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 can either bribe bureaucrats to "bend the rules" or lobby the government to "change the rules". While changing the rules is more permanent, the bureaucrat cannot commit not to ask for bribes also in the future. Based on this assumption, we find that firms bribe when the level of development is low, but they switch to lobbying when the level of development is sufficiently high. However, bribing leads to hold-up problems which discourage firms from investing, and the economy might get stuck in a poverty trap with bribing forever.

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 *get around* existing rules or policies.

While there is little comprehensive data on the extent of corruption and lobbying across countries, 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.[2] What can account for this difference between developed and developing countries? Should we expect an evolution from bribing to lobbying, as the above quotation suggests, or can countries get trapped in a bribing equilibrium forever?

Bribing and lobbying differ in important dimensions. First, lobbying is a legal and regulated activity in many countries, while bribing is not. 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 the effect of bribing 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. Although policies and politicians also change over time, relaxing the rules changes the status quo. This makes a change in the rules more permanent, since there is a status-quo bias in politics. The driving force in our model is thus that government's ability to commit is *relatively* stronger than that of an individual hbureaucrat.[3]

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

[2] There is a fairly close (negative) correlation between various subjective measures of corruption and income (for a review of the literature, see Svensson 2005). There is also some preliminary evidence that the extent of lobbying increases with income. Using firm data from almost 4000 firms from 25 transition countries, Campos and Giovannoni (2005) find that the share of firms belonging to a lobby group increases with GDP per capita. They also find evidence suggesting that corruption and lobbying are substitutes; i.e., firms belonging to a lobby group are significantly less likely to pay bribes.

[3] Empirical support for this assumption is discussed in Section 7. Intuitively, a status-quo bias arises in politics if e.g. there are several pivotal legislators, and that one of these are reluctant to re-introduce the rule, once it is relaxed. Moreover, a change of the rules may be governed by time-consuming procedural rules. It may also require the commission of reports to study impact and may need to be referred for

We study a simple growth model where firms are initially subject to a regulation. For example, a licence 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. At some point, the bribes are so high that the bureaucrats price themselves out of the market. Thus, there might be an evolution from bribing to lobbying. On the other hand, there is a hold-up problem between the bureaucrats and the firms, because the more a firm invests, the more it has to pay in bribes. 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 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 key 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 – exactly the perception mentioned above.[4] 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. We follow Shleifer and Vishny (1993) and 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,

consideration at various authorities and courts. Frequent changes in, for example, the tariff structure may also have an impact on a country's relation to its trading partners. All these factors suggest that frequently changing the law is costly. Nevertheless, Section 6.3 discusses how this assumption could be relaxed.

[4]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.

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.[6]

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 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) 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. The model is solved in the following section. Section 3.1 solves for the bribes, Section 3.2 solves for the lobbying equilibrium, and Section 3.3 compares the two and determines when firms prefer one rather than the other. 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. That section also discusses competition between the firms, and how that can make the poverty trap more likely. Section 5 analyzes the penalty on corruption, and finds that this is likely to increase with the level of development. Alternative possible extensions are discussed in Section 6, while Section 7 discusses the empirical predictions.

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

[6] This paper is also related to the political economy literature on policy reform and policy persistence. Fernandez and Rodrik (1991) and Alesina and Drazen (1991) argue that informational asymmetries between winners and losers of the reform can explain why reforms are not undertaken or are delayed. Brainard and Verdier (1997) and Coate and Morris (1999) instead stress the reaction of interest groups to the introduction of a policy. Our argument for policy persistence differs from these models in important ways. Specifically the policy in place is assumed to be costly for the firms. Thus, when firms lobby, they do it to change the policy. As in Brainard and Verdier (1994) and Coate and Morris (1999), adjustment (or investment) is a key variable in our analysis. However, if firms undertake less adjustment or invest too little, they may never build up a sufficiently large stock of capital to make lobbying worthwhile. The economy will then be stuck in an equilibrium with policy persistence and bribing.

2. A Model of Bribing, Lobbying and Growth

2.1. Players and Preferences

There are three sets of players in this 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 $f(k_i) = rk_i$, where r is a productivity parameter. To simplify, we let there be a large (infinite) number of identical firms, of measure one. In equilibrum, $k_i = k$, the average (and aggregate) level of capital. Thus, we often drop the subscript (i) denoting firm i. Section 6.4 discusses how the results would change if there were a finite number of firms, and Section 5.3 analyzes competition between the firms.

Each firm faces some regulation which it must overcome.[7] 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 the entire production, which is proportional to k_i. Thus, the rule could be interpreted as an industrial licensing requiremen, where either input or output is subject to administrative approval or a tariff.

Section 4 discusses the "red tape" interpretation of regulation, where the rules are in place mainly to generate revenues for the government. In this section we assume that the rule is in place because the government prefers the firms to comply.[8] Assume that for a firm i that does not comply, the government's utility is $-ek_i$. The parameter e measures the externality if firms comply instead of not comply. This externality 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.

Even a bureaucrat may prefer that the firm complies, since otherwise bureaucrat j's utility is $-e_j k_i$. The bureaucrat and the government can of course have different preferences for compliance, so we allow $e_j \neq e$. Moreover, e_j may be different for different bureaucrats. Assume that the e_js are uniformly *i.i.d.* distributed across firms and time:

$$e_j \sim U[0, x].$$

Let $c \in (0, x)$, such that some bureaucrats (and firms) are corrupt, while other comply. The results below would be identical if we instead assumed that the firms have different costs of complying (that may change over time), while bureaucrats have identical preferences (e.g. $e_j = e$). There is no need for private information in the model, so we let e_j be observed by the firm before it negotiates with the bureaucrat.

While both the government and the bureaucrats may prefer the firms to comply, the interpretation of e_j can be very different from the interpretation of e: A bureaucrat may not necessarily care about pollution, per se, but, for example, about being punished if the firm he is supposed to monitor, does not comply. Thus, e_j can represent the expected penalty

[7] We do not formalize how the rule was introduced in the first place, although it will become clear from the analysis that the government do benefit from the regulation at low levels of development.

[8] Pigou's (1938) public interest theory of regulation holds that unregulated markets exhibit frequent market failures and that a government that pursues social efficiency counters these failures and protects the public through regulation (see Djankov *et al.*, 2002).

for the bureaucrat, $e_j = \theta x$, if $\theta \sim U[0,1]$. With this interpretation, x may measure the expected penalty for being caught for corruption, while θ may represent the individual stigma associated with being penalized for corruption, or the individual probability of being investigated. The total expected penalty, $\theta x k_i$, increases in 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. We frequently drop the subscript on k_i, and write simply k, whenever this is not misleading.

2.2. Bribing

If a firm does not want to comply to 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.[9] 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

Second, the firms may lobby the government to *change* the rules. Successful lobbying requires that the firms pay an amount L to the government, compensating it for the future disutility when no firms have to comply. 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 power is β_G, and the firms share equally the remaining bargaining power, $1 - \beta_G$.[10]

In contrast to the bureaucrat's "bending" of the rule, *changing* the rules affect the status quo. After the rule is relaxed, there is no need to comply or negotiate with the bureaucrat. There is a status-quo bias in politics which prevents the rule for being re-introduced immediately. To simplify, we assume that if the rules are relaxed, they are relaxed forever. In contrast to the bureaucrat, the government can commit, and it can

[9] This bargaining power may be interpreted as the number of bureaucrats that are necessary to bribe.

[10] The government's bargaining power may be interpreted as the number of legislators that are necessary to lobby.

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.

commit to relax the rule for all future. This is an extreme assumption, and Section 6.3 discusses how it can be relaxed: It is sufficient for our results that the government is *better* able to commit than the bureaucrat. 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. Since the firms are identical in equilibrium, they all agree on whether (and when) to lobby. In fact, even the government agrees on when (and whether) to negotiate with the firms.[11] If the firms end up not lobbying, they proceed individually. Then, each firm observes the type of its bureaucrat and determines whether to negotiate a bribe B 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.

Although it is convenient to refer to "period t", we let time 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.

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:

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

The discount rate, δ, captures the firms' valuation of the future and may be small in consolidated democracies but large in unstable environments. We normalize time such that $k_0 = 0$ at $t = 0$. Subscript t is frequently suppressed for convenience.

3. From Bribing to Lobbying

We solve the model 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 in equilibrium lobby instead of bribe. Our main results are that (i) bribing generates a hold-up problem that reduces investments, (ii) firms prefer to lobby if k is large, but (iii) the economy may be stuck in a poverty trap, where the bribes are so high that the firms never reach the capital level necessary to trigger the switch to lobbying. All proofs are in the Appendix.

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

3.1. Bribes and Investments

Before deciding whether to comply, a firm learns the type $e_j \in [0, x]$ of its current bureaucrat. If $e_j k < ck$, the firm and the bureaucrat can both be better off if the firm pays a bribe $B \in (e_j k, ck)$ to the bureaucrat to circumvent the regulation.[12] 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:

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

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 it is more likely that a large firm will be investigated). For both reasons, large firms pay more bribes. Clearly, B is also increasing in c, the cost of compliance, since a larger c reduces the firm's bargaining power and the bureaucrat can ask for accordingly higher bribes. This is particularly important if the bureaucrat's relative bargaining power is large. Thus, B also increases in β. Finally, notice that if e_j is large, then B is large because the bureaucrat must be compensate the bureaucrat for the large loss he faces when the firm is not complying.

Since e_j is uniformly distributed on $[0, x]$, the probability that $e_j < c$ and the firm bribes is c/x, while it complies with probability $1 - c/x$. This is quite intuitive: 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), is increasing in k, c, β and e_j.*

Before learning the bureaucrat's type, a firm's current expected profit, if there is no lobbying, can be written as

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

b increases in c, x and β. 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 c, x and β.*

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

[12] We frequently drop subscribt i for the firm.

The more capital the firm has, the higher the bribes will be. This discourages the firm from investing. Thus, bribing leads to a typical hold-up problem, since the bureaucrat cannot commit to not ask for higher bribes in the future. 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 reduces the incentives to invest. A large x reduces 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, $V(k, b)$, which depends on its current level of capital and, of course, 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 $V(k, 0)$. Whether the firms benefit from lobbying thus depends on a consideration of $V(k, b)$, $V(k, 0)$ and the cost of lobbying, $L(k)$.

The cost of lobbying will be an increasing function of k, $L(k)$. But since there are many firms, each firm perceives its effect on L (through k_i) to be negligible. However, the firms not only negotiate L, but also the individual contributions under the constraint that the contributions must sum to L. If the negotiations fail, the default is to bribe or comply.[13] Since Proposition 1 states that larger firms must pay more bribes, it is more beneficial for firm i to lobby instead of to bribe if its level of capital, k_i, is large. Firm i's eagerness to lobby, however, can be exploited by the other firms which can force firm i to pay more of the costs.

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

$$L_i = \frac{b(k_i - k)}{d + \delta} + L(k). \tag{3.5}$$

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.[14] If lobbying has taken place, such that the rules are relaxed, the firms approach a new steady state. Then, without hold-up problems in every period, firms choose to invest more.

[13] 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.

[14] The reason is that bribing is the default if the firms' negotiations break down. At the lobby stage, with the Nash bargaining solution, each firm ends up with a payoff equal to its default payoff $V(k_i, b)$ 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 $V(k_i, b)$, plus a constant which is independent of k_i. Thus, i invests as if it had to continue to bribe forever.

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 $t > T$, the investments are given by:*

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

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. In equilibrium, all firms make equally large investments and they will thus agree on when to lobby and when to 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 e is small while β, c, d, δ, z are large.*

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

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

The cost of bribing and the cost of lobbying are both increasing in k, the aggregate level of capital. If (3.6) holds, the bribes are increasing faster in k than the cost of lobbying. Since the first term of (3.6) always is positive, the condition always hold unless c is sufficiently larger than e. It follows, as a corollary, that the regulation always is relaxed unless it is sufficiently "good". Intuitively, the reason is that while some firms comply, and this is beneficial to the government, other firms bribe. This generate a deadweight loss which increases in k. For k sufficienty large, therefore, the deadweight loss of the bribes is so large that the firms are willing to compensate the government (and the government is willing to accept) for its future loss when no firms are going to comply.

Suppose that (3.6) holds. If k is small, the equilibrium bribes are small and cheaper than lobbying (if $e > b/2$). But as k grows, the bureaucrat continues to ask for increasingly larger bribes. Since the bureaucrats cannot commit not to ask for higher bribes in the future, they eventually "price themselves out of the market". At that point, firms turn to politicians and instead lobby. It is costly to lobby since the government prefers the firms to comply to the rule. If d, δ and 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 if the bribes are large, which is the case if c and β are large. x also increases the bribes, but it 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) 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 instead of bribing 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).*

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

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

The result follows from Propositions 4 and 5. Investments are larger if r is large while b is small, 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 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, x, is thus one of the parameters that can make the poverty trap more likely.

Notice that neither $\overline{k}$ nor T depend on β_G, the government's bargaining power. When bargaining with the government, the firms get a fraction $(1-\beta_G)$ 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 β_G, and it would be the same if the government could decide when to negotiate with the firms.

4. Concerns for Revenues, Growth and Competition

This section shows how the simple model above can easily be extended. In turn, we discuss "red tape" regulation (where the government benefits directly from the bribes); the government's concern for economic growth; and externalities (or competition) between the firms.

4.1. Red Tape

Above, we assumed that the government benefit by the firms that comply only. An alternative view, the public choice theory or "tollbooth view", is that regulation is in place to extract rents from the firms.[15] The bribes collected by the bureaucrat 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. 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 7. *Assume (4.2) holds. (i) Lobbying replaces bribing if* k is sufficently large. (ii) *Given* k*, lobbying is more likely to replace bribing if* f *is small, and (iii) it does so at an earlier point in time.*

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

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 eventually replace bribing. 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. Intuitively, the reason is that there is a deadweight loss when not all firms bribe: Some firms comply, and this loss increases in k. For a sufficiently large k, firms lobby instead of bribe.

Part (ii) and (iii) are both quite intuitive: 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 deadweight loss is sufficiently large.

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

[15] 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).

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.

$$u_G = -e(c/x)k + f(c/x)c(1+\beta)k/2 + gk, \tag{4.3}$$

The Appendix proves the following result:

Proposition 8. *Assume (4.2) holds. (i) Lobbying replaces bribing if* k is sufficently 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.*

Condition (*4.2*) is the same as before, since g does not affect how the bribe (or the cost of lobbying) depends on k. Part (ii) and (iii) are both very intuitive: If the government benefits by economic growth, it is more symphatetic 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.

4.3. Competition between the Firms

It is simple to modify the firms' profit function, and study the impact on the equilibrium. 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 also be an important aspect when firms decide whether to lobby or bribe. If, for example, 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'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. The Appendix proves:

Proposition 9. *Assume (4.2) holds. (i) Lobbying replaces bribing if* k is sufficently 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.*

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.[16] 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.

5. Penalties on Corruption

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 favoured direction. In particular, the parameter x above may, as mentioned in Section 2, be interpreted as the (expected) penalty of being caught in corruption. How should the government set this penalty? The government may also, in some cases, be able to influence the bureaucrat's bargaining power (β) and the cost of compliance (c).

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. One extreme view is that the government is totally unable to commit, and that it sets policies in each period with no promises for what comes next. The other extreme view is that the government can perfectly well commit to policies in the future, for example by setting policies now that are protected by constitutional rules forever. We will analyze both these cases, recognizing that the reality is probably somewhere in between.

We start with the no-commitment case, assuming that every period t starts with the government setting its policy for that period.[17] Since investment decisions depend on the expected *future* policies, the actual policy at time t will not affect any investments. However, by changing c or 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 (4.3), we immediately find:

Proposition 10. *With short-term policies, the government prefers to set* (i) *c high if and only if f is large and e is small,* (ii) *x high if and only if e is large and f is small, and (iii) β high in any case.*

These results are quite intuitive. According to the tollbooth view on regulation (f

[16] 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.

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

large), the government prefers bribing instead of compliance. By decreasing x and increasing c, more firms choose to bribe, thereby increasing the revenues for the government. According to the public interest view (e large), the government prefers firms to comply. Then, it prefers x to be large while making c small. In either case, the government prefers to give most bargaining power to the bureaucrats (large β), because this increases the bribes without affecting anything else.

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 policies. If the firms anticipate that, in the future, c, x and β are going to be high, the incentives to invest are low. Thus, the government may be better off if it can somehow commit to its future policies. The government is able to commit, indeed, if policies are costly to change and thus sticky. Suppose, therefore, that the government at time t can set its policies which will thereafter be in place forever.[18] This is in line with our assumption that lobbying induces the government to permanently relax the rules. For simplicity, assume $\beta_G = 0$, 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 c, x and β affect 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 may want to reduce these parameters to boost the incentives to invest.

Proposition 11. *With long-term policies, the government prefers to set* (i) *c, x and β lower than in the short-term case, but* (ii) *higher c, x and β for large k.*

If k is small, such that the economy is not yet developed, the dynamic effects are very important. To encourage growth, low regulation costs c, small penalties x on corruption, and less power to the bureaucrat, β, are optimal since lowering any of these parameters reduces the bribes and boosts investments. For k large, however, the dynamic effects are relatively less important than the static, or short-sighted, concerns. Then, c, x and β should be larger. Therefore, Proposition 10 suggests that as the economy is developing, the extent of regulation and the penalties on corruption should both increase.

In contrast to the short-term case, where k is given, long-term policies depend on the government's value of growth, g. A larger g results in lower c, x and β, since the effects on growth are then more important.[19]

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

[19] The above discussion has presumed that $u_G > 0$, 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 and β to discourage economic growth. With enough discretion over the policies, however, the government should be able to select x and β so high that, eventually, $u_G > 0$. Then, the above results continue to hold.

6. Robustness and Possible Extensions

In this section, we discuss several possible extensions.[20] First, we discuss two extensions that would strengthen our results, i.e., by weakening the conditions necessary for lobbying to eventually replace bribing. Thereafter, we discuss three assumptions that may, at first, appear to be strong. We argue that the results would survive if these assumptions were relaxed.

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 w_0, and that the wage offered by the government, w, must be strictly positive. Since larger expected bribes reduces the necessary explicit wage, equilibrium wage is:

$$w = \max\left\{0, w_0 - \mathrm{E}B\right\}.$$

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. Thus, 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 contributes to explain why firms bribe in poor countries, while they lobby in rich.

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 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 modelling credit constraints is to let the firms borrow an amount sk, proportional to their 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 is small and a great deal of expensive borrowing is necessary. As k grows, however, the effective cost of lobbying, $L + R(L - sk)$, decreases 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

[20] Each extension can be analyzed formally, but we have abstained from doing this in order to keep the paper short.

less than the cost of bribing.The above analysis is a first attempt at comparing corruption and lobbying and the transition from the former to the latter. Much more research needs to be done, however, as we have relied on a number of simplifying assumptions. This section discusses some of these assumptions and suggests how they might be relaxed.

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 were less than one, the results above would continue to hold. Once the capital level was 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, mentioned above. 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

Another simplifying assumption is to let there be an infinite number of firms. With a finite number of firms, Proposition 4 would need to be modified, since the firms would invest more as they approach 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 j's investment would increase since the long-run return of investments increases (of which firm j 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 makes lobbying less likely to eventually replace bribes, 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.[21]

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

6.5. Continuous vs. Discrete Time

Some assumptions are of a more 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. Assuming continuous time is only due to convenience, since it simplifies the analysis.

7. Discussion

Corruption and lobbying are substitutes to some extent. Through 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: Lobbying changes the status-quo and its effect is thus more permanent than bribing. Promises by individual bureaucrats not to ask (or extort) for bribes in the future are not credible since such contracts cannot be written when corruption is illegal and because firms 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 permanent.[22]

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 many 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 preliminary 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, 2005). 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. All these facts are consistent with our theory.[23]

[22] 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, 2003).

[23] 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.

While our model does not address why firms are regulated in the first place, it has predictions on the evolution (or liberalization) of the regulatory framework over time. Specifically, it suggests that the regulatory framework tends to be more "efficient" over time (since sufficiently good rules are never relaxed by 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.[24]

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).[25,26]

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.[27] 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 corruption should be lower in poor countries.

This paper is only a first attempt at comparing bribing and lobbying as alternative influence-seeking activities. Future research should explore how this choice depends on the market structure and the environment more generally. This is necessary not only to understand large cross-country variations in corruption and lobbying activities, but also to derive policies that mitigate corruption and, at the same time, avoid poverty traps.

[24] 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, 2003).

[25] Results and graphs available upon request.

[26] 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.

[27] 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.

8. 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:

$$\begin{aligned} \dot{p} - \delta p &= -\frac{\partial H}{\partial k} = -(r-b) + dp \\ \frac{\partial H}{\partial I} &= -zI + p = 0. \end{aligned} \tag{8.1}$$

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:

$$k_\tau = \frac{I}{d}\left(1 - e^{-d(\tau - t)}\right) + k_t e^{-d(\tau - t)}. \tag{8.2}$$

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

$$V(k_t, b) = \int_t^\infty \left((r-b)k_\tau - \frac{z}{2}I^2\right) e^{-\delta(\tau - t)} d\tau = \frac{(r-b)k_t}{d+\delta} + \frac{(r-b)^2}{2z\delta\left(d+\delta\right)^2}. \tag{8.3}$$

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 $(1 - \beta_G)/n$. 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

$$\max_{\{L_i\}_i} \left[\prod_i \left(V(k_i, 0) - V(k_i, b) - L_i\right)^{(1-\beta_G)/n}\right] \left(L - \Delta u_G(k)\right)^{\beta_G} \text{ s.t. } \textstyle\sum_i L_i/n = L. \tag{8.4}$$

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 $\sum_i L_i/n = L$:

$$\begin{aligned} V(k_i, 0) - V(k_i, b) - L_i &= \textstyle\sum_j \left(V(k_j, 0) - V(k_j, b) - L_j\right)/n \Rightarrow \\ \frac{bk_i}{d+\delta} - L_i &= \frac{b\sum_j k_j/n}{d+\delta} - L \Rightarrow L_i = \frac{b(k_i - k)}{d+\delta} + L. \end{aligned} \tag{8.5}$$

Clearly, this holds also when $n \to \infty$.

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 (8.1), as before. The terminal condition, however becomes $p_T = \partial \left(V(k_{i|\tau=T}, 0) - L_i \right) / \partial k_{i|\tau=T} = (r-b)/(d+\delta)$ when substituting for L_i from (8.5). 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 (4.3) 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 (4.3), which gives:

$$\left[(f(1+\beta)c/2 - e)(c/x) + g \right] K(k,b), \text{ where} \tag{8.6}$$

$$K(k,b) \equiv \int_t^\infty k_\tau e^{-\delta(\tau - t)} d\tau = \frac{r-b}{z\delta (d+\delta)^2} + \frac{k_t}{(d+\delta)}.$$

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:

$$\begin{aligned} \Delta u_G(k) &= (f(1+\beta)c/2 - e)(c/x) K(k,b) + eK(k,0) - g\left[K(k,0) - K(k,b) \right] \\ &= \frac{\eta k}{d+\delta} + \frac{(r-b)\left[(f(1+\beta)c/2 - e)c/x \right] + re - gb}{z\delta (d+\delta)^2} \\ &= \frac{\eta k}{d+\delta} + \frac{(r-b)\eta + b(e-g)}{z\delta (d+\delta)^2}, \text{ where} \qquad (8.7) \\ \eta &\equiv f(c/x)(1+\beta)c/2 + e(1-c/x). \qquad (8.8) \end{aligned}$$

The total surplus, when the government relaxes the rule, is:

$$V(k_T, 0) - V(k_T, b) - \Delta u_G = mk - s, \text{ where} \tag{8.9}$$

$$\begin{aligned} m &= \frac{b-\eta}{d+\delta}, \\ s &= \frac{b(e - g - b/2) - (b-\eta)(r-b)}{z\delta (d+\delta)^2}. \end{aligned}$$

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

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

while the government receives the other fraction (β_G) 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 β_G. 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 $m > 0$. Solving for k_T, we get:

$$\begin{aligned} k_T &= \frac{mI + \delta s}{m(\delta + d)} = \frac{(b-\eta)I + \delta\left(d+\delta\right)s}{(b-\eta)(\delta+d)} \\ &= \frac{(b-\eta)I\left(d+\delta\right)z + \left[b(e-g-b/2) - (b-\eta)(r-b)\right]}{(b-\eta)\left(d+\delta\right)^2 z} \\ &= \frac{e-g-b/2}{(1-\eta/b)\left(d+\delta\right)^2 z}, \end{aligned} \tag{8.10}$$

where b and η are given by (3.2) and (8.8). 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 denumerator increases, and k_T decreases. If x increases, both the numerator and the denumerator 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.

Proof of Proposition 6: Substituting for k_T in (8.10) gives T, the time at which firms switch from bribing to lobbying:

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

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 7-8 follows from the two previous proofs.

Proof of Propositions 9: The total surplus will be as in (8.9), minus $h\left(K(k,0) - K(k,b)\right)$. Thus, the results above holds if just g is replaced by $(g-h)$.

Proof of Proposition 10: When taking the derivatives of (4.1), we can ignore the effects on I and k (since these depend on *future* policies, not current policies):

$$\begin{aligned} \frac{\partial u_G}{\partial c} &= f(1+\beta)ck/x - ek/x \\ \frac{\partial u_G}{\partial(-1/x)} &= -f(1+\beta)c^2k/2 + eck \\ \frac{\partial u_G}{\partial \beta} &= fkc^2/2x. \end{aligned} \tag{8.11}$$

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 these derivatives do not pin down the optimal policies (the proposition refers to the sign of the derivatives), there are two alternative ways of pinning these down. Either these derivatives could be set equal to some marginal cost of adjusting these policies,[28] or the derivatives could be set equal to zero given some boundaries on $c \in [\underline{c}, \overline{c}]$, $x \in [\underline{x}, \overline{x}]$ and $\beta \in [\underline{\beta}, \overline{\beta}]$. In any case, Proposition 10 follows. *QED*

Proof of Proposition 11: 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 derivatives w.r.t. c, $(-1/x)$ and β becomes:

$$\begin{aligned} &[f(1+\beta)c/x - e/x]\, K(k,b) + \left(\frac{u_G}{k}\right) \frac{\partial K(k,b)}{\partial c} \\ &\left[ec - f(1+\beta)c^2/2\right] K(k,b) + \left(\frac{u_G}{k}\right) \frac{\partial K(k,b)}{\partial(-1/x)} \\ &\left[fc^2/2x\right] K(k,b) + \left(\frac{u_G}{k}\right) \frac{\partial K(k,b)}{\partial \beta}, \text{ where} \end{aligned} \tag{8.12}$$

$$\begin{aligned} \frac{\partial K(k,b)}{\partial c} &= \frac{-1 + (1-\beta)c/x}{z\delta\left(d+\delta\right)^2} < 0 \\ \frac{\partial K(k,b)}{\partial(-1/x)} &= -\frac{(1-\beta)c^2/2}{z\delta\left(d+\delta\right)^2} < 0 \\ \frac{\partial K(k,b)}{\partial \beta} &= -\frac{c^2/2x}{z\delta\left(d+\delta\right)^2} < 0. \end{aligned}$$

For each of the first-order conditions (8.12), the first bracket is simply the derivative in the short-term case (8.11). These are multiplied by $K(k,b)$, increasing in k. The second terms take into account the long-run effects on investment and growth, and their signs dictate the difference to the previous proof. As we noticed there, to pin down policies, the derivatives could be equalized to marginal costs of adjusting the policies, or they could be set equal to zero given some boundaries on $c \in [\underline{c}, \overline{c}]$, $x \in [\underline{x}, \overline{x}]$ and $\beta \in [\underline{\beta}, \overline{\beta}]$. *QED*

[28] If κ represented U-shaped cost functions proportional to k, the first-order conditions would be:

$$\begin{aligned} f(1+\beta)c/x - e/x &= \kappa_c'(c) \\ -f(1+\beta)c^2/2 + ec &= \kappa_x'(x) \\ fkc^2/2x &= \kappa_\beta'(\beta). \end{aligned}$$

For interior solutions to exist, κ_c must be sufficiently convex and $\kappa_\beta'(\beta) > 0$.

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