From Corruption to Lobbying and Economic Growth*

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Abstract

Why do we often observe corruption in poor countries and lobbying in rich ones, and what are the consequences? We present a simple growth model where firms initially are subject to a regulation. Instead of complying with the regulation, a firm can bribe bureaucrats to "bend the rules" and thus be exempted, or firms can lobby the government to "change the rules". In equilibrium, firms bribe when the level of development is low but they tend to switch to lobbying when the level of development is sufficiently high. Bribing, however, is associated with hold-up problems, which discourage firms from investing. If the hold-up problems are severe, firms will never build up a high enough capital to make lobbying worthwhile. The economy is then stuck in a poverty trap with bribing forever. The model generates a rich set of empirical predictions and provides new insights into the effects of anticorruption policies and the evolution of the regulatory framework over time.

Keywords: Corruption, lobbying, development, poverty trap

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In India, as elsewhere in the developing world, the old business of corruption is meeting a new rival: the Washington-style business of persuasion [International Herald Tribune, May 31, 2006]

1. Introduction

Lobbying and corruption have been the subject of tremendous public interest and research. Somewhat surprisingly, however, these two means of influencing the regulatory environment have either been studied separately or viewed as basically being the same thing.[1] The question why firms choose to lobby or bribe, and the consequences of this choice, largely remain unanswered. In this paper, we try to shed some light on the issue.

We define lobbying, taking the form of campaign contributions or influence-buying through other means, as an activity that aims at *changing* existing rules or policies, while we view bribing as an attempt to *bend* or *get around* existing rules or policies. The analysis contrasts these two means of influencing politics. We use the labels "lobbying" and "bribing" for convenience and not because they are perfect definitions for the two rent-seeking activities we study.

While there is little comprehensive data on the extent of lobbying across countries (subjective cross-country data on corruption is available though), a common perception is that firms in developing countries are more likely to pay bribes to get around regulatory constraints, while firms in developed countries are more prone to lobby the government to change rules that have an adverse affect on them. There is also suggestive evidence, both across and within countries, that the extent of lobbying increases with income and that lobbying and corruption are substitutes.[2] What can account for this difference between developed and developing countries and the variation in influence-seeking activities between firms/sectors in a give country? Should we expect an evolution from bribing to lobbying, as the above quotation suggests, or can countries/sectors get trapped in a long-lasting bribing equilibrium?

Bribing and lobbying are perceived to differ in several dimensions. First, lobbying is a legal and regulated activity in many countries, while bribing is not.

[1] For example Coate and Morris (1999), building on Grossman and Helpman's (1994) lobbying model, interpret lobbying as a bribe.

[2] On corruption and income, see the review in Svensson (2005). Preliminary firm-level results on bribing and lobbying (conditional on income) are discussed in Campos and Giovannoni (2006) and Bennedsen et al. (2007). See also our discussion in Section 7.

Second, a change in the rule as a result of lobbying often affects all firms, while the return to bribing is more firm specific. Third, a government that ponders a change in the rule might have quite different concerns than a bureaucrat considering a bribe. Our model captures all these differences. However, possibly the most important difference, and the driving assumption in the model, is that bending the rules is only temporary. Bureaucrats can seldom commit not to ask for bribes in the future, since corrupt deals are not enforceable in courts and since firms deal with different officials over time. A legislative change, on the other hand, alters the status-quo and its effect is therefore likely to be more long-lasting.[3] Although policies and politicians also change over time, our key assumption is that changing the rules is long-lasting *relative* to bending them.

We study a simple growth model where firms are initially subject to a regulation. For example, a license is required to import essential inputs or the inputs are subject to a tariff. Instead of complying with the regulation, a firm can either bribe the official to "bend the rules" and be exempt from the regulation, or the firms can collectively lobby the government to change or relax the requirements. In addition, each firm decides how much to invest in capital.

In this setting, we show that firms are most likely to bribe when their level of capital is small. The equilibrium bribe, however, increases in a firm's level of capital, partly because its willingness to pay increases. As the bureaucrat cannot commit to not raise the necessary bribes after the firm has invested, at some point, the bribes are so high that the firms prefer to instead to lobby for deregulation. After the rule is relaxed, there is no need to comply or negotiate with the bureaucrat, so in essence, the bureaucrats price themselves out of the market. On the other hand, the firms anticipate the hold-up problem and the larger bribes that follow its investments.[4] This reduces the incentives to invest, and the economy may get stuck in a poverty-trap with extensive bribing forever. The conditions for when such poverty traps arise depend on a number of parameters, generating a rich set of empirical predictions.

The analysis provides new insights into how policies affect corruption. For example, tough penalties on corruption make firms more likely to lobby instead of

[3]Intuitively, a status-quo bias arises in politics if, for example, there are several pivotal legislators, and that one of these are reluctant to re-introduce the rule, once it is relaxed. Empirical support for this assumption is discussed in Section 7, while Section 6.3 discusses how this assumption could be relaxed. Coate and Morris (1999) discuss theories on policy persistence.

[4]Olken and Barron (2007) provide evidence consistent with hold-up problems in corrupt markets.

bribe - conditional on the stage of development - but they also increase the bribes a firm must pay, and the incentives to invest are accordingly reduced. Thus, tough penalties can make the poverty trap more likely. We show that equilibrium (and optimal) penalties increase in the level of development and that they depend on whether the regulation is intended to internalize externalities or rather generate revenues for the government.

Our main predictions receive broad support from existing data on corruption and lobbying across countries and sectors. The model predicts that corruption (lobbying) should be more prevalent in poorer (richer) countries – a result consistent with a large cross-country literature on corruption and a smaller one on lobbying. Specifically, our model predicts an inverted U-shape relationship between capital and the amount of bribes, a finding that also matches the evidence (see further Section 7). More broadly, our theory suggests that the hold-up problem is less severe if governments or bureaucrats can commit. With a coordinated bureaucracy, therefore, high growth and bribery can coexist, as some suggest to be the situation in current China.

Modern research on the economics of corruption began with Rose-Ackerman (1975, 1978). Following Becker and Stigler (1974), the early literature studied corruption primarily within a principal (government) agent (public official) framework. As do Shleifer and Vishny (1993), we take the principal-agent problem as given and instead focus on the consequences of corruption for resource allocation. As in Choi and Thum (2004), we study the effects of repeated extortion, but our focus is primarily on firms' behavior, rather than that of bureaucrats.[5]

The literature on lobbying is reviewed by Austen-Smith (1997) and Grossman and Helpman (2002). Starting with the issue of interest group formation (Olson, 1965), the recent literature looks at how lobbying influences policy choices in an environment with competing interests. Lobbying, often taking the form of strategic provision of information or campaign contributions, can either influence policy makers' positions and actions or help preferred candidates win elections. As argued by Grossman and Helpman (2002), the degree to which an industry can influence policy depends on the strength of its political organization and various industry characteristics. We follow this framework, although our formalization may be considered a short-cut for various types of lobbying.

Given the large literature on both corruption and lobbying, it is surprising that the intersection is almost empty. Lambsdorff (2002) surveys the literature on rent seeking and argues that, traditionally, it takes corruption to be less wasteful than

[5] The literature on corruption is reviewed in Bardhan (1997) and Svensson (2005).

lobbying because bribes are pure transfers. Dal Bó et al. (2006) study alternative means of extortions (bribing vs. punishing), while others compare various types of lobbying: Bardhan and Mookherjee (1999, 2000) contrast lobbying to central vs. local governments, while Bennedsen and Feldmann (2006) compare campaign contributions to informational lobbying. To our knowledge, this is the first study comparing bribing and lobbying in a dynamic framework.

The paper is organized as follows. The next section presents a simple model of bribing, lobbying and growth. Section 3.1 solves for the bribes, Section 3.2 solves for the lobbying equilibrium, and Section 3.3-3.4 compares the two and determines when firms prefer one rather than the other and the welfare implications of these choices. While Sections 2 and 3 assume that the government prefers firms to comply to the rule, Section 4 discusses "red tape" where the government benefits from the bribes paid as well as other extensions of the basic model. Section 5 endogenizes the penalty on corruption, and finds that this is likely to increase with the level of development. In Section 6, we discuss how we could relax some of the simplifying assumptions and argue that the main findings would hold or be strengthened. Section 7 discusses the empirical predictions and Section 8 concludes.

2. A Model of Bribing, Lobbying and Growth

The model presented in this section is simple and quite stylized. This allows us to derive analytical results, and it makes it straightforward to extend and generalize the model in several directions in Sections 4 and 5. Robustness is discussed in Section 6.

2.1. Players and Preferences

There are three sets of players in the model: The firms, the bureaucrats, and the government. Utility is transferable, so that everyone cares equally about money.

A firm i's production function is given by $f(k_{it}) = rk_{it}$, where r is a productivity parameter, and k_{it} is firm i's capital stock at time t. We let there be a large (infinite) number of identical firms, of measure one. This simplifies the analysis, but our results hold for any number of firms, as discussed in Section 6.4. There is no competition between the firms (competition is allowed for in Section 5.3). It is also straightforward to allow for heterogeneity between the firms (in e.g. r), but since that would not add any insight, we keep the model symmetric. Thus, in equilibrium, $k_{it} = k_t$, the average (and aggregate) level of capital. We therefore often drop the subscript (i) denoting firm i. In fact, we also frequently drop the subscript for time, whenever this is not misleading.

Assume each firm faces some regulation which it must overcome.[6] If it complies with the regulation, it costs c per unit of capital. The total cost of compliance, ck_i, is proportional to k_i because the regulation constrains production, which is proportional to k_i. This simple set-up, we believe, captures in a reduced form many types of regulations. For example, the rule could be interpreted as an industrial licensing requirement, where either input or output is subject to administrative approval, a tariff, or as an environmental regulation where firms are required to take costly action to curb pollution associated with production.

In this section we assume that the rule is in place because the government prefers the firms to comply (for instance because of environmental concerns).[7] If a firm i does not comply, the government's utility-loss is e per unit of capital, where the parameter e measures the externality of non-compliance. For this reason, the government certainly prefers to introduce regulation if there is none. The total externality ek_i is proportional to the size of the firm or, equivalently, the size of its production: The more the firm produces, the larger is the negative externality if it is not complying.

Also a bureaucrat may prefer that the firm complies. Specifically, we assume that a bureaucrat receives a utility-loss e_B per unit of capital if a firm does not comply. The bureaucrat and the government can of course have different preferences for compliance, so we allow $e_B \neq e$. Moreover, the interpretation of e_B can be very different from the interpretation of e. Consider the case of environmental regulation: A bureaucrat may not necessarily care about pollution, per se, but about being punished if the firm he is suppose to monitor does not comply. One can therefore interpret e_B as representing the expected penalty for the bureaucrat. If the actual penalty is x and the probability of being detected is θ, $e_B = \theta x$. The probability of being caught, θ, may vary across bureaucrats as well as time, so let θ be uniformly *i.i.d.* distributed over $[0, 1]$. θ can, alternatively, represent the individual stigma associated with being penalized for corruption. In either case, if bending the rules for firm i, a bureaucrat faces the cost $\theta x k_i$. This increases in

[6] As will become clear in Section 4.3, the government do benefit from introducing regulation at the beginning of the game.

[7] Section 4 discusses the "red tape" interpretation of regulation, where the rules are in place mainly to generate revenues for the government.

k_i because it is more likely that a large firm will be investigated, or because the penalty of such a large crime is larger. There is no need for private information in the model, so we let θ be observed by the firm before it negotiates with the bureaucrat. Moreover, let $c \in (0, x)$, such that some bureaucrats (and firms) are corrupt, while other comply. The results below would be the same if firms were being penalized instead of (or in addition to) the bureaucrats. The results would also be similar if we allowed compliance costs to be randomly drawn each period, while θ were fixed.

2.2. Bribing

If a firm does not want to comply with the rules it has two alternatives. First, it may bribe the bureaucrat to "bend the rules". That is, a firm can pay a bribe B to the bureaucrat for letting the firm proceed without complying with the regulation. The size of B is negotiated between the firm and the bureaucrat. We let the generalized Nash bargaining solution characterize the outcome of the negotiations, and the bureaucrat's relative bargaining power is β. Our key assumption is that the bureaucrat cannot commit to bend the rules also in the future; that remains to be negotiated at a later stage. This is quite reasonable, since bending the rules does *not* change the law, and a bureaucrat cannot write enforceable contracts stating that he will not monitor the firm later. This may be related to our assumption that the firms deal with different bureaucrats over time, or that corruption is illegal.

2.3. Lobbying

As an alternative to *bending* the rules, the firms may lobby the government to *change* them. Successful lobbying requires that the firms spend an amount L, compensating the government for the future utility-loss when no firms have to comply.[8] After the rule is relaxed, there is no need to comply or negotiate with the bureaucrat. Changing the rules benefit all firms, so they may share the cost of lobbying in equilibrium. In particular, we assume that L, and how this cost is shared among the firms, is negotiated between the government and the firms. Relying on the Nash bargaining solution again, the government's relative bargaining

[8] This is consistent with the menu-auction literature on lobbying (e.g. Grossman and Helpman, 1994).

power is γ, the sum of the firms' bargaining power is $1 - \gamma$, and every firm has the same bargaining power. If the firms had all the bargaining power, such that they could make a take-it-or-leave-it offer to the government, then $\gamma \approx 0$.[9]

In contrast to the case where the bureaucrat *bends* the rule, *changing* the rules affect the status quo. To simplify, we assume that if the rules are relaxed, they are relaxed forever. This is an extreme assumption, and Section 6.3 discusses how it can be relaxed: It is sufficient for our results that changing the rules has a more long-lasting effect than bending them. Notice that it is straightforward to endogenize this assumption: Simply assume that several legislators are pivotal when changing a law, e.g. because of a super-majority requirement, or because a proposal must pass two political chambers. If one of the pivotal legislators has preferences that are more aligned with the firm, then she will never accept to re-introduce the rule (unless the firms lobbied for it).

2.4. Economic Growth

In each period t, the timing is as follows. The firms collectively decide whether to lobby the government to change the rules. If they do, their contributions are determined in a bargaining game, where each firm (and the government) get their share of the total surplus generated by relaxing the rules. Since every firm (and the government) would thus like to maximize the total surplus, they all agree on when and whether to lobby.[10] If the firms end up not lobbying in this period, they proceed individually. Then, each firm observes the type of its bureaucrat and determines whether to negotiate with him. If the negotiation breaks down or is never initiated, the firm complies. As already mentioned, the firm faces a new bureaucrat every period, such that this sequence repeats itself at each time t.

The capital depreciates at rate d, but each firm may increase its stock of capital by investing I_t at cost $zI_t^2/2$ at the beginning of each period:

$$\dot{k}_t = I_t - dk_t. \tag{2.1}$$

We normalize time such that $k_0 = 0$ at $t = 0$. The discount rate, δ, is the same for all agents. Although it is convenient to refer to "period t", we let time

[9] Technically, the Nash bargaining solution is well defined only when the number of firms is finite. We take the limit of this solution, and assume this outcome characterizes the bargaining outcome.

[10] Thus, the results below would be identical if the government were the active part, deciding when (and whether) to negotiate with the firms.

be continuous in the model. This simplifies some of the calculations without affecting the results. Whether time should be discrete or continuous in the model is a matter of taste, and Section 6.5 discusses how the results would prevail if time were discrete.

3. From Bribing to Lobbying

This section derives the unique subgame perfect equilibrium in three steps. First, we solve for the bribes and the steady state investment levels. Second, we derive the individual cost of lobbying and the investment levels when lobbying is anticipated. Finally, we investigate when firms prefer to lobby rather than bribe. We conclude the section by discussing some welfare implications. All proofs are in the Appendix.

3.1. Bribes and Investments

Before deciding whether to comply, a firm learns the type $\theta \in [0,1]$ of its current bureaucrat. If $\theta x < c$, the firm and the bureaucrat can both be better off if the firm pays a bribe $B \in (\theta xk, ck)$ to the bureaucrat to circumvent the regulation. The size of the bribe is determined by negotiations between the firm and the bureaucrat. Relying on the generalized Nash bargaining solution, where β represents the bureaucrat's bargaining power, we can determine the equilibrium bribe:

$$\max_B (B - e_j k)^\beta (ck - B)^{1-\beta} \Rightarrow B = \beta ck + (1-\beta) e_j k. \tag{3.1}$$

The bribe increases in k for two reasons. First, a large k implies that the firm's cost of compliance is large, and it is thus willing to pay more to circumvent the rules. Second, the bureaucrat's cost of bending the rule is larger (e.g. because a large firm's failure to comply is more likely to be detected, or it is penalized more). For both reasons, large firms pay more bribes. Clearly, B is also increasing in c, the cost of compliance, since the bureaucrat can ask for accordingly higher bribes. This is particularly important if the bureaucrat's relative bargaining power, β, is large. Finally, notice that if θ is large, then B is large because the firm must compensate the bureaucrat for the large expected penalty he is risking.

Since θ is uniformly distributed on $[0,1]$, the probability that $\theta x < c$ and the firm bribes is c/x, while it complies with probability $1 - c/x$. In other words, the larger is the cost of compliance, the more firms prefer to bribe instead of comply.

Proposition 1. *A fraction c/x of the firms bribe and the bribe B, given by (3.1), increases in the capital stock (k), the unit cost of compliance (c), the bureaucrat's bargaining power (β), the penalty for corruption (x), and the individual probability of being caught (θ).*

Before learning the bureaucrat's type, a firm's current expected profit can be written as

$$\begin{aligned} rk - \mathrm{E}\min\{ck, B\} &= (r-b)k, \text{ where} \\ b &\equiv c\left(1-(1-\beta)c/2x\right). \end{aligned} \tag{3.2}$$

where b, the firm's expected cost of bribing or complying, increases in the unit cost of compliance (c), the bureaucrat's bargaining power (β), and the penalty if caught taking bribes (x).

When a firm invests, it takes into account how investments affect profit, including the effect on the bribes. To solve for the equilibrium investments, consider, first, an equilibrium where bribing takes place forever. In such a steady state, each firm will at time t plan its investments in order to solve:

$$\max_{I_\tau} \int_t^\infty \left((r-b)k_\tau - \frac{z}{2}I_\tau^2\right) e^{-\delta(\tau-t)} d\tau \text{ s.t. } k_t \text{ and (2.1).} \tag{3.3}$$

Proposition 2. *In a bribing equilibrium investment I, given by (3.4), is decreasing in b, and thus in the cost of compliance (c), the bureaucrat's bargaining power (β), and the penalty if caught taking bribes (x).*

$$I = \frac{r-b}{z\left(d+\delta\right)} = \frac{r-c\left(1-(1-\beta)c/2x\right)}{z\left(d+\delta\right)}. \tag{3.4}$$

The more capital the firm has, the higher the bribes will be. Thus, bribing leads to a typical hold-up problem, since the bureaucrat cannot commit to not ask for higher bribes in the future. This discourages the firm from investing. Since the equilibrium size of the bribes increases in c, x and β, investments do the opposite. Naturally, powerful bureaucrats (β large) extract more bribes which reduce the incentives to invest. Harsher penalties on corruption reduce growth as well, because the bureaucrats then demand higher bribes, worsening the hold-up problem. If c increases, both the cost of compliance and the bribes are larger, and investments decrease for both reasons.

3.2. Lobbying and Investments

Having solved for the steady state investments above, it is easy to calculate a firm's present discounted value, $V(k_{it}, b)$, which depends on its current level of capital and, of course, the firm's expected loss due to compliance or bribing, b. If successful lobbying has taken place and the rules have been relaxed, the firm's investment decision is similar to (3.3) if just b is replaced by zero. Then, a firm's present discounted value is $V(k_{it}, 0)$. Whether the firms benefit from lobbying thus depends on a consideration of $V(k_{it}, b)$, $V(k_{it}, 0)$ and the cost of lobbying, L.

Although the total cost of lobbying, L, depends on the total level of capital, k, there are many firms and each take L as given. However, even if L were given, firm i's share of the cost, L_i, is the outcome of the bargaining game with the other firms. If the negotiations fail, the default is to bribe or comply. Since Proposition 1 states that larger firms must pay more bribes, lobbying is better relative to bribing if i's level of capital, k_{it}, is large. The other firms can hold up i, then, and require i to contribute more to the lobbying. In the bargaining outcome, L_i is larger if $V(k_{it}, b) - V(k_{it}, 0)$ is large, and this increases in k_{it}.[11]

Proposition 3. *Let the total cost of lobbying be L. Firm i's cost of lobbying increases in k_i and is given by (3.5):*

$$\begin{aligned} L_i &= \frac{b(k_i - k)}{d + \delta} + L, \text{ where} \\ L &= k\left(\frac{\gamma b + (1-\gamma)\, e(1 - c/x)}{d + \delta}\right) + \left[(1-\gamma)\,\frac{re(1-c/x) + bec/x}{z\delta\,(d+\delta)^2}\right]. \end{aligned} \tag{3.5}$$

If a firm anticipates that lobbying will take place at some time T in the future, it realizes that the more it has invested up to then, the more it will have to contribute to lobbying in equilibrium. This discourages firms from investing. Thus, lobbying generates a hold-up problem, just like bribing. In fact, investment levels turn out to be the same at any time $t < T$, as they would be if bribing were to continue forever.[12] If lobbying has taken place, there is no need to comply or

[11] In the proof, we assume that the default is to continue to bribe forever, if the negotiations fail. The result would be identical if the default were instead to lobby in the next period in a discrete time model. In continuous time, it is not obvious how to model such a situation.

[12] Intuitively, the reason is that bribing is the default if the collective negotiations break down. With the Nash bargaining solution, each firm ends up with a payoff equal to its default payoff $V(k_{it}, b)$ plus a fraction of the total surplus from lobbying. This fraction would be $1/n$ if there were n firms. When $n \to \infty$, therefore, firm i's payoff is simply $V(k_{it}, b)$, plus a constant which is independent of k_{it}. Thus, firm i invests as if it had to continue to bribe forever.

bribe and the firms choose to invest more.

Proposition 4. *Suppose that, in equilibrium, lobbying replaces bribing at time T.* (i) *At any time $t < T$, each firm invests according to (3.4).* (ii) *At any time $t > T$, investments are higher and given by:*

$$I = \frac{r}{z\,(d+\delta)}.$$

Note that there is no assumed collective action problem when it comes to the timing of lobbying. When using the Nash Bargaining Solution, the firms share equally the surplus from switching to lobbying, and they thus agree on whether and when to lobby. This would be true even if firms where heterogenous in equilibrium. On the other hand, the bargaining solution creates a hold-up problem, inducing the firms to invest less prior to the negotiations. If there were only one firm, this effect would be absent but the main results would continue to hold (Section 6.4 discusses this further).

3.3. From Bribing To Lobbying

Having derived the costs of bribing and lobbying, we can compare the two to determine what the firms do. When bargaining over whether to lobby, each firm (and the government) receive a share of the total surplus from relaxing the rules, and everyone will thus agree on when and whether to lobby rather than bribe.

Proposition 5. *Suppose (3.6) holds. The firms prefer lobbying instead of bribing if and only if $k \geq \overline{k}$, given by (3.7). For a given k, (3.7) is more likely to hold if the externality (e) is small while the bureaucrat's bargaining power (β), the unit cost of compliance (c), the rate of capital depreciation (d), the discount rate (δ), and the cost of investments (z) are large.*

$$(1+\beta)c^2/2x + (c-e)(1-c/x) > 0 \tag{3.6}$$

$$k \geq \overline{k} \equiv \frac{b(e-b/2)}{\left[(1+\beta)c^2/2x + (c-e)(1-c/x)\right](d+\delta)^2 z}. \tag{3.7}$$

Intuition: If k is small, the bribes are small and so is the firms' willingness to lobby. Moreover, the government anticipates that k is going to grow over time, particularly if it relaxes the rule. Such a large growth in k would increase the negative externality on the government. The government is thus unwilling to relax the rule when k is small, and the firms do not find it worthwhile spend a lot to relax the regulation.

But two kinds of inefficiencies may grow as k increases. If $c > e$, the firms' cost of compliance is larger than the government's benefit. Even if all firms complied, the social cost of compliance $k(c - e)$ would increase in k. For k sufficiently large, the firms find it worthwhile to compensate the government for the losses it faces by relaxing the rules. If $c < e$, the benefit of compliance is larger than the cost. If every firm complied, the rule should thus never be relaxed. However, a fraction c/x is not complying and the wasteful bribe increases in k. If the bureaucrats could, they would have liked to commit to not raise the bribes after the firms had invested. But they cannot commit, and the larger k gives the bureaucrats the upper hand when negotiating over the bribe. The firms anticipate this, of course, and when k is sufficiently large they prefer to instead lobby (and compensate) the government for relaxing the rule. Thus, for "red tape" regulation where $c > e$, the rule is always changed by lobbying for a sufficiently large k. "Good regulation", characterized by $c < e$, is less likely to be relaxed, but if c/x is large, many firms do not comply and, because this deadweight loss increases in k, even good regulation may eventually be relaxed due to lobbying unless e is sufficiently large. This is the intuition behind (3.6), the condition for when firms lobby for k sufficiently large.

Comparative static is provided by (3.7). If the rate of capital depreciation (d), the discount rate (δ), and the cost of investments (z) are small, the government anticipates large investments after relaxing the rule, and it must be compensated for the externalities this causes. This increases the cost of lobbying, and the threshold $\overline{k}$ at which firms switch from bribing to lobbying. For a given k, lobbying is more attractive for the firms if the bribes are large, which is the case if the bureaucrat's bargaining power (β) and unit cost of compliance (c) are large. The penalty if caught taking bribes, x, also increases the bribes, suggesting that lobbying becomes more attractive. But a large x also increases the government's benefit of the rule, since more firms comply if x is large. The latter effect dominates if (and only if) the value of compliance for the government, e, is large. For e small, however, firms are more likely to lobby if x is large.

Combining Propositions 4 and 5 leads to the main result of this section: While Proposition 5 says that the firms are more inclined to lobby rather than bribe when k is large, Proposition 4 states that the growth rate of k depends on whether the firms actually bribe or lobby. Thus, there may be an evolution where the firms bribe for low k, but when time passes and k increases, the firms eventually reach a stage where they rather lobby. However, the hold-up problem between the bureaucrat and the firm implies that investments are lower when firms bribe. If these investments are sufficiently low, the capital level never reaches the threshold $\overline{k}$ for when the firms switch from bribing to lobbying. Then, the economy is stuck in a "poverty trap": High bribes lead to low investments which, in turn, never make it beneficial to switch from bribing to lobbying.

Proposition 6. (i) *The firms will eventually switch from bribing to lobbying if and only if (3.8) holds.* (ii) *If (3.8) holds, the time T of the switch is given by (3.9).*

$$(r-b) > \frac{db(e-b/2)/\left(d+\delta\right)}{[(1+\beta)c^2/2x+(c-e)(1-c/x)]} \tag{3.8}$$

$$\left(1-e^{-dT}\right)(r-b) = \frac{db(e-b/2)/\left(d+\delta\right)}{[(1+\beta)c^2/2x+(c-e)(1-c/x)]} \tag{3.9}$$

Intuition: The result follows from combining Propositions 4 and 5. Investments are larger if r (the productivity parameter) is high relative to the firm's expected cost of bribing or complying, b, and the level of development will then sooner reach the critical $\overline{k}$ where the firms switch to lobbying. If r is small, however, firms invest less and the capital level may never reach the threshold level, $\overline{k}$. Thus, for small r, the economy is in a poverty trap: Low investments lead to a low level of capital, and the low level of capital induces firms to bribe instead of lobby. Bribing, in turn, reduces economic growth relative to an equilibrium with lobbying.

The effect of the firm's expected cost of bribing or complying (b), and thus c, x, and β, is ambiguous: One the one hand, a larger b may reduce the threshold at which firms switch from bribing to lobbying. On the other hand, a larger b reduces investments and it is less likely that any k will ever be reached. In particular, if b is very large, such that $r-b$ is very small, then it is clear from (3.8) that the economy is in a poverty trap: High bribes may, in isolation, make lobbying attractive relative to bribing, but the high bribes generate a hold-up problem that is so severe that the firms never invest enough to find it optimal to ever switch to lobbying. High penalties on corruption can thus can make the poverty trap more likely.

Note that if $e < b/2$, the left-hand side of (3.9) is larger than the right-hand side, even for $T = 0$. Then, the rule is relaxed immediately, even when $k_t \approx 0$

at $t = 0$. However, if $e > b/2$, the rule is not relaxed immediately, even though the government certainly has the discretion of doing so. This implies that when $e > b/2$, if the rule is not in place at $t = 0$, the government will benefit by introducing it.

Notice further that neither $\overline{k}$ nor T depend on γ, the government's bargaining power. When bargaining with the government, the firms get a fraction $(1 - \gamma)$ of their joint surplus when the rule is relaxed. Thus, the firms switch to lobbying as if maximizing this joint surplus. The optimal T is therefore independent of γ, and it would be the same if the government could decide when to negotiate with the firms.

3.4. Welfare Implications

While the results above are positive, various social welfare functions could be added to the analysis. Let V_j, $j \in \{B, F, G\}$ be the present discounted utilities for the groups of bureaucrats, firms and the government, respectively. Similarly, let α_j be the associated weight in the welfare functions. Transfers such as bribes and lobby contributions are included in these utilities. Define social welfare as

$$W = \alpha_B V_B + \alpha_F V_F + \alpha_G V_G. \tag{3.10}$$

Take investments, the cost of bribes and the cost of lobbying as given by the equilibrium. A remaining question is whether T, the time at which firms switch to lobbying, is socially optimal. It is certainly optimal for the firms, since the firms pick T in order to maximize V_F. Moreover, T is jointly optimal for the firms and the government since they all get a share of the same surplus when negotiating whether to switch to lobbying. Thus, T is also optimal for the government when the lobby contribution is taken into account.

Proposition 7. *Take investments, the costs of the bribe and lobbying as given. If social welfare is given by (3.10), then the equilibrium T is first best for any $\alpha_F \geq 0$ and $\alpha_G \geq 0$ as long as $\alpha_B = 0$.*

This welfare function ($\alpha_B = 0$) may be reasonable, since the transfer paid to the bureaucrats might be considered as a waste from a social point of view. In fact, if the government is benevolent, then $W = V_G$ so that also $\alpha_F = 0$. But even then, as Proposition 7 shows, the equilibrium T is optimal. Of course, the firms *invests* suboptimally since they do not take into account the negative externality.

If $\alpha_B = \alpha_F = \alpha_G = 1$, however, the firms and the government do not internalize the bureaucrats' utility-loss when relaxing the rule. The firms, then, switch to lobbying too quickly, from a social point of view.

Alternatively, one could argue that the citizens should also be taken into account, even though they are not players in the model above. The citizens may prefer a larger k because of the employment this generates, or because that would lead to more competition and thus lower prices. Since k is larger after the switch to lobbying, the firms start lobbying *too late* compared to what is optimal from a social point of view. Moreover, the economy may be stuck in a poverty trap, where firms never switch to lobbying, even if such a switch would be socially optimal.

As this discussion makes clear, the welfare implications depend on the objective function. The next section generalizes the government's objective function to investigate precisely how other concerns would or should affect T.

4. Generalizing the Objective Function

This section shows how the simple model above can easily be extended. In turn, we discuss "red tape" regulation (where the government benefits from the bribes); a direct benefit from economic growth; and externalities (or competition) between the firms. The first two extensions require us to modify the government's objective function, while the third require the firms' objective to be altered.

4.1. Red Tape

Above, we assumed that the government benefits only if firms comply. An alternative view, the public choice theory or "tollbooth view", is that regulation is in place to extract rents from the firms.[13] The bribes collected by the bureaucrat

[13] De Soto (1989), Shleifer and Vishny (1993), and Djankov et al. (2002) argue that regulations are partly instituted to provide public officials with the power, or the property rights, to demand and collect bribes. Evidence is provided in Wade's (1982) account of corruption in the canal irrigation department in a South Indian state. Wade describes how some irrigation engineers raise vast amounts in bribes from the distribution of water and contracts, and redistribute parts to superior officers and politicians. Corruption is institutionalized and there is even a second-hand market for posts that provide the holder with an opportunity to extract bribes. The existence of entry fees for positions in the bureaucracy is documented in many developing and transition countries (see World Bank, 1998).

may indirectly benefit the government because, with high expected bribes, the bureaucrats' wages can be reduced accordingly. Or, the bribes may directly benefit the government if it can control the bureaucrats and thereby collect a fraction of the bribes. We let the constant $f \in (0,1)$ represent this fraction or, more generally, the extent to which the government benefits from the collected bribes.[14] The government's objective function can thus be written as

$$u_G = -e(c/x)k + f(c/x)c(1+\beta)k/2, \tag{4.1}$$

as long as the firms bribe. The second term captures the benefit of the bribes: The fraction of firms that bribe is c/x and, conditional on bribing, the expected (and average) bribe is $c(1+\beta)k/2$. If the regulation has been relaxed, no bribes are paid and no firms comply. Then, the government's payoff is reduced to $u_G = -ek$, just as before.

Proposition 8. *Assume (4.2) holds. (i) Lobbying replaces bribing if k is sufficiently large. (ii) For a given k, lobbying is more likely to replace bribing if f is small, and then it does so at an earlier point in time, given by (4.3).*

$$(1-f)(1+\beta)c^2/2x + (c-e)(1-c/x) > 0 \tag{4.2}$$

$$\left(1-e^{-dT}\right) = \frac{db(e-b/2)/\,(r-b)\,(d+\delta)}{[(1-f)(1+\beta)c^2/2x + (c-e)(1-c/x)]} \tag{4.3}$$

Condition (4.2) replaces (3.6). If f is small, (4.2) is more likely to hold, such that lobbying replaces bribing for a sufficiently large k. If f is equal to 1, such that the government captures the entire bribe, then $c > e$ is both necessary and sufficient for lobbying to replace bribing when k is large. Thus, "red tape" policies, in place mainly to extract bribes from the firms (such that $f \approx 1$ but $c > e$) will eventually be relaxed when firms start to lobby instead of bribe.

Part (ii) is quite natural: If f is large, the rule is more beneficial for the government, it is more reluctant to relax the rule, and it does so only when the externality generated by firms that avoid complying by paying bribes is sufficiently large.

[14] Section 6.1 discusses how f can be endogenized, and that f is then likely to decrease in k. This would strengthen our results.

4.2. A Concern for Growth

The government may also care about the level of development, k, by itself. After all, k measures the amount of taxable output and the activity in the economy, with positive effects on both consumption and employment. To capture the concerns for development and growth, we let g measure the government's benefits of a larger k.

$$u_G = -e(c/x)k + f(c/x)c(1+\beta)k/2 + gk. \tag{4.4}$$

Proposition 9. *Assume (4.2) holds. (i) Lobbying replaces bribing if k is sufficiently large. (ii) Given k, lobbying is more likely to replace bribing if g is large, and then it does so at an earlier point in time, given by (4.5).*

$$\left(1 - e^{-dT}\right) = \frac{db(e - g - b/2)/\,(r - b)\,(d + \delta)}{[(1 - f)(1 + \beta)c^2/2x + (c - e)(1 - c/x)]} \tag{4.5}$$

Part (ii) is very intuitive: If the government benefits by economic growth, it is more sympathetic to relax the rule, since it generates a hold-up problem which reduces growth. The larger is g, the earlier the firms find it worthwhile to switch to lobbying, and the more likely it is that they eventually will do this. Condition (4.2) is the same as before, since g does not affect how the bribe (or the cost of lobbying) depends on k.

4.3. Competition between the Firms

So far, we have simply assumed firms to be identical and ignored the market structure; there is no competition between firms. This allowed us to isolate the difference between a temporary *bending* and a more permanent *changing* of the rules. In reality, the market structure may be an important aspect when firms decide whether to lobby or bribe. If the firms' capital stocks generate a negative externality on the other firms (since more output reduces the price, for example), firms anticipate that this negative externality would be even larger if they were to lobby, since relaxing the rules would increase aggregate investments. Suppose a firm i's profit function is not rk_i, as assumed above, but $rk_i - hk$. Thus, there is a negative externality (measured by $h > 0$) by the capital stock owned by the other firms.

Proposition 10. *Assume (4.2) holds. (i) Lobbying replaces bribing if k is sufficiently large. (ii) Given k, lobbying is more likely to replace bribing if h is small, and then it does so at an earlier point in time, given by (4.6).*

$$\left(1-e^{-dT}\right)=\frac{db(e+h-g-b/2)/\left(r-b\right)\left(d+\delta\right)}{\left[(1-f)(1+\beta)c^{2}/2x+(c-e)(1-c/x)\right]} \tag{4.6}$$

Intuition: Technically, the effect of a larger h is identical to the effect of a smaller g. If h is large, there is a large negative externality from one firm's investment to the other firms' profit. This makes the firms reluctant to lobby, since they realize that after the rule is relaxed, investments will be even larger, reducing overall profit. Thus, the firms may prefer to continue in a bribing equilibrium simply because this limits competition between them. Hence, the bribing equilibrium may remain in place since it functions as a barrier to invest.[15] Later in the development process, however, the firms may already be large and the threat of further investments might be relatively smaller. Then, the firms find it more attractive to lobby for a permanent change of the rule, and a switch from bribing to lobbying may occur.

4.4. Welfare Implications

Just as in Section 3.4, the equilibrium T is optimal for the government and the firms. This result holds even when the government cares about the bribes or economic growth, as described by equation (4.4). It also holds when the firms care about the effect of competition. Thus, given the bribe and the investment levels, T is socially optimal for any $\alpha_F \geq 0$ and $\alpha_G \geq 0$ as long as $\alpha_B = 0$. Proposition 7 continues to hold.

But another interpretation of this section is normative: the government *should* internalize some of the bribes and the benefit from economic growth. Internalizing the bribe would, or should, lead to a later relaxation of the rules, while the concern for growth has the opposite effect, in that the switch to lobbying should occur

[15] This reasoning might be particularly important if the market were open to entry. If relatively few firms have entered the market, they might rationally anticipate that many more firms would enter if they lobbied the government. Relaxing the rules permanently would intensify the competition and reduce the firms' profit. Thus, the firms currently in place may choose not to lobby, and instead bribe, just to keep potential firms out of the market.

sooner. Interpreting f normatively is equivalent to setting α_B in (3.10) such that $\alpha_B = f$.

With the positive interpretation, however, the government may care about the collected bribes even though they are wasteful from the citizens' point of view: The government may stick to "red tape" and the bribing equilibrium, even though a switch to lobbying would be socially optimal. For this reason, a poverty trap is more likely if the government is able to collect and benefit from the bribes.

Moreover, while the effect of competition in Section 4.3 may harm the producers, it is likely to benefit the consumers. Although they are not players in the model, their welfare should ideally be taken into account. Proposition 10 states that more competition induce firms to continue in the bribing equilibrium (perhaps leading to a poverty trap, where lobbying never takes place), but a switch to lobbying may benefit citizens since the capital levels (and the consumer surplus) would increase. The economy may thus end up in a socially suboptimal poverty trap because firms, or the government, do not fully internalize the citizens benefit.

5. Mitigating Corruption: Endogenizing the Policies

The equilibrium above determines whether firms comply, bribe or lobby, and how much they invest. These decisions depend on various parameters, which we have taken to be exogenous. The government may, however, be able to influence some of these parameters in order to tilt the equilibrium in its favored direction. In particular, the penalty on corruption, x, is a policy parameter and it may be deliberately chosen.[16] How should the government set this penalty? The following analysis takes (4.4) to be the government's objective function, and derives positive predictions for what the government will do. Alternatively, by interpreting (4.4) as the social welfare function, the results below should be viewed as normative recommendations for the optimal penalty.

5.1. Short-term Policies

Setting policies in a dynamic framework brings us to the question of whether the government can commit to its choices of rewarding and punishing public officials.

[16] The government may also, in some cases, be able to influence the bureaucrat's bargaining power (β) and the cost of compliance (c). See the last footnotes in Sections 5.1 and 5.2.

One extreme view is that the government is totally unable to commit, and that it sets penalties in each period with no promises for what comes next. The other extreme view is that the government can perfectly well commit to penalties in the future. We will analyze both these cases, recognizing that the reality is probably somewhere in between. The exact conditions underlying the results can be found in the Appendix.

We start with the no-commitment case, assuming that every period t starts with the government setting x for that period. Since investment decisions depend on the expected *future* policies, the actual policy at time t will not affect any investments.[17] However, by changing x, the government affects the fraction of firms (c/x) that bribe instead of comply. As noticed in Section 4.1, the government may benefit from both compliance and corruption, but these two concerns are clearly in conflict when the government can influence c/x. From the government's utility function (4.4), we immediately find:

Proposition 11. *With short-term policies, the government prefers to set x high if and only if e is large and f small.*

Intuition: If f is large, the government prefers bribing instead of compliance. By decreasing x, more firms choose to bribe, thereby increasing the revenues for the government. This is in line with the "tollbooth view" on regulation. According to the public interest view, however, the government prefers firms to comply because e is large relative to f. To encourage compliance, therefore, the government prefers x to be large.[18]

5.2. Long-term Policies and Development

Above, the government only had short-term concerns since its current policies did not affect the firms' investment decision. The investments instead depend on the expected future penalties if caught taking bribes. If the firms anticipate that, in the future, x is going to be high, the bribes will be high and the incentives to invest are low. Thus, the government may be better off if it can somehow commit to its

[17] Technically, we assume that the government can only use Markov strategies.

[18] If the government also could set c and β, it is straightforward to show that it would set c high if and only if f is large and e is small and β high in any case. The government prefers to give most bargaining power to the bureaucrats (large β), because this increases the bribes without affecting anything else. The intuition for c is just the opposite of that for x.

future policies. Suppose, therefore, that the government at time t can set x once and for all.[19] For simplicity, assume $\gamma = 0$, such that the firms just compensate the government for its losses when it relaxes the rule.

Taking into account the long-term consequences of its policies, the government realizes that x, through its effect on the equilibrium bribe, affects the investment levels of the firms. To the extent that the government benefits from economic growth or a higher level of development ($u_G > 0$), it prefers to reduce x to boost the incentives to invest.[20]

Proposition 12. *With long-term policies, the government prefers to set x lower than in the short-term case, but the optimal x increases in k.*

If k is small, such that the economy is not yet developed, the dynamic effects are important. To encourage growth, small penalties on corruption are optimal since they reduce bribes and boosts investments. For k large, however, the dynamic effects are relatively less important than the static, or short-sighted, concerns. Then, x should be larger. Hence, Proposition 12 suggests that as the economy is developing, the penalties on corruption should increase.[21]

6. Robustness and Possible Extensions

In this section, we discuss several possible extensions. We first show that our results would be strengthened by (1) endogenizing f ; and (2) assuming the firms are partially credit constrained. Thereafter, we argue that our main results would continue to hold if (3) a change in the rule were long-lasting but not permanent;

[19] Ideally, the government would prefer time-dependent policies, but it is probably even harder to commit to these, as they would optimally hinge on future parameters that may not be verifiable.

[20] This discussion presumes that u_G in (4.4) is positive, implying that the government likes economic growth, all effects taken into account. If e is very large, however, it might be that the government prefers k to be low if the benefits from income and the revenues for bribes do not compensate for the externality of all firms that do not comply. If this were the case, the government would prefer high x to discourage economic growth. With enough discretion over the policies, however, the government should be able to select x so high that, eventually, $u_G > 0$. Then Proposition 11 continues to hold.

[21] Similarly to the choice of x, with long-term policies, the government prefers to set c and β lower than in the short-term case but higher c and β for large k.

(4) the number of firms were finite; and (5) time were discrete and not continuous. The formal analysis, for each extension, is available upon request.

6.1. Wage for Bureaucrats

When discussing red tape above, we assumed that the government captures a fraction f of the bribes. There are several possible explanations for this. The government may investigate the bureaucrat, and capture the bribe if it is discovered. Alternatively, the government may reduce the bureaucrat's wage in advance, if one can expect that the bureaucrat will collect a lot of bribes. Building on this assumption, suppose that the bureaucrat's reservation wage is $\underline{w}$, and that the wage offered by the government, w, must be strictly positive. Since larger expected bribes reduce the necessary explicit wage, the equilibrium wage is:

$$w = \max\{0, \underline{w} - \mathrm{E}B\}.$$

For k small, w decreases as k (and thus B) increases. Thus, $f = 1$ for small k. For k large, however, $w = 0$ and the government is unable to capture the increased bribes that follows a larger k. Hence, the government will be reluctant to relax the rule if k is small, since the government then captures all the bribes, while it can more easily be convinced to relax the rule if k is large. This mechanism may contribute to explain why firms bribe in poor countries, while they lobby in rich.[22,23]

6.2. Imperfect Credit Markets

Lobbying may require a substantial amount of resources from the firms, particularly when they compensate the government once and for all. In our analysis, this caused no problems since the firms maximized their intertemporal profit without

[22] Since some of the bribe B compensates the bureaucrat for its cost of bending the rules, one may argue that we should instead write:

$$w = \max\{0, \underline{w} - \mathrm{E}(B - \theta xk)\}.$$

This would give the same conclusion, qualitatively, since $\mathrm{E}(B - \theta xk)$ increases in k.

[23] Banerjee (1997) provides an alternative theory of why corruption may be more prevalent in poor countries.

constraint. In reality, firms may face credit constraints making them unable to overcome the cost of lobbying. How would this change the analysis?

One way of modeling credit constraints is to let a firm borrow an amount sk_{it}, proportional to its size or production, for "free" (at an interest rate of zero), while additional loans must be repaid by the factor $R > 1$. Such a high interest rate makes lobbying less attractive, particularly when k_{it} is small and a great deal of expensive borrowing is necessary. As k_{it} grows, however, the effective total cost of lobbying, $L(k) + R(L(k) - sk)$, may decrease since less money needs to be borrowed at the high interest rate. When k is sufficiently large, firms can afford to lobby. Thus, imperfect credit constraints strengthen our results, since it then becomes more likely that the cost of lobbying, as a function of k, increases less than the cost of bribing.

6.3. Changing the Rules Temporarily

The assumed difference between bribing and lobbying is extreme in that while bribing has a temporary effect, lobbying is assumed to relax the rules forever. A more general model would allow the rules to stay in place in only a certain number of periods, or let the rules change back to the original form with some positive probability every period. As long as this probability would be less than one, the results above would continue to hold: Once the capital level is sufficiently large, firms would lobby instead of bribe. New results would emerge, however: The more stable were the rules, the larger the investments would be, and the more likely it would be that the firms would eventually start lobbying. It is straightforward to introduce some stability-parameter (or number of periods before the rules can change again).

Alternatively, one could formalize the status-quo bias in politics, as mentioned in Section 2.3. With two political chambers, or a super-majority rule, several legislators are pivotal when the rule is changed. If one is pro regulation, another is against, then the firm only need to lobby the former to get the rule relaxed. Thereafter, the latter legislator prevents the former from re-introducing the rule.

6.4. A Finite Number of Firms

Qualitatively, our results hold for any number of firms, whether this number is 1, finite or infinite. But with a finite number of firms, Proposition 4 would need to be slightly modified, since the firms would invest more as they approached the time T at which they switch from bribing to lobbying. Specifically, with n firms, each firm would receive $1/n$ of the total surplus of lobbying at time T. Approaching the time of lobbying, T, firm i's investment would increase since the long-run return of investments increases (of which firm i captures $1/n$ at time T). As n increases, however, the $1/n$-effect decreases, as do the investments prior to T. This implies that investments at $t < T$ are smaller if n is larger. Thus, a large number of firms make lobbying less likely to eventually replace corruption, and if it does, this takes place at a later point in time. A greater n makes lobbying less likely, *not* due to any assumed "collective action" problem, but since the larger hold-up problem reduces the incentives to invest. If $n \to \infty$, the $1/n$ effect vanishes and investments do not increase at all when t approaches T. This simplifies the analysis and is the reason we assume an infinite number of firms.[24]

6.5. Continuous vs. Discrete Time

Some assumptions are of a rather technical nature. For example, while we occasionally talk about "period t", time is assumed to be continuous. A discrete time model may be easier to interpret. Fortunately, all our results survive in a discrete-time version of the model. Continuous time is chosen since it simplifies the analysis.

7. Empirical Evidence: A Discussion

Corruption and lobbying are substitutes to some extent. Through what we denote lobbying, a firm may be able to *change* existing rules to the firm's advantage. Through bribery, a firm may get the bureaucrat to *bend* the rules and thus avoid the full cost of compliance. There are differences, however, and in this paper we have primarily focused on one: Changing the rule affects the status-quo and its effect is thus more long-lasting than bending the rules. Promises by individual bureaucrats not to ask (or extort) for bribes in the future are typically not credible since such contracts cannot be written when corruption is illegal and because firms

[24] There might also be multiple equilibria when $n < \infty$ because, if the firms anticipate lobbying at T, they invest more and it is then likely that lobbying actually becomes worthwhile. If lobbying is not expected, investments are low and the expectation may thus be self-fulfilling.

deal with different officials over time. While policy also changes over time, we have in mind larger structural reforms, such as a trade reform, that shift property rights from bureaucrats to firm owners. Such policy reforms are typically more long-lasting.[25]

The analysis has yielded a number of empirical predictions. While it is beyond the scope of this paper to thoroughly look at them all, it is worth noting that several of the predictions are consistent with existing evidence. For example, our main result is that firms prefer bribing to lobbying early in the development process but that at later stages, when firms have invested more, they are more likely to lobby the government. However, since corruption discourages investments, the economy may be trapped in a bribing equilibrium with so little investments that the firms never switch from bribing to lobbying. The steady-state prediction for the cross-country relationship between income (or capital) and corruption is thus a decomposition of countries into two groups: one with high corruption but low investment and income and another with low corruption but high investment and income. As discussed in the Introduction, this is broadly consistent with available evidence on corruption and income. Moreover, there is some evidence, based on firm data from transition countries, that the extent of lobbying increases with income and that firms belonging to a lobby group are significantly less likely to pay bribes (Campos and Giovannoni, 2006). Campos and Giovannoni also find that in politically less stable countries, firms are more likely to bribe and less likely to join a lobby group. Using firm-level data from the World Bank's World Business Environment Survey, Bennedsen et al. (2007) show that larger firms pay bribes less frequently but have more political influence (possible due to lobbying). All these facts are consistent with our theory.[26]

Our model has also predictions on the evolution (or liberalization) of the regulatory framework. Specifically, it suggests that the regulatory framework tends to be more "efficient" over time (since sufficiently good rules are never relaxed by

[25] As an example, of the 111 countries classified as either open or closed (to trade) by Sach and Warner (1995), *no* country that had reformed and was thus classified as open in the early period (1970-1989) was classified as closed in the 1990-1999 period (Wacziarg and Welch, 2008).

[26] The analysis also highlights the role of commitment. In reality, the degree to which governments and/or bureaucrats can commit to the future differs across countries for various institutional and historical reasons. According to the model, this variation will affect firms' incentives to lobby and bribe. For example, the hold-up problem will be much less severe if the bureaucracy is coordinated and can commit to not ask for higher bribes in the future. In this case, high growth and bribery can go hand-in-hand as some suggest to be the situation in China, for example.

lobbying). To exemplify, consider two types of regulations: one put in place out of public interest, for example out of health or environmental concerns, and another instituted to provide bureaucrats with the power to demand bribes. Propositions 6-7 then state that firms are more likely to eventually, or at an earlier point in time, lobby for the removal of the "bad" regulations while the "good" regulations are less likely to be relaxed. This prediction is consistent with the regulation of trade, for example.[27] However, there is a caveat here. Good regulations may not be sustained in an environment characterized by high corruption (for instance due to a high compliance costs). In this case, the good regulations, of course, is only good "on paper", because most firms bribe their way around them anyway.

As just illustrated, the theory has cross-sectional implications. In particular, the model suggests that an industry's size is a predictor of when and whether firms switch from bribing to lobbying. The bribes increase in the firms' capital up to the point at which they switch to lobbying. Thus, the analysis predicts an inverted U-shape relationship between capital and bribes. This prediction is consistent with evidence from Uganda, for which firm survey data are available on both measures (Svensson, 2003).[28,29]

Our analysis of policy instruments provides both normative and positive predictions. Tough penalties on corruption, for example, may not be a good thing since they lead to larger bribes and thus lower investments.[30] This is in particular the case if the cost of compliance is large and in early phases of development. To the extent that poor countries regulate business more than rich countries, as suggested in Djankov et al. (2002), both these results suggest that the penalty of

[27] In the period 1970-1989, 70 percent of the countries classified by Sach and Warner (1995) were closed. In the 1990-1999 period, this number has fallen to below 30 percent (Wacziarg and Welch, 2008).

[28] Results and graphs available upon request. Svensson (2003) does not report results on industry averages or nonlinear effects of capital.

[29] Naturally, k is endogenous in the model, so that simple cross-sectional estimates of the size of an industry and the extent of bribing cannot be interpreted causally. Fortunately, our model identifies a set of variables that only affects equilibrium bribes through its effect on k; i.e., the model identifies a set of instrument variables that can be used to test this and other predictions of the model. We leave this to future work.

[30] There is plenty of anecdotal evidence supporting this mechanism. For example, Fjelstad (2003, 2006) studies the impact of the reforms of the tax administrations in Tanzania and Uganda. He argues that the reforms (increased salaries for tax officials and more relaxed rules for firing) did not result in less, but if anything more, corruption. He also reports evidence from a PriceWaterhouseCoopers' survey of firms in Dar es Salaam which indicates that the price per bribe rose following the reform.

corruption should be lower in poor countries.

Finally, it is also possible to view our model as a formalization of the human capital theories of institutions. The human capital theories argue that growth in human capital and income cause institutional development (Lipset, 1960; and more recently Glaeser et al., 2004). Interpreting the rule as a composite measure of property rights protection, we provide a model with exactly this prediction. As income grows, the hold-up problem becomes so severe (too much must be paid in bribes) that firm owners have strong incentives to lobby for improved protection of property rights.

8. Concluding Remarks

This paper distinguishes two alternative rent-seeking activities: Bending versus changing the rules. Since it is typically bureaucrats that enforce rules, while only legislators can change them, we denote a bribe aimed at bending the rule as "corruption", while an attempt to change the rule is denoted "lobbying". Assuming that changing the rule has a more long-lasting effect than bending them, we discover a larger hold-up problem associated with corruption than with lobbying. This creates a two-way relationship with the economy's level of development. On the one hand, firms invest less in a bribing equilibrium than in a lobby equilibrium. On the other, firms prefer to lobby rather than bribe if, and only if, the capital level is sufficiently large. Thus, our theory predicts an evolution where firms bribe at low levels of development, while they lobby in richer societies. However, the hold-up problem associated with corruption can be so large that the firms never invest enough to make a switch to lobbying worthwhile. The result is a poverty trap. Our model also predicts that it is good regulation, and not "red tape", that survive as the economy develops. Moreover, the optimal penalty on corruption should increase in the level of development. The model's predictions are broadly consistent with empirical evidence.

As more and better data on the extent of bribing and lobbying become available, a theory to explain why and when firms choose to lobby or bribe, and the consequences of this choice, has been called for. Here we have taken a first step in developing such a theory. Future research on comparing bribing and lobbying as alternative influence-seeking activities should explore how this choice depends on the market structure and the environment more generally.

9. Appendix

Proof of Proposition 2: (3.3) is an optimal control theory problem, with the following current-value Hamilton function:

$$H = (r-b)k - \frac{z}{2}I^2 + p\left(I - dk\right),$$

where p is the shadow value of capital. The first-order conditions are:

$$\begin{aligned} \dot{p} - \delta p &= -\frac{\partial H}{\partial k} = -(r-b) + dp \qquad (9.1) \\ \frac{\partial H}{\partial I} &= -zI + p = 0. \end{aligned}$$

Together with (2.1), this gives two differential equations with only one stable solution, which can be found straightforwardly:

$$p = \frac{r-b}{d+\delta} \quad \text{and} \quad I = \frac{p}{z}.$$

Proof of Proposition 3: If bribing were to take place forever, the evolution of k follows from (2.1). Since I is constant, solving this differential equation gives:

$$k_\tau = \frac{I}{d}\left(1 - e^{-d(\tau - t)}\right) + k_t e^{-d(\tau - t)}. \qquad (9.2)$$

The present discounted value of the firm, at time t, would be (after substituting for I):

$$V(k_t, b) = \int_t^\infty \left((r-b)k_\tau - \frac{z}{2}I^2\right) e^{-\delta(\tau - t)} d\tau = \frac{(r-b)k_t}{d+\delta} + \frac{(r-b)^2}{2z\delta\left(d+\delta\right)^2}. \qquad (9.3)$$

If lobbying has taken place, however, the firm's present value is $V(k_t, 0)$. If we let k_i represent firm i's capital level at the current time, i's benefit from lobbying is $V(k_i, 0) - V(k_i, b) - L_i$.

Suppose, for a moment, that there are n firms, and that each of them has the same relative bargaining power $(1-\gamma)/n$. Let $\Delta u_G(k)$ denote the government's present discounted reduction in utility by relaxing the rule. The Nash bargaining solution is given by

$$\max_{\{L_i\}_i}\left[\prod_i \left(V(k_i,0)-V(k_i,b)-L_i\right)^{(1-\gamma)/n}\right]\left(L-\Delta u_G(k)\right)^{\gamma} \text{ s.t. } \textstyle\sum_i L_i/n = L. \tag{9.4}$$

This problem can be solved in two stages. For a given L, the distribution of the L_is across the firms are given by maximizing the square brackets subject to $\sum_i L_i/n = L$:

$$\begin{aligned} V(k_i,0)-V(k_i,b)-L_i &= \textstyle\sum_j \left(V(k_j,0)-V(k_j,b)-L_j\right)/n \Rightarrow \\ \frac{bk_i}{d+\delta}-L_i &= \frac{b\sum_j k_j/n}{d+\delta}-L \Rightarrow L_i = \frac{b(k_i-k)}{d+\delta}+L. \end{aligned} \tag{9.5}$$

Clearly, this holds also when $n\to\infty$. Having solved L_i as a function of L, we can use this function to calculate the equilibrium L when solving (9.4). This gives

$$\begin{aligned} L-\Delta u_G(k) &= \gamma\left(\frac{bk_t}{d+\delta}-\Delta u_G(k)\right)\Rightarrow \\ L &= \frac{\gamma bk}{d+\delta}+(1-\gamma)\,\Delta u_G(k) \\ &= \frac{k}{d+\delta}\left[\gamma b+(1-\gamma)\,e(1-c/x)\right]+(1-\gamma)\frac{re(1-c/x)+bec/x}{z\delta\,(d+\delta)^2}, \end{aligned}$$

where I have calculated $\Delta u_G(k)$ in a similar way as done in the proof of Proposition 5.

Proof of Proposition 4: (i) Anticipating lobbying at time T, a firm's problem is:

$$\max_{I_\tau}\int_t^T\left((r-b)k_\tau-\frac{z}{2}I^2\right)e^{-\delta(\tau-t)}d\tau+\left[V(k_{i|\tau=T},0)-L_i\right]e^{-\delta(T-t)} \text{ s.t. (2.1).}$$

The first-order conditions are (9.1), as before. The terminal condition, however becomes $p_T=\partial\left(V(k_{i|\tau=T},0)-L_i\right)/\partial k_{i|\tau=T}=(r-b)/\left(d+\delta\right)$ when substituting for L_i from (9.5). This is clearly satisfied when $p=zI$ and I is given by (3.4). (ii) follows from Proposition 2. *QED*

Proof of Proposition 5: The proofs below are assuming the most general utility function (4.4) for the government. Setting $f = g = 0$ gives Propositions 5-6.

In a bribing equilibrium, the present discounted value of the government's welfare function is found by simply integrating (4.4), which gives:

$$
\begin{aligned}
& [(f(1+\beta)c/2 - e)(c/x) + g]\, K(k,b), \text{ where} && (9.6) \\
K(k,b) &\equiv \int_t^{\infty} k_\tau e^{-\delta(\tau - t)} d\tau = \frac{r-b}{z\delta\,(d+\delta)^2} + \frac{k_t}{(d+\delta)}.
\end{aligned}
$$

If the government relaxes the rule, c and b become 0, and the government's welfare simply $(g-e)\,K(k,0)$. The reduction in the government's utility is:

$$
\begin{aligned}
\Delta u_G(k) &= (f(1+\beta)c/2 - e)\,(c/x)\,K(k,b) + eK(k,0) - g\,[K(k,0) - K(k,b)] \\
&= \frac{\eta k}{d+\delta} + \frac{(r-b)\,[(f(1+\beta)c/2 - e)c/x] + re - gb}{z\delta\,(d+\delta)^2} \\
&= \frac{\eta k}{d+\delta} + \frac{(r-b)\eta + b(e-g)}{z\delta\,(d+\delta)^2}, \text{ where} && (9.7) \\
\eta &\equiv f(c/x)(1+\beta)c/2 + e(1 - c/x). && (9.8)
\end{aligned}
$$

Notice that $\Delta u_G(k) > 0$ (unless g is very large), implying that the government, in isolation, always prefer regulation. The total surplus, when the government relaxes the rule, is:

$$
\begin{aligned}
& V(k_T, 0) - V(k_T, b) - \Delta u_G = mk - s, \text{ where} && (9.9) \\
m &= \frac{b-\eta}{d+\delta}, \\
s &= \frac{b(e-g-b/2) - (b-\eta)(r-b)}{z\delta\,(d+\delta)^2}.
\end{aligned}
$$

Note: The firms' aggregate present discounted value, at time t, if lobbying is expected at time T, is:

$$
V(k_t, b) + (1 - \beta_G)\,[mk_T - s]\,e^{-\delta T},
$$

while the government receives the other fraction (γ) of the surplus when the firms move to lobbying instead of bribing (due to the Nash bargaining solution). Thus, both firms and the government would like to maximize this surplus, i.e., they agree on T, which is independent of γ. Maximizing the present-discounted value of this surplus leads to the first-order condition:

$$\begin{aligned} \left[mk_T' - \delta\left(mk_T - s\right)\right] e^{-\delta T} &= 0, \text{ where} \\ k_T' &= I - dk. \end{aligned}$$

The second-order condition holds if $m > 0$, which gives condition (3.6) when substituting for m, η, b and setting $g = f = 0$. Solving for k_T, we get:

$$\begin{aligned} k_T &= \frac{mI + \delta s}{m(\delta + d)} = \frac{(b-\eta)I + \delta\left(d+\delta\right)s}{(b-\eta)(\delta+d)} \\ &= \frac{(b-\eta)I\left(d+\delta\right)z + \left[b(e-g-b/2) - (b-\eta)(r-b)\right]}{(b-\eta)\left(d+\delta\right)^2 z} \\ &= \frac{e-g-b/2}{(1-\eta/b)\left(d+\delta\right)^2 z}, \end{aligned} \tag{9.10}$$

where b and η are given by (3.2) and (9.8). Thus, k_T is increasing in e and f but decreasing in g, d, δ, z. Setting $f = g = 0$, we see that if β or c increases, the numerator decreases while the denominator increases, and k_T decreases. If x increases, both the numerator and the denominator decreases (since η increases in x). The latter effect dominates if e (and thus $\partial\eta/\partial x$) is large, and then k_T increases in x. Condition (3.7) follows from (9.10) by setting $f = g = 0$ and $\overline{k} = k_T$.

Proof of Proposition 6: Substituting for k_T in (9.10) gives T, the time at which firms switch from bribing to lobbying:

$$\begin{aligned} \frac{I}{d}\left(1 - e^{-dT}\right) &= \frac{b(e-g-b/2)}{(b-\eta)\left(d+\delta\right)^2 z} \\ \left(d+\delta\right)\left(r-b\right)\left(1-e^{-dT}\right) &= \frac{db(e-g-b/2)}{\left[(1-f)(1+\beta)c^2/2x + (c-e)(1-c/x)\right]}. \end{aligned}$$

However, if e.g. $(r - b)$ is small, the left-hand side is always smaller than the right-hand side, such that k never reaches k_T.

Proof of Propositions 7: The proof follows from the *Note* in the proof of Proposition 5.

Proofs of Propositions 8-9 follow from the proofs of Propositions 5 and 6.

Proof of Propositions 10: The total surplus will be as in (9.9), minus $h(K(k,0) - K(k,b))$. Thus, the results above holds if just g is replaced by $(g - h)$.

Proof of Proposition 11: When taking the derivative of (4.1), we can ignore the effects on I and k (since these depend on *future* policies, not current policies):

$$\frac{\partial u_G}{\partial(-1/x)} = -f(1+\beta)c^2 k/2 + eck \tag{9.11}$$

The derivative is taken with respect to $(-1/x)$ instead of x for convenience only (the two derivatives are obviously of the same sign). Although this derivative does not pin down the optimal penalty (the proposition refers to the sign of the derivative), there are two alternative ways of pinning it down. Either the derivative could be set equal to some marginal cost of adjusting the penalties,[31] or the derivative could be set equal to zero given some boundary on $x \in [\underline{x}, \overline{x}]$.[32] In either case, Proposition 10 follows. *QED*

Proof of Proposition 12: With commitment to policies, the government's intertemporal utility is

$$[f(1+\beta)c/2 - e)(c/x) + g]\, K(k,b),$$

i.e., just as if bribing were to continue forever, since this is the utility it will receive when the firms have all the bargaining power, and can make a take-it-or-leave-it offer. The derivative w.r.t. $(-1/x)$ becomes:

$$\left[ec - f(1+\beta)c^2/2\right] K(k,b) + \left(\frac{u_G}{k}\right) \frac{\partial K(k,b)}{\partial(-1/x)}\text{ , where} \tag{9.12}$$

$$\frac{\partial K(k,b)}{\partial(-1/x)} = -\frac{(1-\beta)c^2/2}{z\delta\,(d+\delta)^2} < 0$$

[31] If κ represented convex cost functions proportional to k, the first-order condition would be:

$$\begin{aligned} ec - f(1+\beta)c^2/2 &= \kappa_x'(x) \Rightarrow \\ x &= \kappa_x'^{-1}\left(ec - f(1+\beta)c^2/2\right). \end{aligned}$$

[32] The optimal x would then be $x = \overline{x}$ if

$$ec - f(1+\beta)c^2/2 > 0,$$

and $\underline{x}$ otherwise.

For the first-order condition (9.12), the first bracket is simply the derivative in the short-term case (9.11). This is multiplied by $K(k,b)$, increasing in k. The second terms take into account the long-run effects on investment and growth, and its sign dictates the difference to the previous proof. As we noticed there, to pin down policies, the derivative could be equalized to marginal costs of adjusting the x, or it could be set equal to zero given some boundary on $x \in [\underline{x}, \overline{x}]$. *QED*

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