of uncertainty, lowering economic growth. Centralized corruption, by contrast, takes away these uncertainties as corruption has been institutionalized to serve a clear, common goal. In a way, producers can hedge the risks of uncertainty, knowing whom to bribe to secure production. In such system, corruption could be conducive to growth, especially when other institutions cannot provide for this. The distinction between decentralized and centralized corruption is related to Mancur Olson's (1993) distinction between "roving bandits" and "stationary bandits." While roving bandits are dictators trying to extract from society as much as possible, a "stationary bandit" realizes that the high levels of uncertainty this implies affects future earnings.

3. A Basic Model for Corruption and Growth

We construct a two-layer model that acknowledges the direct and indirect effects corruption has on growth. The first layer models the direct effect of corruption on economic growth, in line with the conventional treatment of corruption as a distortion. The second layer models corruption's indirect institutional effect, acknowledging that corruption also affects economic growth through its impact on the working of the institutional system. For now, we will confine ourselves to the degree of political stability and the degree of property rights protection.

The First Layer—Corruption and Growth in an Institutional Vacuum

The first layer follows Mauro (2004), who models corruption as lowering production and hampering the rate of economic growth. Mauro's line of reasoning is based on the well-known Barro (1990) framework, where government provides public goods that are input for private production. Mauro incorporates corruption in this model as rent-seeking.

The economy consists of economic agents who try to maximize overall utility:

$$U = \int_0^{\infty} u(c) e^{-\rho t} dt, \tag{1}$$

where c is per capita consumption and ρ represents the constant rate of time preference. The consumption good is produced by economic agents using capital, labor, and public goods: $Y = F(K, L, G)$. Including G represents the productive role of government in the model, but it also creates room for bureaucratic corruption. Economic agents will try to use some of the public goods for their own benefit, and not for production. In the model, individuals allocate their time between productive work, L, and socially unproductive stealing, S. Corruption therefore has two effects on output: due to rent-seeking, less time will be devoted to productive work, while also fewer public goods reach the production process. Specifically,[9]

$$Y = K^{1-\alpha} L^{\alpha} [G(1-S)]^{\alpha}. \tag{2}$$

In equilibrium the net wage must equal the marginal product of rent-seeking. For an individual, the marginal product of rent-seeking is G. When the government produces more public goods, rent-seekers can consequently appropriate a larger amount of these public goods. The marginal product of labor is the wage net of taxes, $(1 - \tau)\partial Y/\partial L$. Using (2), we get $\partial Y/\partial L = \alpha Y/L$ and the equilibrium value of L becomes:

$$L = 1 - S = \alpha(1-\tau)\frac{Y}{G}.$$

Substituting for L in the production function, subsequently deriving the marginal product of capital $\partial Y/\partial K$, gives the following growth path:

$$\gamma = \frac{(1-\tau)\partial Y/\partial K - \rho}{\sigma}$$

$$= \frac{1}{\sigma}\left[(1-\tau)(1-\alpha)\underbrace{\left[\alpha(1-\tau)\frac{Y}{G}\right]^{\frac{\alpha}{1-\alpha}}}_{(*)}\left(\frac{1}{Y}\right)^{\frac{\alpha}{1-\alpha}}\underbrace{[G(1-S)]^{\frac{\alpha}{1-\alpha}}}_{(**)} - \rho\right]. \tag{3}$$

This is essentially a tax-ridden Euler equation with $1/\sigma$ representing the intertemporal substitution elasticity in consumption. The expression is similar to the one derived by Mauro (2004),[10] making clear that rent-seeking impedes economic growth by lowering the amount of public goods reaching the production process (the **-term) and reducing agents' optimal labor input (the *-term, equalling $1 - S$). The inclusion of corruption thus leads to additional effects of government expenditure on growth. Apart from Barro's (1990) tax burden effect of G on growth, government expenditures also create room for rent-seeking and a concomitant decrease of productive work.

The Second Layer—Incorporating Institutions

To incorporate the indirect institutional effect of corruption on growth, we extend our model with a second, institutional layer. As we have argued, the expected interactions depend on the particular institution considered and we therefore model each institution separately. This enhances tractability, but at the same time implies that our analysis should be seen as a first attempt to unravel the theoretical intricacies involved when

taking the impact of the institutional framework on corruption seriously. We first deal with the degree of political stability and then with the degree of property rights protection.

Political stability Political stability is a key element of the institutional framework affecting production and growth. A certain degree of political stability is a necessary condition for production and economic development: it provides trust and confidence, facilitating investment and production. Furthermore, political instability can easily break down into anarchy and physical aggression, making the climate for production anything but good.

To integrate political stability, we alter the production function of the first layer. Following Klein et al. (1999), we make it a combination of a long-run production function and an extra variable. Production in the long-run depends on capital, labor, and public goods; the extra variable is a stability factor. Formally,

$$Y = K^{1-\alpha}L^{\alpha}[G(1-S)]^{\alpha}\cdot[Stab], \tag{4}$$

implying that political stability enhances production, as it is a necessary condition to produce. Stability itself depends on stealing as well, apart from a multitude of other factors that might influence it. The effect stealing will have, however, differs between a situation of political stability and a situation of political instability. When the political climate is stable, corruption is detrimental to political stability. But in a situation of high political instability, corruption serves to enhance it, serving to hold the economic system together. To formalize these threshold effects, we assume the following function for stability:[11]

$$Stab = X + S\left[\overline{Stab} - Stab\right],$$

where X represents a composite of other (institutional) factors influencing political stability and where $\overline{Stab}$ is some threshold level of stability above (below) which stealing affects political stability negatively (positively). Rewriting this to $Stab = \left(X + S\cdot\overline{Stab}\right)/(1+S)$, it follows that only if $\overline{Stab} - X > 0$ stealing affects political stability positively, at a decreasing rate.[12]

For the growth rate this implies

$$\gamma = \frac{1}{\sigma}\left\{\begin{array}{l}(1-\tau)(1-\alpha)\underbrace{[1-S]^{\frac{\alpha}{1-\alpha}}}_{*}\left(\frac{1}{Y}\right)^{\frac{\alpha}{1-\alpha}} \\ \times\underbrace{[G(1-S)]^{\frac{\alpha}{1-\alpha}}}_{**}\underbrace{\left(\frac{X+S\cdot\overline{Stab}}{1+S}\right)^{\frac{1}{1-\alpha}}}_{***} - \rho\end{array}\right\}. \tag{5}$$

The direct effects of stealing are as before, affecting growth through labor input choices (*) and the availability of public goods for private production (**). But now also an indirect effect arises through political stability (the ***-term). This effect is ambiguous and depends on the extent of political stability. There is no additional impact of stealing through its effect on optimal labor choices since laborers do not take the indirect effects of stealing on political stability into account when making their choices.

Formally, the effect of stealing on the growth rate is given by

$$\frac{\partial\gamma}{\partial S}\frac{S}{\gamma}=\frac{\sigma\gamma+\rho}{(1-\alpha)\sigma\rho}\left\{\frac{S}{1+S}\frac{\overline{Stab}-X}{X+S\cdot\overline{Stab}}-\frac{2\alpha S}{1-S}\right\}$$
$$=\frac{S}{1-S}\frac{\sigma\gamma+\rho}{(1-\alpha)\sigma\rho}\left\{\frac{1-S}{1+S}\left(\frac{\overline{Stab}-X}{X+\overline{Stab}\cdot S}\right)-2\alpha\right\}\gtrless 0. \quad (6)$$

Corruption affects economic growth negatively if the threshold level of stability is low enough, so that corruption affects political stability negatively. If this is not the case, corruption enhances growth, provided labor is not too important in production (small α). Corruption reduces the amount of labor that is used for productive activities and the smaller labor's share in production, the less likely it is that corruption affects growth negatively on that account.

Considering the evolution of political stability over time, we note that it is always constant, provided the government pursues a policy of balanced budget at any point in time (which we assume). The growth rate of public good provision is then always equal to that of aggregate output, implying that the marginal revenue of rent-seeking changes in tandem with the marginal revenue of productive work. Consequently, the chosen levels of L and S are always the same. Our model thus incorporates an extreme form of path dependency: if the initial situation is such that corruption facilitates growth, such a situation persists unless environmental variables change exogenously.[13]

Property rights Also the degree of protection of property rights is a feature of the institutional environment affecting the relation between corruption and growth. Without a proper system of property rights, the economic system is plagued by severe uncertainty, making it a crucial condition for economic growth. When property rights protection is effective, corruption has adverse effects on economic growth, due to its misuse of resources. However, when a decent protection of property rights is lacking, economic growth is also reduced. In such a situation, corruption affects growth positively by taking over the role of property rights.

To take this into account, we alter the production function into

$$Y=K^{1-\alpha}L^{\alpha}[G(1-S)]^{\alpha}\cdot[Prop]^{\beta}, \quad (7)$$

with $0<\beta<1$ and where *Prop* indicates the presence of a system of property rights. The specification marks the extreme importance of property rights for production. Production is zero when there is no property rights protection and the marginal productivity of introducing a property rights system is extremely high, $dY/dProp\to\infty$ for $Prop\to 0$. Also increments to the system work out positively, be it at a declining rate.

We see *Prop* as a system that includes both formal and informal rules, while corruption may substitute for some of the formal rules. We acknowledge this by assuming that especially when formal property rights are lacking, stealing may replace their function. But above a certain minimum level of formal property rights, stealing will obstruct the system's functioning. More specifically, we assume $Prop=PR+S\left(\overline{PR}-PR\right)$, with $\overline{PR}>0$ and with PR denoting the formal property rights. Since $0\le S\le 1$ and $\overline{PR}>0$, *Prop* will take any positive value, also greater than one. For the sake of interpretation we will however think of it as being between zero and one, meaning that the system facilitates production rather than that it contributes directly to it.

The production function becomes

$$Y = K^{1-\alpha}L^{\alpha}[G(1-S)]^{\alpha}\cdot\left[PR + S\left(\overline{PR} - PR\right)\right]^{\beta}, \tag{8}$$

which shows the divergent roles corruption may have on it through the property rights system. When the formal property rights are below the threshold $\overline{PR}$, corruption is conducive to private production. If, by contrast, a system of property rights is sufficiently established, corruption erodes its working, affecting production negatively.

The growth rate becomes:

$$\gamma = \frac{1}{\sigma}\left\{\begin{array}{c}(1-\tau)(1-\alpha)[1-S]^{\frac{\alpha}{1-\alpha}}\left(\frac{1}{Y}\right)^{\frac{\alpha}{1-\alpha}} \\ \times[G(1-S)]^{\frac{\alpha}{1-\alpha}}\left[PR + S\left(\overline{PR} - PR\right)\right]^{\frac{\beta}{1-\alpha}} - \rho\end{array}\right\} \tag{9}$$

and the effect of corruption on growth is given by

$$\frac{\partial\gamma}{\partial S}\frac{S}{\gamma} = \frac{S}{1-S}\frac{\sigma\gamma+\rho}{(1-\alpha)\sigma\rho}\left\{\frac{\beta\left(\overline{PR} - PR\right)}{PR + \frac{S}{1-S}\overline{PR}} - 2\alpha\right\} \gtrless 0. \tag{10}$$

If $\overline{PR} < PR$, the effect of corruption on growth is clearly negative, but if the formal property rights are below the threshold, corruption may enhance growth. This, however, depends on the marginal importance of property rights (β) and labor in production. Everything else the same, the larger β, the more likely corruption will enhance growth as the marginal productivity of a system of property rights (i.e. corruption taking over its role) is high. Corruption, however, also reduces the amount of labor that is used for direct production, so that the smaller α, the lower the negative effect of corruption on growth on this account.[14]

4. The Political System

In this section we apply our two-layer framework to analyze to what extent the political system matters for the impact of corruption on economic growth. We thereby take the particular type of governance as given, since we are interested in how interactions within the institutional system matter for our results.[15] The analysis we offered so far can be seen as resembling the outcomes of corruption in a democratic system. No individual agent has power over other agents, whereas the role of government is limited to producing and distributing public goods. But also the political system, as part of the institutional setting, will have consequences for the impact of corruption on economic growth. As discussed in section 2, these effects will be different in democratic systems and totalitarian systems, whereas also the particular form of the totalitarian system is relevant—Mancur Olson's (1993) distinction between "roving bandits" and "stationary bandits."

To analyze these different set-ups we retain our assumption that government collects taxes and produces public goods to facilitate private production. When there is a democratic government in place, outcomes are as in the previous section, requiring no further elaboration. The growth rate in the institutional vacuum is given by (3), whereas the growth rate when also political stability or property rights is taken into account is given by, respectively, (5) and (9). When a totalitarian system is in place, we assume that government—the dictator—also uses tax income to serve needs that do not add to private production ("grand corruption"). We also assume that the dictator is a

"stationary bandit," who recognizes that public goods facilitate production.[16] Accordingly, it chooses "the revenue-maximizing tax rate [. . .] and will spend money on public goods up to the point where his last dollar of expenditure on public goods generates a dollar's increase in his share of the national income" (Olson, 1993, p. 570).

Without the impact of corruption on institutional quality, this optimization stance improves economic growth when there is stealing. The marginal cost of public good provision equals one for the stationary bandit, whereas the marginal benefit is $\tau(dY/dG)$. Stationary bandits will therefore spend $G = \tau\alpha Y$ on public goods, keeping the remainder for themselves. Public good provision is less than in a democratic society, reducing the amount of stealing and increasing the amount of labor supplied. Using L_{SB} to denote optimal labor input under the stationary bandit regime, we get:

$$L_{SB} = \frac{(1-\tau)}{\tau} > \alpha\frac{(1-\tau)}{\tau} = L,$$

where L is taken from section 3 and where we applied the appropriate values for G. For the growth function this implies:

$$\gamma_{SB} = \frac{1}{\sigma}\left[(1-\tau)(1-\alpha)[\alpha(1-\tau)L_{SB}]^{\frac{\alpha}{1-\alpha}} - \rho\right],$$

which is higher than the equivalent growth rate in a democratic system.[17] By rationally reducing public goods provision, the stationary bandit effectively reduces the amount of corruption in society, which is good for growth.

This growth rate is also higher in comparison to a society where a democratic government would set public expenditures and tax rates optimal for economic growth. In such society, government would set $G/Y = \tau$ equal to α, the natural efficiency condition for government expenditures (Barro and Sala-i-Martin, 1999, p. 155). Labor input is then $L = (1 - \tau) < L_{SB}$. In the presence of stealing, however, the natural efficiency condition for government expenditure changes to $G/Y = \alpha\sqrt{1-\tau} < \alpha$.[18] Stealing implies that it is optimal to spend a lower percentage of national income on public goods, which the stationary bandit unintentionally honors by selfishly requiring a higher marginal benefit on public goods provision.

To infer the importance of the political system in an institutional setting, we verify the implications of having a stationary bandit for the second layer of our framework. Since we know that $S_{SB} < S$, for both political stability and property rights, the effect of a stationary bandit on growth boils down to determining how the growth rates (5) and (9) change the moment that S decreases. Recalling (6) and (10), it follows that whether or not a stationary bandit enhances growth depends on the quality of the institutional framework. From section 3 we know that the effect of corruption on economic growth is negative in case the political environment is sufficiently stable or when the system of formal property rights is sufficiently developed. With $S_{SB} < S$, the stationary bandit is therefore beneficial to growth in these cases. For insufficient political stability or formal property rights, growth thrives upon corruption, making a stationary bandit detrimental to the growth rate. This underlines the mutual dependence of different institutions for generating end-outcomes.

5. Social Planning in the Wake of Corruption

A stationary bandit apparently has qualities that makes it equivalent to a social planner; this section compares the outcomes of a stationary bandit with a democratic

government that acts as social planner. Referring to such government as "rational democratic government" (RDG), the main distinction with the stationary bandit is that the RDG takes aggregate output as a yardstick for social planning, and not its own income. We discuss two levels of social planning. First, we let governments determine the optimal division between labor and rent-seeking, since they acknowledge that rent-seeking leads to suboptimal labor input decisions. Second, we analyze the consequences when government recognizes that both L and S depend on G, optimizing public good provision accordingly. We apply our analysis to the case of political stability, noting that the results are qualitatively the same for property rights.[19]

A Social Planner that Optimizes Labor Supply Choices

The societal optimal value of L is obtained by setting the marginal product of labor equal to that of rent-seeking. For the RDG, the former is $\alpha(Y/L)$, while the latter is:[20]

$$\frac{dY}{dS} = \frac{Y}{1+S}\left[\frac{\overline{Stab} - X}{X + S\cdot\overline{Stab}}\right] - \frac{\alpha Y}{1-S}. \tag{11}$$

This differs from the marginal product of rent-seeking for the individual, which was simply G. Moreover, dY/dS is positive only if $\overline{Stab} > X$; hence, if stability is below the threshold level. In that case, (11) illustrates that rent-seeking has two opposing effects. For the stationary bandit, the relevant comparison is between the marginal effect of stealing and working on the share of tax revenues it keeps for itself, $(1-\alpha)\tau Y$. Hence, the stationary bandit also optimizes L by setting $dY/dL = dY/dS$, and the optimal labor input is the same as for the RDG (for $\overline{Stab} - X > 0$):

$$L = 2\alpha(S+1)\left[\frac{X + S\cdot\overline{Stab}}{\overline{Stab} - X}\right]. \tag{12}$$

Optimal L is positively correlated with the presence of stealing in society if, and only if, all other factors that determine political stability (X) fall short of the threshold level of stability, $\overline{Stab}$. Irrespective of its type, the social planner internalizes the stealing's positive externality on political stability. When there is no such externality, the optimal labor supply choice would be one; see (11).

The ambiguity of effects is also apparent from the growth function. Using (12),

$$\gamma = \frac{1}{\sigma}\left\{\begin{array}{l}(1-\tau)(1-\alpha)\underbrace{\left[2\alpha(S+1)\frac{X + S\cdot\overline{Stab}}{\overline{Stab} - X}\right]^{\frac{\alpha}{1-\alpha}}}_{***}\left(\frac{G}{Y}\right)^{\frac{\alpha}{1-\alpha}} \\ \times \underbrace{[(1-S)]^{\frac{\alpha}{1-\alpha}}}_{*}\underbrace{\left(\frac{X + S\cdot\overline{Stab}}{1+S}\right)^{\frac{1}{1-\alpha}}}_{**} - \rho\end{array}\right\}. \tag{13}$$

Stealing influences the rate of growth by altering the degree of political stability (**) and the input of public goods for private production (*), but also through its impact on the amount of labor employed (***). This effect arises because the social planner acknowledges that rent-seeking affects total output. Moreover, it only contributes positively to economic growth if stability falls short of the threshold level. This holds for both the RDG and the stationary bandit. The growth rate will nevertheless be lower with the stationary bandit in charge: $\gamma_{SB} < \gamma_{RDG}$. The stationary bandit provides fewer

public goods than the RDG, $G/Y = \alpha\tau$ versus $G/Y = \tau$. Clearly, it was the stationary bandit's planning capacity that made the difference before, not its selfishness.

A Social Planner that Optimizes Public Good Provision

Suppose now that social planning involves choosing the optimal level of public good provision, taking into account that individual labor supply decisions depend on G. This boils down to assuming that government equates the marginal cost and benefits of G, based on an aggregate production function that incorporates individual optimal labor supply choices derived in section 3. Recalling from there that $L = 1 - S = (1 - \tau)\alpha Y/G$ and ignoring momentarily the impact of political stability on output, the relevant production function becomes $Y = K^{1-\alpha}[(1 - \tau)\alpha]^{2\alpha}Y^{2\alpha}G^{-\alpha}$. Rearranging gives

$$Y = [(1-\tau)\alpha]^{\frac{2\alpha}{1-2\alpha}}K^{\frac{1-\alpha}{1-2\alpha}}G^{\frac{\alpha}{2\alpha-1}}. \tag{14}$$

For the stationary bandit the marginal costs of public good provision are one and the marginal benefits amount to $\tau \cdot dY/dG$. Hence,

$$G/Y = \frac{\alpha}{2\alpha-1}\tau,$$

which is positive for $\alpha > 1/2$. Labor must have sufficient weight in final good production to convince the stationary bandit to produce a positive amount of G. Provided that is the case, the stationary bandit will choose a higher level of G/Y than before, when it did not take into account the impact of stealing. Acknowledging the impact of stealing ensures that the stationary bandit increases public good provision, to keep the stream of tax revenues intact. In the absence of a political stability externality, this has no effect on the growth rates though. Higher public good provision entails level effects only.

For the RDG, the marginal costs of public good provision are one while the marginal benefits amount to dY/dG. Hence,

$$G/Y = \frac{\alpha}{2\alpha-1},$$

since the balanced budget requires $G = \tau Y$. Public good provision is positive for $\alpha > 1/2$, in which case G/Y is also higher than before. Also for an RDG it holds that if it acknowledges that society is plagued by stealing, it increases outlays on public good provision.

Investigating optimal public good provision in the presence of other institutions alters these results. The optimal labor supply choice of individuals remains the same, but the production function is a stability-augmented version of (14):

$$Y = [(1-\tau)\alpha]^{\frac{2\alpha}{1-2\alpha}}K^{\frac{1-\alpha}{1-2\alpha}}G^{\frac{\alpha}{2\alpha-1}}Stab(G),$$

where $Stab(G) = \left(X + S(G)\cdot\overline{Stab}\right)\Big/(1+S(G))$. The implications of including $Stab(G)$ may be verified from:

$$\frac{dY}{dG} = \frac{\alpha}{2\alpha-1}\frac{Y}{G} + \alpha(1-\tau)\left(\frac{Y}{G}\right)^2\left[\frac{\overline{Stab} - X}{\left(X + S\cdot\overline{Stab}\right)(1+S)}\right].$$

The first term on the right-hand side is the expression for dY/dG in an institutional vacuum. Including political stability implies that dY/dG goes up, provided stealing

affects political stability positively: $\overline{Stab} - X > 0$. As the marginal costs of generating G are constant for the RDG and the stationary bandit, this implies that if stealing exerts a positive externality through political stability, it is optimal to increase spending on public goods.

6. Conclusion

Much of the empirical and theoretical literature on corruption and economic growth ignores the fact that the impact of corruption on growth depends on the institutional environment. And when this is taken into account, the institutional framework is treated as a black box, making it impossibile to analyze corruption in interplay with other institutions. However, being part of a close web of formal and informal institutions, corruption may facilitate the institutional system's working and removing it may leave the economy worse off. The effect of corruption on economic growth can therefore not be studied without taking into account how corruption affects the institutional framework.

The model we develop in this paper tries to take (some of) these vital interdependencies into account. We construct a two-layer model in which the first layer treats the relation corruption–growth in an institutional vacuum, while the second layer adds institutions to assess how this alters the impact of corruption on growth. The institutions incorporated are political stability, property rights, and the political system.

The model shows that, in an institutional vacuum, corruption depresses growth by lowering both the input of productive public goods and labor. When institutions are taken into account, however, this relationship becomes ambiguous. Only when the amount of political stability or property rights protection is above some threshold value, corruption affects these institutions negatively, depressing economic growth. This implies that the initial institutional environment is important for determining the corruption–growth relationship. If the initial situation is such that corruption hampers growth, this will continue unless exogenous changes occur in (some of) the environmental variables. This finding is supported by the recent empirical literature, which emphasizes institutional threshold effects regarding the relation between corruption and economic growth.

These effects also depend on the political system that is in place. A system where an autocrat selfishly engages in rent-extraction features lower corruption than a democratic society. Whether or not an autocratic system has higher economic growth depends on the initial institutional setting. Moreover, it appears to be the autocrat's planning that makes the difference, not its selfishness. A democratic government acting as social planner would generate higher growth.

Our results provide an explanation for the ambiguous findings in the theoretical literature, just as it provides a theoretical underpinning for recent findings in the empirical literature that the institutional setting of countries is important for assessing the effects of corruption. While these findings are generally ascribed to Huntington's greasing-the-wheels hypothesis, our model provides a deeper theoretical foundation to the argumentation that corruption raises efficiency by evading institutional hurdles. The modeling framework provides a theoretical basis for analyzing and predicting the effects of corruption in a specific institutional setting. By modeling several institutional aspects explicitly, we have moreover opened the institutional black box. Our results indicate that this is important for assessing the effects of corruption on economic growth. Moreover, the dependence of our results on the political system shows that also the interaction between different institutions is important. Nevertheless, we emphasize

that our analysis is only a first attempt to formalize the close interaction between corruption and other institutions. For instance, it remains uncertain which institutions should be incorporated, while we also have only partly succeeded in analyzing the specific interplay between institutions. Yet, we believe that our modeling approach could serve as a useful framework for future analyses of corruption, institutions, and economic growth.

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Notes

1. Heckelman and Powell (2008) show that the empirical studies on the corruption–growth relationship provide very mixed outcomes and generally ignore institutional measures. Recent studies have begun to include the institutional environment in the analysis, showing empirically that institutions imply a nonmonotonic corruption–growth relation (e.g. Méon and Sekkat, 2005; Méndez and Sepúlveda, 2006; Aidt et al., 2008; Méon and Weill, 2010). This is in contrast to the earlier empirical studies which always found a clear-cut negative relationship between corruption and growth.
2. The concept of using a two-layer model is taken from Ehrlich and Lui (1999), who analyze the implications of political systems on individual labor supply decisions.
3. For instance, Ehrlich and Lui (1999), Barreto (2000), Mauro (2004), and Aidt et al. (2008).
4. This definition is in line with the World Bank definition that corruption is "the abuse of public power for private benefit," but is preferred because it highlights that both a briber and a bribee are involved. Macrae's definition also makes clear that the bribee uses his public position for its own benefit and that it affects the allocation of resources. Further refinements of the definition are possible, such as making a distinction between corruption with and without theft, or between centralized and decentralized corruption.
5. This does not mean that the institutions are necessarily efficient. Laws and social norms may be inefficient, but they still perform a role in the society by reducing uncertainty. By reducing uncertainty, individuals will engage in cooperation despite the fact that they do not possess perfect information about the other players or despite the fact that the game is not repeated.
6. Granovetter (1985) describes why the interplay between institutions matters for economic growth, emphasizing their embeddedness. Gradstein (2004) stresses the importance of property rights for economic growth, as a specific feature of the institutional framework. See the edited volume by Eicher and García-Peñalosa (2006) for an overview of these and other issues.
7. Nelson and Sampat (2001) propose that the theory of production should involve two different aspects: a recipe that is anonymous regarding any division of labor, the "physical" technology, and a technology that involves coordination of human action, referred to as "social capital."

8. The importance of property rights for economic growth can be found in Gradstein (2004). Colombatto (2003) presents the political system and the degree of political stability as a crucial determinant for the relation between corruption and growth.
9. In constructing the production function we depart from Mauro in the sense that Mauro introduces a term $\phi(S)$ that represents the amount of stolen goods rent-seekers actually keep. Mauro assumes $\phi(S)$ is a positive function of the total amount of rent-seeking, reflecting strategic complementarities: if one agent steals, it becomes more profitable for other agents to steal as well. This results in the possibility of obtaining equilibria without rent-seeking, which we want to rule out by setting $\phi(S) = 1$.
10. The difference is the absence of the strategic complementarity term $\phi(S)$ as a pre-multiplier of the G terms in (3).
11. Modeling threshold effects is consistent with recent findings in the empirical literature; see note 1.
12. Formally, $dStab/dS = \left(\overline{Stab} - X\right)/(1+S)^2 \gtrless 0$ with $d^2Stab/dS^2 = -2\left(\overline{Stab} - X\right)/(1+S)^3 \gtrless 0$.
13. This is, however, not uncommon in the literature on threshold effects and institutions, where unfavorable initial situations may leave the economy locked in in a bad equilibrium. See Aidt et al. (2008) for an example in the realm of political institutions.
14. The evolution of property rights over time is as for political stability. The chosen levels of L and S remain constant over time, making *Prop* constant as well. Again, the dependency of growth on corruption is fully determined by the initial conditions.
15. See Aidt et al. (2008) for an analysis of how the quality of political institutions and economic growth co-determine the viability of the "stationary bandit" regime we use.
16. A roving bandit type would extract as much from society as possible, with disastrous effects for private production and economic growth.
17. Equation (3) can be rewritten as

$$\gamma = \frac{1}{\sigma}\left[(1-\tau)(1-\alpha)[\alpha(1-\tau)L]^{\frac{\alpha}{1-\alpha}} - \rho\right].$$

18. Recognizing that part of public good production dissipates because of corruption, the government sets $(1 - S)dY/dG = 1$. The expression in the text then readily follows upon substitution of $1 - S = (1 - \tau)\alpha Y/G$.
19. The results for property rights are available from the authors upon request.
20. Output also depends on stealing through its effect on G. But since we require balanced government budgets, G is a fixed proportion of Y, independent of S.