doi:10.1017/S0003055410000523

Bribes, Lobbying, and Development

BÅRD HARSTAD *Northwestern University*
JAKOB SVENSSON *Stockholm University*

When faced with a regulatory constraint, firms can either comply, bribe the regulator to get around the rule, or lobby the government to relax it. We analyze this choice, and its consequences, in a simple dynamic model. In equilibrium, when the level of development is low, firms are more inclined to bend the rule through bribery but they tend to switch to lobbying when the level of development is sufficiently high. Bribery, however, is associated with holdup problems, which discourage firms from investing. If the holdup problems are severe, firms will never invest enough to make lobbying worthwhile. The country may then be stuck in a poverty trap with bribery forever. The model can account for the common perception that bribery is relatively more common in poor countries, whereas lobbying is relatively more common in rich ones.

> *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

Lobbying and corruption have been the subject of tremendous public interest and research. Surprisingly, these two means of influencing regulation have either been studied separately or viewed as basically being one and the same. The question of why firms choose to lobby or bribe, and of the consequences of this choice, remains largely unanswered.

The common perception is that firms in developing countries are more likely to pay bribes to get around regulatory constraints, whereas firms in developed countries are more prone to lobby the government to change the rules. There is also evidence, both across and within countries, that the extent of lobbying increases with income and that lobbying and corruption are substitutes.[1] What can account for this difference between developed and developing countries — as well as the *variation* in influence-seeking activities across firms/sectors in a given country? Should we expect an evolution from bribery to lobbying, as the above quotation suggests, or can countries/sectors get trapped in a long-lasting bribery equilibrium?

In this paper, we try to shed some light on these issues. We define lobbying, taking the form of campaign contributions or influence-buying through other means, as an activity that is aimed at *changing* existing rules or policies. We view bribery, in contrast, 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 "bribery" for convenience and not because they are perfect definitions for the two rent-seeking activities we study.

In reality, bribery and lobbying differ in several dimensions. First, lobbying is a legal and regulated activity in many countries, whereas bribery is not. Second, a change in the rules as a result of lobbying often affects an entire industry, whereas the return to bribery is more firm-specific. Third, a government that ponders a change in the rules might have quite different concerns than a bureaucrat considering a bribe. Our model captures all these differences. Possibly the most important difference, however, and the driving assumption in the model, is that bending the rules is only temporary. Bureaucrats can seldom commit to not asking for bribes in the future, because corrupt deals are not enforceable in courts and because firms deal with different officials over time. A legislative change, on the other hand, alters the status quo and is therefore likely to last longer. Although policies (and politicians) also change over time, our key assumption is that changing the rules is long-lasting *relative* to bending them.[2]

We present a simple growth model where firms are initially subject to 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 an 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. After a firm

Bård Harstad is Associate Professor of Managerial Economics and Decision Sciences, Kellogg School of Management, Northwestern University, 2001 Sheridan Road, Evanston, IL 60208; also University of Oslo and the National Bureau of Economics Research (harstad@northwestern.edu).

Jakob Svensson is Professor of Economic, Institute for International Economic Studies, Stockholm University, SE-106 91 Stockholm, Sweden; also Centre for Economic Policy Research (jakob.svensson@iies.su.se).

This paper has also circulated as "From Corruption to Lobbying and Economic Growth." We thank the *APSR* co-editor Daniel Treisman; several reviewers; Abhijit Banerjee, Sourav Bhattacharya, Ernesto Dal Bó, Sven Feldmann, Nicola Gennaioli, and Andrei Shleifer; also audiences at the University of Concordia, CORE, the Harvard–MIT development workshop, Lausanne, Maryland, Northwestern, Oslo, Princeton, Stavanger, a CEPR workshop, and the 2005 Summer Meeting of the European Economic Association.

[1] See our discussion in *Predictions and Evidence*.

[2] Intuitively, a status-quo bias arises in politics if, for example, there are several pivotal legislators, and one of them is reluctant to reintroduce the rule once it is relaxed. Empirical support for this assumption is discussed in what follows (*The Key Assumption*), whereas Appendix A discusses how this assumption can be relaxed or endogenized.

has invested more, the bureaucrat demands a higher bribe. At some point, bribes are so high that the firms prefer instead to lobby for deregulation. In essence, the bureaucrats price themselves out of the market because they cannot commit to not raising bribes after the firm has invested.

The evolution from corruption to lobbying is not certain, however. In equilibrium, firms anticipate the holdup problem and larger bribes following their investments. This reduces the incentives to invest, perhaps preventing the industry to reach the capital level at which they would have switched to lobbing. The result might be a poverty trap with extensive bribery forever. The condition for when such poverty traps arise depends on a number of parameters, generating a rich set of empirical predictions.

The analysis also provides new insight into how policy affects 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 level of bribes. This reduces the incentives to invest, making a poverty trap more likely. We show that equilibrium (and optimal) penalties increase in the level of development.

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. The model also yields predictions on what types of firms are most likely to bribe or lobby and the evolution of regulation—findings that also match the evidence, as discussed in Section 6.

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–agent (government–public official) framework. Like 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.[3]

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, which often takes 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.

Although there is extensive literature on corruption as well as on lobbying, few papers compare these alternative ways of influencing policies. Lambsdorff (2002) surveys the literature on rent-seeking and argues that, traditionally, corruption is viewed as less wasteful than lobbying because bribes are pure transfers. Dal Bó, Dal Bó, and Di Tella (2006) allow for alternative means of extortion (bribery vs. punishment) and focus on how this affects the selection of politicians. Others compare various types of lobbying: Bardhan and Mookherjee (1999, 2000) contrast lobbying of central vs. local governments, whereas Bennedsen and Feldmann (2006) compare campaign contributions to informational lobbying. To our knowledge, this is the first study comparing bribery and lobbying in a dynamic framework.

The first section presents a simple model of bribery, lobbying, and growth. The following section solves the model and investigates when firms bribe rather than lobby, and when an evolution from one to the other should be expected. Although that model is quite simple, the subsequent section generalizes the government's objective function, discusses firm-specific regulation, and draws implications for welfare and the existence of poverty traps. Thereafter, we endogenize the penalty on corruption, the level of red tape, and the bureaucrat's bargaining power: the results suggest that corruption ought to be penalized more in rich than poor countries. Although this paper is theoretical, *Predictions and Evidence* discusses the existing empirical support for our key assumption and main predictions. Additional extensions are discussed in Appendix A, and Appendix B contains all the proofs.

THE MODEL: BRIBERY, LOBBYING, AND GROWTH

Players and Preferences

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

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. There are 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 *Firm-specific Regulation* and Appendix A. There is no competition between firms (competition is allowed in an earlier working paper version). It is also possible to allow heterogeneity, for example in r, but because 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.

Each firm faces some regulation it must overcome. If it complies with the regulation, this costs c per

[3] The literature on corruption is reviewed in Bardhan (1997), Svensson (2005), and Treisman (2007). Banerjee (1997) provides an alternative theory of why corruption may be more prevalent in poor countries.

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.[4]

If firm i does not comply, the government's utility loss is $e > 0$ per unit of capital, where the parameter e measures the externality of noncompliance. For this reason, the government always prefers introducing regulation if there is none, so this can explain the rule's existence in the first place.[5] 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.[6]

Similarly, a bureaucrat may also prefer that the firm compliy. 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 care about pollution per se, but about being punished if the firm he or she is supposed 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, then $e_B = \theta x$. The probability of being caught, θ, may vary across bureaucrats as well as time, so let θ be uniformly i.i.d. over $[0, 1]$. Alternatively, let θ represent the *individual stigma* associated with being penalized for corruption, whereas x is the *expected* penalty. In either case, a bureaucrat faces the cost $\theta x k_i$ for bending the rules for firm i. This cost increases in k_i because it is more likely that a large firm will be investigated, or because the penalty for 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 (if $\theta < c/x$), whereas other comply (if $\theta > c/x$).[7]

Bribery

Instead of complying, a firm 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 assume that the bargaining solution is efficient (for the bureaucrat and the firm) and let $\beta \in [0, 1]$ measure the bureaucrat's share of the bargaining surplus. This would follow, for example, by relying on the generalized Nash bargaining solution if the bureaucrat's relative bargaining power was β.[8]

Our key assumption is that the bureaucrat cannot commit to bend the rules in the future. Future deals remains to be negotiated at a later stage. This is quite reasonable, because bending the rules does *not* change the status quo (i.e., the law), and a bureaucrat cannot write enforceable contracts stating that he will not monitor the firm later. This is consistent with our assumption that firms deal with different bureaucrats over time and that corruption is illegal.

Lobbying

As an alternative to *bending* the rules, the firms may lobby the government to *change* them. To be successful, the firms must spend more resources on lobbying if the government is reluctant to relax the rule. In particular, we assume that the firms can make a take-it-or-leave-it offer to the government, specifying a transfer of size L from firms to the government.[9] The proofs in the Appendix tolerate that the government has some bargaining power when negotiating L. After the rule is relaxed, there is no need to comply or negotiate with the bureaucrat.

Changing the rules benefits all firms, so they may share the cost of lobbying in equilibrium.[10] Realistically, the firms negotiate how to split the cost L, and we assume that each firm ends up with an equal share of the bargaining surplus. This would be implied by relying on the Nash bargaining solution, for example.[11]

In contrast to the case where the bureaucrat *bends* the rule, *changing* the rules affects the status quo. To simplify, we assume that if the rules are relaxed, they are relaxed *forever*. This is an extreme assumption, and Appendix A discusses how it can be weakened. For our results, it is sufficient to assume that changing the rules has a longer-lasting effect than bribery. Nevertheless, note that it is straightforward to endogenize this assumption: simply assume that several legislators are pivotal in changing a law, e.g., because of a supermajority requirement, or because a proposal must pass two political chambers. If one of the pivotal legislators has preferences that are aligned with the firms, then he or she will never accept to reintroduce the rule once it is relaxed.

[4] This simple setup, we believe, captures in a reduced form many types of regulation. For example, the rule could be interpreted as an industrial licensing requirement, where either input or output is subject to administrative approval, as tariff, or as an environmental regulation where firms are required to take costly action to curb pollution associated with production.

[5] This follows as a corollary in *Mitigating Corruption: Endogenizing the Policies*.

[6] *Regulation Types and Poverty Traps* discusses the "red tape" interpretation of regulation, where the rules are in place mainly to generate revenues for the government. It also allows the government to benefit from economic growth.

[7] 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, whereas θ was fixed.

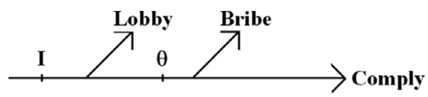
[8] Firms do not pay bribes when they comply or if there is no regulation. Thus, we assume away outright extortion. This is a simplifying assumption: for our results, we only need to assume that if the firm wants to persuade the bureaucrat to overlook the firm's noncompliance, then the bureaucrat can and will demand an *even larger* bribe.

[9] This is consistent with the menu-auction literature on lobbying (including, for example, Grossman and Helpman 2002; Dekel, Jackson, and Wolinsky 2009).

[10] This assumption is relaxed in *Firm-specific Regulation*.

[11] Technically, the Nash bargaining solution is well-defined only when the number of firms is finite. The Appendix takes the limit of this solution when the number of firms approaches infinity.

FIGURE 1. Timing of the Game



Investment and Growth

A firm's capital stock depreciates at rate d, but it can increase its capital stock by investing I_t at cost $zI_t^2/2$:

$$\dot{k}_t = I_t - dk_t. \tag{1}$$

We normalize the *time* such that $\boldsymbol{k_0} = 0$ 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 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 the results would prevail if time were discrete.

In each period t, the timing of the game is as illustrated in Figure 1. After the firms have invested, they 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 gets an equal share of the total surplus generated by relaxing the rules. Because every firm would thus like to maximize the total surplus, they all agree on when and whether to lobby.[12] 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 offer a bribe. If these negotiations fail or are never initiated, the firm complies. As already mentioned, the firm faces a new bureaucrat every period, so that this sequence repeats itself at each time t.

THE EQUILIBRIUM: FROM BRIBERY 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 cost of lobbying, and then the investment levels when a switch to lobbying is expected in the future. Finally, we investigate the equilibrium choice between lobbying and bribery, and the timing of a switch from one to the other. All proofs are in the Appendix.

Bribes and Investments

Before deciding whether to comply, a firm learns the type $\theta \in [0, 1]$ of the current bureaucrat. If $\theta < c/x$, 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. By assumption, the bureaucrat's surplus $(B - \theta xk)$ is β multiplied by the total surplus from bending the rule, $ck - \theta xk$.[13] The bribe B is thus

$$B = \beta ck + (1 - \beta)\theta xk. \tag{2}$$

The bribe B 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, if k is large, the bureaucrat's cost of bending the rule is larger (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. Furthermore, note that if θ is large, B is large because the firm must compensate the bureaucrat for the severe expected penalty he risks. B is also increasing in c, the cost of compliance, because the bureaucrat can ask for accordingly higher bribes. This is particularly important if the bureaucrat's relative bargaining power, β, is high.

Because θ is uniformly distributed on $[0, 1]$, the probability for $\theta x < c$, implying that the firm bribes, is c/x. A firm complies with probability $1 - c/x$. In other words, the larger 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 (2), increases in the capital stock (k), the cost of compliance (c), the bureaucrat's bargaining power (β), and the expected penalty for corruption (θx).*

Before it learns the bureaucrat's type, a firm's current expected profit is

$$rk - \mathrm{E}\min\{ck, B\} = (r - b)k, \text{ where}$$
$$b \equiv c\left(1 - (1 - \beta)c/2x\right). \tag{3}$$

The firm's expected cost of bribing or complying, b, is increasing 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 total profit, including the impact on the bribes. To solve for the equilibrium investment, consider, first, an equilibrium where bribery takes place forever. In such a steady state, each firm will at time t plan its investments in order to solve

$$\max_{\{I_\tau\}_\tau} \int_t^\infty \left((r - b)k_\tau - \frac{z}{2}I_\tau^2\right) e^{-\delta(\tau - t)}d\tau$$
$$\text{s.t. (1) and given } k_t. \tag{4}$$

Proposition 2. *In a bribery equilibrium, investment I is decreasing in b, and thus in the cost of compliance (c),*

[12] Also, the government would agree on the timing of lobbying if it had some bargaining power when negotiating L. This is proved in the Appendix. When the government has no bargaining power, it is indifferent to the timing of lobbying, because it will receive only its default payoff in any case.

[13] This B would also follow from maximizing the Nash product:

$$\max_B (B - \theta xk)^\beta (ck - B)^{1-\beta} \Rightarrow B = \beta ck + (1 - \beta)\theta xk.$$

the bureaucrat's bargaining power (β), and the penalty if caught taking bribes (x):

$$I = \frac{r-b}{z(\delta+d)} = \frac{r-c(1-(1-\beta)c/2x)}{z(\delta+d)}. \quad \textbf{(5)}$$

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

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 the firm's expected loss due to compliance or bribery, b. If successful lobbying has taken place and the rules have been relaxed, it is no longer necessary to pay bribes. Then, the firm's investment decision is similar to (5) if just b is replaced by zero. 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.

The total cost of lobbying, L, must be large enough to compensate the government for its utility loss from relaxing the rule. If the rule stays in place, the government's present discounted utility is $V_g(k_t) = -e\int_t^\infty k_{b,\tau}(c/x)d\tau$, where c/x is the fraction of firms that do not comply, whereas $k_{b,\tau}$ is the equilibrium level of k at time τ, given that the rule stays in place. Once the rule is relaxed, and no firm needs to comply, the government's present discounted utility is $V_g(k_t) = -e\int_t^\infty k_{l,\tau}d\tau$, where $k_{l,\tau}$ is the equilibrium level of k at time τ, given the larger investments following liberalization. The cost of lobbying is the difference in these payoffs:

$$\begin{aligned} L &= e\int_t^\infty k_{l,\tau}d\tau - e\int_t^\infty k_{b,\tau}(c/x)\,d\tau \\ &= e\frac{1-c/x}{\delta+d}k_t + e\left[\frac{k_{l,\infty}-k_{b,\infty}c/x}{(\delta+d)\,\delta/d}\right] \quad \textbf{(6)} \\ &= e\frac{1-c/x}{\delta+d}k + e\left[\frac{r-(r-b)\,c/x}{z\delta\,(\delta+d)^2}\right]. \quad \textbf{(7)} \end{aligned}$$

Thus, L is the government's loss, for the entire future, when relaxing the rule. As shown on the r.h.s. of (6), this loss depends not only on the current capital level, but also on the long-run steady state levels for k. This steady state level is given by $k_{l,\infty}$ if the rule is relaxed, and otherwise by $k_{b,\infty}$. In each case, the steady state capital level is independent of the current level, and thus the *steady state* utility loss for the government is independent of the current k. L therefore has a fixed component, the second term in (7), in addition to the first term, which is increasing in k.

Proposition 3. i. *At equilibrium, the total cost of lobbying is given by (7).*

ii. *Firm i's individual cost of lobbying increases in k_i and is given by*

$$L_i = \frac{b(k_i-k)}{\delta+d} + L. \quad \textbf{(8)}$$

Whereas the intuition for part (i) is explained above, part (ii) can be explained as follows: First, when negotiating the L_is, the sum must equal L, so that $\int_i L_i di = L$. Second, by assumption, or by using the Nash bargaining solution, every firm gets the same share of the bargaining surplus. If the negotiations fail, the default is to bribe or comply. Thus, i's net surplus, which is $V(k_{it}, 0) - V(k_{it}, b) - L_i$, must be the same for every firm. Because $V(k_{it}, 0) - V(k_{it}, b)$ increases in k_{it}, so must L_i. Intuitively, i's bribes are larger if i's level of capital, k_{it}, is large, as Proposition 1 shows. It is then highly important for i to circumvent the bureaucrat's power and relax the rules. The other firms can hold up i, then, and require i to contribute more to the cost of lobbying.[14]

Thus, lobbying generates a holdup problem, just like bribery. In fact, investment levels turn out to be the same at any time $t < T$, when lobbying is coming up in the future, as they would be if bribery were to continue forever. The explanation is as follows: Remember that i's net surplus, $V(k_{it}, 0) - V(k_{it}, b) - L_i$, must be the same for all firms, say ϖ. Thus, i's payoff is $V(k_{it}, 0) - L_i = V(k_{it}, b) + \varpi$, and each firm is therefore ending up with its default payoff $V(k_{it}, b)$, plus a constant that is independent of k_{it}.[15] When investing, therefore, firm i invests in such a way as to maximize its default payoff $V(k_{it}, b)$, just as in the case where bribery continued forever.

If lobbying has taken place, on the other hand, there is no need to comply or bribe and the firms choose to invest more (as if $b = 0$ in (5)).

Proposition 4. *Suppose that, in equilibrium, lobbying replaces bribery at time T.*

i. *At any time $t < T$, each firm invests according to (5).*

[14] The exact form (8) follows from the formula for $V(.)$, as shown in the Appendix. Intuitively, a larger $k_{i,t}$ raises the benefit from relaxing the rule by b, divided by $\delta + d$, because the benefit arises in every period but future utilities are discounted at the rate δ, whereas $k_{i,t}$ depreciates at the rate d.

[15] If there were $n < \infty$ firms, i would realize that ϖ is actually not a constant, because it is $1/n$ of the total surplus when the firms lobby, and this surplus is increasing in k_i. Consequently, i would increase its investments when $t \to T$. This follows from the proof of Proposition 8 and it is also true when there is a single firm, as discussed in *Firm-specific Regulation*. When $n \to \infty$, however, the impact of k_i on ϖ is negligible, and investments are constant for all $t < T$. This simplifies the analysis and is the why we assume a continuum of firms.

ii. *At any time $t > T$, investments are higher and given by*

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

From Bribery to Lobbying

Having derived the costs of bribery and lobbying, and the investment levels for each situation, we can compare them to determine what firms prefer to do. When bargaining over whether to lobby, each firm receives a fraction of the *total* surplus from relaxing the rules, and every firm prefers to maximize this total surplus. They thus agree on *whether* and *when* to lobby rather than bribe.

When k is small, the bribe is small and it is not worthwhile to pay the high cost of lobbying. However, the cost of the bribes increases faster in k than does the cost of lobbying if the following condition holds:[16]

$$\widehat{\Omega} \equiv c\frac{1+\beta}{2}\left(\frac{c}{x}\right) + (c-e)\left(1-\frac{c}{x}\right) > 0. \qquad \textbf{(9)}$$

To understand this condition, note that two kinds of inefficiencies grow as k increases. First, the bribes increase. A fraction c/x of the firms bribe and, conditional on doing so, the expected bribe is $c(1+\beta)/2$, multiplied by k. This cost corresponds to the first term in (9). Second, if $c > e$, the firms' cost of compliance is larger than the government's benefit. The social cost of compliance is thus $k(c-e)$, multiplied by the fraction of firms that does comply $(1 - c/x)$. This corresponds to the second term in (9). If this sum is positive, the cost of bribery increases in k faster than does the cost of compensating the government, and (9) holds.

Note that "good" regulation, where $e > c$, is necessary, but not sufficient, to violate (9). Even if $e > c$, it might be that the cost of bribery increases in k faster than does the cost of lobbying, particularly if most firms bribe (c/x large) and the bureaucrat is powerful (β large). If $e - c$ is sufficiently large, however, the cost of lobbying increases faster than the cost of the bribes, and (9) is violated.

In sum, condition (9) is likely to hold if most firms bribe (c/x large), the bureaucrat is powerful (β large), and the social benefit of compliance $(e - c)$ is relatively low. In these circumstances, the cost of bribery increases in k faster than does the cost of compensating the government, and the firms prefer lobbying, rather than bribery, for a sufficiently large k. If (9) fails, the firms will never switch to lobbying.

Proposition 5. *If (9) holds, the cost of the bribes increases faster than the cost of lobbying. Thus, the firms lobby, rather than bribe, if and only if $k \geq \widehat{k}$, where the threshold $\widehat{k}$ increases in e but decreases in β, c, z, d, and δ:*

$$\widehat{k} \equiv \frac{b(e - b/2)}{\widehat{\Omega} z(\delta + d)^2}.$$

The intuition for the comparative statics is as follows. If the externality e is high, the cost of lobbying is high, and the firms are willing to lobby only if k is very large. If the rate of capital depreciation (d), the discount rate (δ), and the cost of investment (z) are low, the government anticipates great investments after relaxing the rule, and it must be compensated for the large externalities this causes. This increases the cost of lobbying, and thus the threshold $\widehat{k}$ at which firms switch from bribery to lobbying. The threshold decreases in c and β, however, because a high compliance cost and powerful bureaucrats raise the firms' cost of the rule.[17]

Combining Propositions 4 and 5 leads to the main result of this section: Whereas 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 will prefer to lobby.

This evolution is not certain, however. The holdup problem between the bureaucrat and the firm implies that investments are lower when firms bribe. If these investments are sufficiently low, for example because the rate of return, r, is low, then k will never reach the threshold $\widehat{k}$ for when the firms would have switched from bribery to lobbying, after which growth would have accelerated.

Proposition 6. i. *The firms will eventually switch from bribery to lobbying if and only if $r > \widehat{r}$, given by*

$$\widehat{r} \equiv b + \frac{db(e - b/2)}{\widehat{\Omega}(\delta + d)}. \qquad \textbf{(10)}$$

ii. *If $r > \widehat{r}$, the time T of the switch is given by*

$$1 - e^{-dT} = \frac{db(e - b/2)}{\widehat{\Omega}(\delta + d)(r - b)}. \qquad \textbf{(11)}$$

If the productivity parameter, r, is large, then investments are larger and the capital level is more likely to eventually reach the threshold for which firms switch to lobbying. And, if the switch takes place, it takes place sooner if r is large. On the other hand, if e is large, lobbying is costly and the thresholds for k and r increases. The firms are then less likely to ever reach the threshold at which they switch to lobbying and, if they do, the time of the switch increases in e. Note that the effect of the firm's expected cost of bribing or

[16] To see why, note that a marginally larger k increases the present discounted value of the bribes by $b/(\delta + d)$, because k depreciates with the rate d, whereas utility is discounted by the rate δ. The cost of lobbying, given by (6), increases by $e(1 - c/x)/(\delta + d)$. The former is larger than the latter if $b > e(1 - c/x)$, which is equivalent to condition (9). The Appendix derives (9) formally.

[17] A larger penalty, x, also increases the bribes, suggesting that lobbying becomes more attractive. But a large x also increases the government's benefit of the rule, because 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.

complying, b, and thus the effects of c, x, and β, are ambiguous. On one hand, a larger b reduces the threshold $\widehat{k}$ at which firms switch from bribery to lobbying. On the other, a larger b reduces investments and it is less likely that any given k will ever be reached.

REGULATION TYPES AND POVERTY TRAPS

This section shows how our simple model can easily be extended. First, we allow the government to benefit from the collected bribes as well as from economic growth. Second, we study firm-specific regulation, formally implying that there is only one firm in the model. Although our results continue to hold, qualitatively, the comparative statics suggest that the economy might be stuck in a welfare-reducing "poverty trap" when the firms never switch to lobbying. This possibility is further discussed in the third subsection. Other extensions are discussed in Appendix A.

The Government's Objective Function

We have so far 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.[18] For example, the bribes collected by the bureaucrat may indirectly benefit the government because the bureaucrat's wage can be reduced accordingly. Relatedly, the bribes may directly benefit the government if it can monitor 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.[19]

In addition, the government may 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, let g measure the government's benefit of a larger k. As long as the firms bribe, the government's objective function can be written as

$$u_G = -e(c/x)k + f\,(c/x)c(1+\beta)k/2 + gk = u'_G k, \tag{12}$$

where

$$u'_G \equiv -e(c/x) + f\,(c/x)c(1+\beta)/2 + g.$$

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 $u_G = (g-e)\,k$.

With this extensions, the results from Propositions 5 and 6 are modified to the following:

Proposition 7. *Suppose*

$$\Omega \equiv (1-f\,)c\frac{1+\beta}{2}\left(\frac{c}{x}\right) + (c-e)\left(1-\frac{c}{x}\right) > 0. \tag{13}$$

i. *The cost of bribery increases in k faster than does the cost of lobbying. Thus, the firms switch from bribery to lobbying when $k \geq \bar{k}$, given by:*

$$\bar{k} = \frac{b\,(e-g-b/2)}{\Omega\,(\delta+d)^2\,z}. \tag{14}$$

ii. *Given the equilibrium investments, the firms will eventually switch to lobbying if $r > \bar{r}$, given by:*

$$\bar{r} = b + \frac{db(e-g-b/2)}{\Omega\,(\delta+d)}. \tag{15}$$

iii. *If $r > \bar{r}$, the switch takes place at time T, determined by:*

$$1 - e^{-dT} = \frac{db(e-g-b/2)}{\Omega\,(r-b)\,(\delta+d)}. \tag{16}$$

iv. *The tresholds $\bar{k}$, $\bar{r}$, and T increase in f and decrease in g.*

Condition (13) replaces (9), and they are identical if $f = 0$. But if $f > 0$, the government benefits from the bribes, which are increasing in k. A large f therefore strengthens the condition under which a large k is sufficient for the regulation to eventually be relaxed by lobbying. If $f = 1$, so that the government captures the entire bribe, then $c > e$ is both necessary and sufficient for lobbying to replace bribery when k is sufficiently large. Thus, "red tape" policies, in place mainly to extract bribes from the firms (such that $f \approx 1$ but $c > e$), will be relaxed by lobbying when k is large enough. In contrast, sufficiently "good" policies, where $e > c$, may violate (13), implying that the firms will never lobby successfully.

With this in mind, parts (ii)–(iv) are quite natural. If the government benefits a lot from economic growth and less from collecting the bribes, then it is more sympathetic to relaxing the rule, and the cost of lobbying declines. The larger g is and the smaller f is, the more likely it is that the firms eventually find it affordable to switch to lobbying and, if they do, the switch takes place earlier. The comparative statics w.r.t the other parameters is as before.

Firm-specific Regulation

The above model assumes that there are a large number of firms and the regulation affects them all. This section,

[18] De Soto (1989) and Shleifer and Vishny (1993) argue that regulations are partly instituted to provide public officials with the power, or the property rights, to demand and collect bribes. Empirical evidence is provided in Djankov et al. (2002). Country-specific evidence is given 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. There is even a second-hand market for posts that provide the holder with an opportunity to extract bribes. Malesky and Samphantharak (2008, p. 231) document a similar pattern in Cambodia, observing that "Cambodian governors purchase their positions, almost as an investment, and maintain their positions by passing a portion of the revenue upward to central benefactors." The existence of entry fees for positions in the bureaucracy is documented in many other developing and transition countries (World Bank, 1998).

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

instead, solves the model if there is only one firm or, equivalently, if each firm faces firm-specific regulation, implying that there would be no benefit of coordinating with the other firms. Solving the model for this case gives us further comparative statics, but it also shows that the main results survive. In addition, the result can be interpreted normatively as the outcome that would have resulted if the firms had coordinated investments and acted as one.

First, note that investments in the *steady state* are the same as before, because there is no interaction between the firms then. However, if lobbying is expected at the future date T, the firms above invested little because of the anticipated holdup problem when negotiating the lobby contributions. If there is only one firm, this holdup problem vanishes. Thus, the single firm invests more when it approaches the switch to lobbying because, after time T, the rate of return is larger. The larger investments raise the chance of ever reaching the threshold at which it is optimal to switch to lobbying.

Proposition 8. i. *If the firm switches to lobbying at time T, then at $t < T$ investments increase gradually and according to*

$$I_F = \frac{r-b}{z(\delta+d)} + \frac{\Omega}{z(\delta+d)} e^{-(\delta+d)(T-t)}, \qquad \textbf{(17)}$$

ii. *The firm will eventually switch from bribery to lobbying if and only if $\Omega > 0$ and $r > \bar{r}_F$, where $\bar{r}_F < \bar{r}$ is given by:*

$$\bar{r}_F \equiv b + \frac{db(e-g-b/2)}{\Omega(\delta+d)} - \frac{\delta d\Omega}{(\delta+d)(\delta+2d)}. \qquad \textbf{(18)}$$

Just as before, if $\Omega > 0$, the cost of bribery increases in k faster than does the cost of lobbying. For a sufficiently large k, then, the firm switches to lobbying. Furthermore, the value of switching to lobbying increases particularly fast in k if Ω is large. Therefore, the firm invests more when t approaches T, especially if Ω is large. This effect is ignored when there are many firms, because the opponents will hold up the investor and require it to share its surplus. This explains why the last term in (17) is absent when there are many firms.

The last term in (17) corresponds to the last term in (18). Because the single firm invests more, it is more likely that the capital will reach the required level. This reduces the threshold for r, above which a switch eventually will take place. In fact, the proof of Proposition 8 permits *any* number of firms. As the number of firms increases, investments decrease (as long as $t < T$) and, therefore, the threshold for r increases.[20]

To conclude, it is more likely that firms eventually switch to lobbying if the regulation is firm-specific, if there is only one firm, or if they act (when investing) in a coordinated manner as if they were one. The last point can be interpreted normatively: If $r \in (\bar{r}_F, \bar{r})$, the many firms continue in the bribery equilibrium forever, despite the fact that, if they had invested to maximize total profit, they would eventually have switched to lobbying, making them all better off. In this case, it is the holdup problem between the firms, at the lobbying stage, that discourages investments and prevents the switch to lobbying. The firms would have been better off, therefore, if they could have committed to not hold up each other at the lobby stage.

Is There a Poverty Trap?

The results above describe the circumstances under which the firms will lobby rather than bribe. For example, firms are more likely to lobby, or to eventually switch to lobbying, if e and f are small whereas g is large. If the bribes are large, however, investments may be low enough so that the firms will never switch to lobbying. In which sense can this situation be referred to as a "poverty trap"?

As a start, take the investments and the costs of bribery and 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, because the firms pick T in order to maximize V. Moreover, T is jointly optimal for the firms and the government because the firms must compensate the government for its utility loss when relaxing the rule. Hence, T is also optimal for the government when the lobby contribution is taken into account.

Proposition 9. *Take investments and the costs of bribery and lobbying as given by the results above. Then T maximizes $\alpha V + (1-\alpha) V_G$ for any $\alpha \in [0, 1]$.*

Thus, T is socially optimal whether we let the government be benevolent (such that social welfare is defined by V_G) or instead define welfare as $V + V_G$. Nevertheless, there are two cases in which the term "poverty trap" is meaningful.

First, the government may not be benevolent. On one hand, 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. On the other, one could argue that the citizens should also be taken into account, even though they are not players in the game. If citizens believe that the government cares too little about ensuring that firms comply, they fear that the government's e is too low, and thus that the regulation will be relaxed, by lobbying, too soon. Alternatively,

[20] Formally, (17) and (18) become

$$I_n = \frac{r-b}{z(\delta+d)} + \frac{1}{n}\frac{\Omega}{z(d+\delta)} e^{-(\delta+d)(T-t)},$$

$$\bar{r}_n = b + \frac{db(e-g-b/2)}{\Omega(d+\delta)} - \frac{1}{n}\frac{\delta d\Omega}{(d+\delta)(\delta+2d)}.$$

There are two reasons that we assume an infinite number of firms in most of this paper. First, when the investments increase gradually towards T, explicit formulae for T are hard to derive. More importantly, there might be multiple equilibria when $n \in (1, \infty)$ 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.

suppose that the citizens think that the government cares too little about economic growth, and too much about the rents it is able to capture from the bribes. The citizens may then fear that the government will not relax the rule, and that the firms cannot afford to compensate the government for such liberalization, even though this would have been desirable from the citizens' point of view. This situation may be referred to as a "poverty trap" because the bribes discourage investments whereas the low investments ensure that the firms will continue to bribe rather than lobby.

Second, although T maximizes the welfare function $V_F + V_G$, conditional on the investments, the equilibrium investments are suboptimally low. A comparison between Propositions 7 and 8 suggests that there may be a poverty trap, from the firms' point of view. If the firms had acted as one, they would have invested more when anticipating lobbying, and this would have increased the chance of reaching the necessary threshold.

Similarly, the firms may also invest too little from the government's point of view. If $u_G > 0$, the government benefits from a larger capital level because this increases the rents from corruption or the direct benefits from economic growth. Ideally, therefore, the firm should invest more and, if they did, it is more likely that they would eventually switch from bribery to lobbying.

Proposition 10. i. *If the firm switches to lobbying at time T, at $t < T$ the optimal investments increase gradually and according to*

$$I_* = \frac{r-b}{z(\delta+d)} + \frac{\Omega}{z(\delta+d)} e^{-(\delta+d)(T-t)} + \frac{u'_G}{z(\delta+d)}. \tag{19}$$

ii. *With such investments, the firms would eventually switch from bribery to lobbying if and only if $\Omega > 0$ and $r > \bar{r}_*$, where $\bar{r}_* < \bar{r}_F < \bar{r}$ if $u_G > 0$:*

$$\bar{r}_* = b + \frac{db(e-g-b/2)}{\Omega(\delta+d)} - \frac{\delta d\Omega}{(\delta+d)(\delta+2d)} - \frac{\delta u'_G}{\delta+d}. \tag{20}$$

Compared to the equilibrium investments, give by (5), I_* has two additional terms. Of these, the first is equivalent to the additional term in (17): when there are many firms, they invest too little compared to what is optimal from the firms' joint point of view. The last term in (19) captures the flow benefit from a larger k for the government during the time where bribery is still taking place. If the government is benefitting from a larger k, because f and g are large relative to e, then this provides a second reason for why the firms invest too little.

The two last terms in (19) correspond to the two last terms in (20). If the investments were higher, k would be larger and it would be more likely that the firms, eventually, switch to lobbying. The higher investments are thus reducing the necessary threshold for r.

If $r \in (\bar{r}_*, \bar{r})$, the firms will never switch to lobbying, although they would have done so if they had invested the ideal amount, from the firms' and the government's joint point of view. A typical firm is not investing enough because of the internal holdup problem when negotiating the lobby contributions and because it does not internalize the government's benefit from the larger k. If the other firms, and the government, could have committed to not raise their demands after firm i had invested, then investments would have been higher and, eventually, it would be jointly optimal to switch to lobbying. Thus, the case where $r \in (\bar{r}_*, \bar{r})$ may be referred to as a poverty trap.

The likelihood of the poverty trap depends on the parameters. If e increases, it is less likely that lobbying will ever take place ($\bar{r}$ increases), but this is also socially optimal ($\bar{r}_*$ increases by even more), and the chance for a poverty trap is actually reduced (in the sense that the distance $\bar{r} - \bar{r}_*$ declines). If f increases, on the other hand, it is less likely that lobbying will take place, because $\bar{r}$ increases. The difference $\bar{r} - \bar{r}_*$ increases, as well, and this can make it more likely that $r \in (\bar{r} - \bar{r}_*)$, implying a poverty trap. Finally, if g increases, $\bar{r}$ declines but $\bar{r}_*$ is reduced by even more: although the firms are then more likely to eventually switch to lobbying, the range (for r) in which there is a poverty trap is larger.

MITIGATING CORRUPTION: ENDOGENIZING THE POLICIES

So far, we have taken the characteristics of the policy and the regulation as exogenous. Although Proposition 7 tells us what type of regulation eventually will be relaxed, we may also ask what type of regulation and policy we can expect to be introduced in the first place.

First, note that Proposition 9 states that relaxing the rule at time T, at the capital level $\bar{k}$, is jointly optimal for the firms and the government. Consequently, if $k < \bar{k}$, it is socially optimal to introduce the rule, even if it is not currently in place. Thus, regulation may always be introduced at the start of the game.[21]

Corollary. *If $k < \bar{k}$, regulation will always be introduced by the government in the first place (whether or not firms are lobbying against this).*

Next, note that, although the time of the switch, T, may be optimal from the government's point of view, there are two types of inefficiencies in equilibrium. First, as discussed in *Is There a Poverty Trap*, the investments may be suboptimally low. Second, with the rule in place, some firms comply whereas other firms bribe, irrespective of the government's preference for this choice.

These choices depend on various parameters, which we have taken to be exogenous. The government may be able to influence some of them, however. In particular, the cost of compliance, c, may be raised or

[21] The firms would not find it worthwhile to lobby against introducing the rule when $k < \bar{k}$, because they would not be willing to compensate the government for its utility loss when doing so. Because such compensation would be necessary, the government will certainly introduce the rule if $k < \bar{k}$, also if the firms are unable to lobby against such a decision (for example, they may not be present once the rule is introduced at the very first stage of the game).

reduced by specifying the compliance procedures and the red tape involved. Similarly, the parameter x may, as mentioned in *The Model: Bribery, Lobbying, and Growth*, be interpreted as the expected penalty of being caught in corruption. This can be increased by raising the penalty itself or the frequency of monitoring and thus the likelihood of being caught when accepting a bribe.[22] Finally, when setting up the regulatory agency, the government might be able to influence the bureaucrat's bargaining power, β.

The following analysis takes (12) to be the government's utility function, and derives positive predictions for the government's preferred c, x, and β. Alternatively, by interpreting (12) as the social welfare function, the results below should be viewed as normative recommendations for the optimal policy.

Short-term Policies

Setting policies in a dynamic framework brings us to the question of whether the government can commit to its choices. One view is that the government is totally unable to commit and 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 future policies. 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 the government sets x, c, and β just after the investment stage in every period. Because investment decisions depend on the *expected* future policies, the actual policy at time t will not affect any investments.[23] However, by changing c and x, the government affects the fraction of firms (c/x) that bribe instead of comply. As discussed in *The Government's Objective Function*, the government may benefit from both compliance and corruption, but these two benefits are clearly in conflict when the government can influence c/x. From the government's utility function (12), we immediately find

Proposition 11. *The optimal short-term policies include*

i. *a low compliance cost, c, if and only if e is large and f small;*
ii. *a high penalty, x, if and only if e is large and f small;*
iii. *a large β in any case.*

Quite intuitively, if the government wants the firms to comply, it should reduce the cost of compliance and raise the penalty on corruption. The government does indeed prefer compliance if e is large relative to f, meaning that regulation is "good" and in line with the public interest view of regulation. According to the tollbooth view, however, regulation is in place to extract bribes, which would correspond to a high f relative to e. In this case, the government prefers a low penalty and a high cost of compliance. In either case, the government prefers to strengthen the bargaining power of the bureaucrats (β), because this increases the bribes without affecting anything else.[24]

Long-term Policies and Development

Above, the government only had short-term concerns, because its current policies did not affect the firms' investment decisions. 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. The government may therefore 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. This is in line with our assumption that lobbying induces the government to permanently relax the rules. Suppose, therefore, that the government at time t can set c, x, and β once and for all.[25]

The government realizes that c, x, and β, through their effects on the equilibrium bribe, affect the investment levels of the firms. To the extent that the government benefits from economic growth or a higher level of development, it prefers to reduce these parameters to boost the incentives to invest.[26]

Proposition 12. i. *With long-term policies, the government prefers to reduce c, x, and β compared to the short-term case.*
ii. *The optimal c, x, and β increase in k.*

If k is small, so that the economy is not yet developed, the dynamic effects are important. To encourage growth, it is therefore optimal with low compliance cost c and penalty x and less power to the bureaucrat, β. For k large, however, the dynamic effects are relatively less important than the static, or short-sighted, concerns. Then, the optimal c, x, and β are larger. Therefore, Proposition 12 suggests that as the economy is developing, the extent of regulation and the penalties on corruption should both increase.

---

[22] Because the cost of being caught for corruption is θx, changing θ would have an effect similar to that of changing x. In fact, if θ measures the individual stigma (or the bureaucrat's honesty), then we may write $x = \rho X$, where $\rho \in [0, 1]$ is the probability that the bureaucrat is monitored and thus detected if accepting a bribe, whereas X is the actual penalty, conditional on being caught. Increasing ρ then has the same effect as increasing X because only the product $x = \rho X$ is of importance.

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

[24] The optimal short-term policies are independent of time and k, the Appendix shows.

[25] 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.

[26] This discussion presumes that u_G in (12) is positive, implying that the government prefers economic growth, all effects taken into account. If e is very large, on the other hand, the government might prefer k to be low, particularly if many firms are not complying (e.g., because x is small). With enough discretion over the policies, however, the government should be able to select x so high that, eventually, $u_G > 0$. Then Proposition 12 continues to hold.

PREDICTIONS AND EVIDENCE

Our model has yielded a number of empirical predictions. Although it is beyond the scope of this paper to look at them all thoroughly, it is worth noting that several of the results are broadly consistent with existing evidence. In this section we discuss the main predictions of the model, as well as evidence for our key assumption.

The Key Assumption: Policy Influence Can Be Short-term or Long-term

The main assumption we make in the model is that changing the rule affects the status quo, and its effect is thus more long-lasting than bending the rules. Bending the rules provides only short-run gains because promises by individual bureaucrats not to ask for (or extort) bribes in the future are not credible. Although policy often changes over time, there is a well-known status quo bias in politics, making (particularly large) reforms relatively more long-lasting.

Although there are surely cases when our key assumption does not hold, there is also broad support for it. Trade reform is an example. Of the 76 countries that liberalized their trade regime in the period 1950–2000 (median year of liberalization is in the mid-1980s), all remained open to trade in 2000 (see data in Wacziarg and Welch 2008). Since 1950, only 11 countries have reversed earlier trade reforms, and even for this smaller subset of countries the mean reform period lasted for more than 10 years. The data on regulation of firms' entry paints a similar picture.[27] In 2005/2006, the first year for which data are available, 54 countries reformed and/or simplified business regulations. Five years later, none of these countries are reported to have taken steps to backtrack on the reforms.

For our results to go through, we do not need to assume that lobbying relaxes the rules forever. As discussed in Appendix A, the rules could stay in place for a certain number of periods, or there could be a positive probability that the rule will be kept in place in each period once it has been enacted. Generally, our theory suggests that the more stable the rules, i.e., the extent to which the government can commit (not to backtrack on reforms), the larger the investments will be, and the more likely it is that firms eventually will start lobbying. This is consistent with the findings of Campos and Giovannoni (2008) and Bennedsen, Feldmann, and Lassen (2009), who show that firms are more inclined to lobby and less inclined to bribe in stable democracies and under perceived high-quality governments (in both cases, we would add, politicians are better able to commit).

For the workings of bribery, Olken and Barron (2009) provide probably the most detailed evidence based on directly observed bribes. They document how firms (truck companies) in the Aceh province in Indonesia use bribes to deal with trucking regulation. Officially, a truck entering a weigh station weighing above the maximum limit is supposed to be ticketed and immediately forced to unload its excess cargo. In practice, however, all drivers operating overweight pay a bribe and the bribes increase with the amount the truck is overweight. In line with our assumption, these bribes need to be paid each time the truck passes the weighing stations.

Olken and Barron (2009) also provide evidence consistent with holdup problems in corrupt markets. However, if the bureaucracy is coordinated and can commit to not asking for higher bribes in the future, these holdup problems will be less severe and thus, in our model, investments will be higher. Thus, when the bureaucracy is coordinated, high growth and bribery can go hand in hand, as has been argued is the case in China (Li and Wu 2007), South Korea in the post-war period (Kang 2002), and Indonesia during the Suharto period (MacIntyre 2001).[28]

The Micro Level: Large Firms Lobby, Small Firms Bribe

Corruption occurs in the model because both the firm and the bureaucrat can be better off by circumventing regulation. However, because the bureaucrat cannot commit to not asking for higher bribes in the future, bribery leads to a typical holdup problem that discourages investment.[29] Because the bureaucrat cannot commit to not asking for higher bribes in the future, when the firm grows, the bribes increase, and, eventually, lobbying is more attractive. The implication is that small firms bribe whereas large firms lobby. Three recent papers, exploiting firm-survey data, provide supporting evidence.

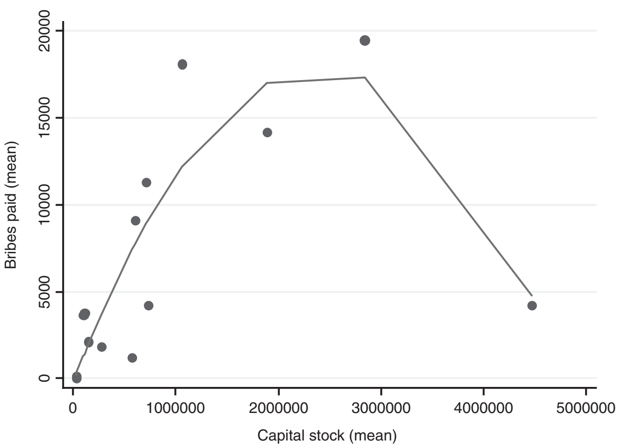
Campos and Giovannoni (2008), using the 2002 Business Environment and Enterprise Performance Survey

[27] Data available on the World Bank's Doing Business site at http://www.doingbusiness.org/.

[28] This result also raises a far deeper question: what determines the industrial organization of corruption markets? As argued by Shleifer and Vishny (1993), collusive bribe maximization can be enforced more easily when bribe increases are more easily detected and more severely punished, as in the case when the government has an effective policing machine to monitor bureaucrats (such as the KGB in the former Soviet Union), and/or when the ruling elite is small and in control of the bureaucracy (as in Indonesia during the Suharto period), and/or when society is homogeneous and close knit (as in Korea and China). The Indonesia case is illuminating: as described in MacIntyre (2001), there were a number of incidents where Suharto clamped down on corruption—not in order to eliminate it but to ensure he controlled the activities.

[29] Analytically, this is similar to the argument in Boycko, Shleifer, and Vishny (1995) and Schleifer and Vishny (1994). They argue that corruption occurs when bureaucrats have "control rights" over firms. With private firms, these control rights stem from the existing regulatory system and the discretion public officials have in implementing, executing, and enforcing rules and benefits that affect firms, such as business regulations and licensing requirements. Empirically, several papers have documented the close relationship between (intrusive) business regulation and corruption both across countries (Ades and Di Tella 1999 and Djankov et al. 2002) and within countries (Svensson, 2003).

FIGURE 2. Relationship between Bribes Paid and Industry Size



(BEEPS) data covering almost 6,000 firms in 26 transition countries, show that larger firms are systematically associated with lobbying, whereas smaller firms are systematically associated with corruption. Moreover, they show that firms that lobbied, grew 15 percentage points faster on average than nonlobbying firms between 1999 and 2002. Although one should be careful in interpreting this result as a causal effect, it is consistent with the holdup problem associated with corruption, as highlighted by Proposition 4.

Using firm-level data from the World Bank's World Business Environment Survey, Bennedsen, Feldmann, and Lassen (2009) also find that larger firms pay bribes less frequently but have more political influence (possibly due to lobbying). Like Campos and Giovannoni (2007, 2008), they conclude that large firms use their influence to change laws and regulations, whereas small firms pay bribes to mitigate the cost of government regulation (Bennedsen 2009, 24).

Figure 2 depicts the relationship between firm size and reported bribe payments for a representative cross-section of firms in Uganda (see Svensson 2003 for details).[30] The data are collapsed at industry level (three-digit ISIC categories) and show that bribes increase in the firm's stock of capital as predicted by Proposition 1, but that the largest firms pay small amounts in bribes. This inverted U-shaped relationship between capital and bribes is as predicted by our model.

The Macro Level: Corruption in Poor Countries, Lobbying in Rich, and the Poverty Trap

By far the most robust and consistent finding of the empirical cross-country work on corruption is the close relationship between economic development and (perceived) corruption (Treisman 2007). Our model can account for this pattern, as it predicts an evolution where firms bribe at low levels of development but lobby in richer societies. Although cross-country data on lobbying are much more scarce, Campos and Giovannoni (2007, 15), using the 1999 BEEPS data, conclude that "lobbying is positively associated with the level of economic development." Consistent with our introductory quote from the *International Herald Tribune*, their finding suggests that the switch from bribery to lobbying is not specific to high-income countries.

In our model, the evolution from bribery to lobbying is not certain, however. The holdup problem associated with corruption can prevent firms from investing enough to make a switch to lobbying worthwhile. If the regulation is mainly in place to collect bribes, and if the underlying productivity in the economy is not sufficiently high, the result will be a poverty trap. Although this proposition is difficult to test empirically, note that the most corrupt countries according to the World Bank's Control of Corruption index—the most comprehensive cross-country data set on (perceptions of) corruption—have characteristics suggesting that they may indeed by stuck in a poverty trap: they have low income, low growth, and to the extent we can measure it, intrusive business regulations.[31]

The Evolution of Regulation

Proposition 7 suggests that the regulatory framework tends to become more "efficient" with development, because sufficiently good rules are never relaxed by lobbying. To exemplify, consider two types of regulations: one put in place out of public interest and another

[30] Total bribes are reported bribe payments in 1997 Uganda shillings. Capital stock is measured as the reported resale value of the capital stock in 1997 Uganda shillings. The 176 firms are classified into 14 three-digit ISIC categories. Dots depict actual bribe payments (B) conditional on size (k), whereas the connected line plots the predicted relationship from the regression

$$B = \underset{(1327)}{594.1} + \underset{(.005)}{0.012}k - \underset{(1.01\times10^{-10})}{2.40 \times 10^{-9}}k^2,$$

with robust standard errors in parenthesis. Svensson (2003) does not report nonlinear effects of capital on bribe payments or industry averages. Technically, our results predict that bribes increase gradually before they suddenly drop to zero, but empirically this relationship may be smoothed somewhat due to heterogeneity across firms in parameters such as r, d, and z, and due to the fact that firms (industries) may face different regulations that may be relaxed at different points in time, implying that the bribes may not fall discontinuously as our result predicts.

[31] See discussion in Svensson (2003, 24). Svensson lists the 10% most corrupt countries according to the World Bank's Control of Corruption index 2002 (Kaufmann, Kraay and Mastruzzi 2003). The median income (real GDP per capita in 1995, Penn World Tables) in the sample of the 10% most corrupt countries is USD 1,450, as compared to USD 5,000 for the median country in the sample of all countries with a corruption score. The average growth rate in the decade preceding the ranking for the 10% most corrupt countries is −0.68%, as compared to 1.61% for the median country in the sample. Of the countries assigned an openness score for the period 1998–1999 (Wacziarg and Welch 2008) using the Sachs and Warner (1995) criteria—a composite index of the regulation of trade with 0 = closed and 1 = open—the median country in the 10% most corrupt sample is closed to trade, whereas the median country in the full sample is open to trade. It takes 408 days at a cost of 613% of per capita income for the median country in the 10% most corrupt sample to register a firm, whereas it takes 154 days and costs roughly 100% of per capita income in the median country to register a firm in the full sample.

instituted to provide bureaucrats with the power to demand bribes. Propositions 6 and 7 state that firms are more likely to eventually, or at an earlier point in time, lobby for the removal of the "bad" regulations, whereas the "good" regulations are less likely to be relaxed. This could explain why regulations that safeguard public health in Europe and the United States, for instance, although costly for firms to comply with, have not been overturned by corporate lobbying. The prediction is also consistent with the regulation of trade and the regulation of entry of firms. In both cases we observe a significant liberalization over time (as is efficient, we would argue). For example, in the period 1970–1989, 70% of the countries classified by Sach and Warner (1995) were closed. In the period 1990–1999, this number has fallen to below 30% (Wacziarg and Welch 2008). Interestingly, the mean annual growth rate from 1970 to the reform date was significantly higher in the reforming countries than in those not reforming during the period, suggesting that, as income grows, the pressure to relax costly regulations increases. The Doing Business dataset covers a much shorter time period but, qualitatively, the results are similar. Of 287 reforms of business regulations in 131 economies introduced between June 2008 through May 2009, only 3 countries introduced rules to make it more difficult to start a firm. Furthermore, cross sectionally, the regulations of entry is closely related to income: rich countries regulate entry less, consistent with our claim that the regulatory framework tends to become more efficient with development (Djankov et al. 2002).

Penalties for Corruption

The section on policy instruments (*Mitigating Corruption: Endogenizing the Policies*) provides both normative and positive predictions. Tough penalties on corruption, for example, lead to larger bribes and thus lower investments in a bribery equilibrium. This result is consistent with the findings in Fjeldstad (2003, 2006). He studies the reforms of the tax administrations in Tanzania and Uganda. The reforms increased salaries for tax officials and relaxed rules for firing, thus raising the opportunity cost for bureaucrats to accept bribes and making it easier to get fired if caught taking bribes. This did not result in less but, if anything, more corruption. Fjeldstad is also reporting evidence from a PriceWaterhouseCoopers survey of firms in Dar es Salaam that indicates that the price per bribe rose following the reform.

In early phases of development, tough penalties on corruption can prolong the period in which firms choose to bribe by reducing the incentives to invest. Thus, from a normative point of view, our model suggests that the penalty for corruption should be lower in poor countries. Furthermore, it suggests that policies aimed at boosting productivity (r in the model) may be a better approach to reducing corruption because they make a switch from bribery to lobbying more likely and at an earlier point in time through its effect on capital accumulation.

CONCLUDING REMARKS

This paper distinguishes two alternative rent-seeking activities: bending versus changing the rules. The results predict an evolution where firms bribe at low levels of development, whereas they lobby in richer societies. However, the holdup problem associated with corruption can prevent firms from investing enough to make a switch to lobbying worthwhile. The outcome might be a poverty trap.

As more and better data on the extent of bribery 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. This paper has taken a first step toward developing such a theory. Future research on comparing bribery and lobbying should explore how this choice depends on the market structure and the environment more generally.

APPENDIX A: ROBUSTNESS AND EXTENSIONS

This Appendix discusses four 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 and (4) the government had some power when negotiating L. The fourth extension is analyzed in Appendix B. The formal analysis for the other extensions is available upon request.

Wage for Bureaucrats

When discussing red tape, we assumed that the government captured a fraction f of the bribes. There are several possible explanations for this. The government may monitor 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. Because larger expected bribes reduce the necessary explicit wage, the equilibrium wage is

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

For k small, w can decrease as k (and thus EB) increases. Thus, $f = 1$ for small k, and the government captures the entire bribe by reducing w. For k (and EB) large, however, $w = 0$ and the government is unable to capture the increased bribes that follows a larger k, because it cannot reduce the wage further. In sum, the government will be reluctant to relax the rule if k is small, because the government then captures all the bribes, whereas 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, whereas they lobby in rich.[32]

[32] Because parts of the bribe B compensate the bureaucrat for its cost of bending the rules, one may argue that we should instead write

$$w = \max\left\{0, \underline{w} - \mathrm{E}\left(B - \theta x k\right)\right\}.$$

This would give the same conclusion, qualitatively, because E$(B - \theta x k)$ turns out to increase in k.

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 because 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?

A simple way of modeling credit constraints is to let a firm borrow an amount sk_{it}, proportional to its size or production, for "free,"[33] whereas 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 total cost of lobbying, $L(k) + R(L(k) - sk)$, may decrease because 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, because it then becomes more likely that the cost of bribery, as a function of k, increases faster than does the cost of lobbying.

Changing the Rules Temporarily

The assumed difference between bribery and lobbying is extreme in that whereas bribery 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 high, firms would lobby rather than bribing. New results would emerge, however. The more stable the rules, the larger the investments would be, and the more likely it would be that the firms eventually would start lobbying. It is straightforward to introduce into the model 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 *Lobbying*. With two political chambers, or a supermajority rule, several legislators are pivotal when the rule is changed. If one is pro regulation, another is anti, then the firm only need lobby the former to get the rule relaxed. Thereafter, the latter legislator prevents the rule from being reintroduced.

If the Government Has Bargaining Power

To simplify the intuition, the above discussion has assumed that the firms have all the bargaining power when lobbying the government. The proofs, however, let L be given by the generalized Nash bargaining solution, where $\gamma \in [0, 1]$ measures the government's bargaining power and thus its share of the bargaining surplus. Although γ certainly affects (and increases) L, it has no impact on investments (I), the required capital threshold ($\bar{k}$), the productivity threshold ($\bar{r}$), or the time of the switch to lobbying (T) in our main model. Furthermore, Proposition 9 continues to hold: the time of the switch to lobbying is optimal for the government and the firms, conditional on the equilibrium investment levels.

However, if the number of firms were $n < \infty$, as in *Firm-specific Regulation*, they would invest less when approaching T if γ were large. Then the government would capture a large share of the surplus at the lobby stage, where this surplus were created by the firms' investments. The interested reader may want to consult the following proofs for more on this.

[33] "Free" loans mean that the present discounted value is zero, i.e., the interest rate is equal to the discount rate, δ.

APPENDIX B: PROOFS

The following proofs allow the most general utility function (12) for the government, and they let the government receive the fraction $\gamma \in [0, 1]$ of the surplus at the lobby stage.

Proof of Proposition 2. Problem (4) is an optimal control theory problem, with the following current-value Hamilton function

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

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

$$\dot{p} - \delta p = -\frac{\partial H}{\partial k} = -(r - b) + dp,$$
$$\frac{\partial H}{\partial I} = -zI + p = 0. \quad \textbf{(A1)}$$

Together with (1), this gives two differential equations with only one stable solution, which can be found straightforwardly:

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

Proof of Proposition 3. If bribery is to take place forever, the evolution of k follows from (1). Because I is constant, solving this differential equation gives

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

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

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

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 $V(k_i, 0) - V(k_i, b) - L_i$. In a bribery equilibrium, the present discounted value of the government's welfare function is found by simply integrating u_G, given by (12). This gives

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

where

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

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

$$\Delta u_G(k) = (f\,(1 + \beta)c/2 - e)\,(c/x)\,K(k, b) + eK(k, 0)$$
$$- g\,[K(k, 0) - K(k, b)]$$
$$= \frac{\eta k}{d + \delta} + \frac{(r - b)\eta + b(e - g)}{z\delta\,(d + \delta)^2}, \quad \textbf{(A2)}$$

where

$$\eta \equiv f(c/x)(1+\beta)c/2 + e(1-c/x) = b - \Omega.$$

Note that $\Delta u_G(k) > 0$ (unless g is very large), implying that the government, in the absence of lobbying, always prefers (to introduce) regulation.

For the firms and the government, the total surplus from relaxing the regulation is

$$\frac{bk_t}{d+\delta} - \Delta u_G(k).$$

Because the government's surplus, $L - \Delta u_G(k)$, is γ multiplied by the total surplus, the equilibrium cost of lobbying is

$$\begin{aligned} L - \Delta u_G(k) &= \gamma\left(\frac{bk_t}{d+\delta} - \Delta u_G(k)\right) \\ &\Rightarrow L = \frac{\gamma bk}{d+\delta} + (1-\gamma)\,\Delta u_G(k) \\ &= k\frac{\gamma b + (1-\gamma)\,\eta}{d+\delta} + (1-\gamma)\,\frac{(r-b)\eta + b(e-g)}{z\delta\,(d+\delta)^2}. \end{aligned}$$

For a given total cost of lobbying, L, the individual cost of lobbying is determined by requiring that each firm gets the same share of the surplus from lobbying, and $\int_j L_j\,dj = L$. This implies that

$$\begin{aligned} &V(k_i, 0) - V(k_i, b) - L_i \\ &= \int_j (V(k_j, 0) - V(k_j, b) - L_j)\,dj \\ &\Rightarrow \frac{bk_i}{d+\delta} - L_i = \frac{bk}{d+\delta} - L \Rightarrow L_i = \frac{b(k_i - k)}{d+\delta} + L, \end{aligned} \tag{A3}$$

where k is the total (and average) stock of capital across the firms.[34]

These expressions for L and (A3) would follow also if we calculated the generalized Nash Bargaining Solution with n firms and let $n \to \infty$.

Proof of Proposition 4. Anticipating lobbying at time T, a firm's problem is

$$\max_{I_\tau} \int_t^T \left((r-b)k_\tau - \frac{z}{2}I^2\right) e^{-\delta(\tau-t)}d\tau + [V(k_{i|\tau=T}, 0) - L_i]\, e^{-\delta(T-t)} \text{ s.t. (1).}$$

The first-order conditions are given by (A1), as before. The terminal condition, however becomes $p_T = \partial\,(V(k_{i|\tau=T}, 0) - L_i)\,/\partial k_{i|\tau=T} = (r-b)/\,(d+\delta)$ when substituting for L_i from (A3). This is clearly satisfied when $p = zI$ and I is still given by (5). (ii) follows from Proposition 2.

Proof of Proposition 5. The total surplus, when the government relaxes the rule, is

$$V(k_T, 0) - V(k_T, b) - \Delta u_G = mk - s, \tag{A4}$$

where

$$m = \frac{\Omega}{d+\delta} \text{ and } s = \frac{b(e-g-b/2) - \Omega(r-b)}{z\delta\,(d+\delta)^2}.$$

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

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

whereas the government receives the other fraction (γ) of the surplus when the firms move to lobbying instead of bribery (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

$$[mk_T' - \delta\,(mk_T - s)]\,e^{-\delta T} = 0,$$

where $k_T' = I - dk$. The second-order condition holds if $m > 0$, which gives condition (9) when substituting for m, η, and b and setting $g = f = 0$. Solving for k_T, we get

$$\begin{aligned} k_T &= \frac{mI + \delta s}{m(\delta+d)} = \frac{(b-\eta)I + \delta\,(d+\delta)\,s}{(b-\eta)(\delta+d)} \\ &= \frac{\Omega I\,(d+\delta)\,z + [b(e-g-b/2) - \Omega(r-b)]}{\Omega\,(d+\delta)^2\,z} \\ &= \frac{b\,(e-g-b/2)}{\Omega\,(d+\delta)^2\,z}, \end{aligned} \tag{A5}$$

where b and η are given by (3) and (A2), and $\Omega = b - \eta$. Thus, k_T is increasing in e and f but decreasing in g, d, δ, and 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 because (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. Proposition 5 follows from (A5) by setting $f = g = 0$ and $\widehat{k} = k_T$.

Proof of Proposition 6. Substituting for k_T in (A5) gives T, the time at which firms switch from bribery to lobbying:

$$\begin{aligned} \frac{I}{d}\left(1 - e^{-dT}\right) &= \frac{b(e-g-b/2)}{\Omega\,(d+\delta)^2\,z} \\ \Rightarrow (d+\delta)\,(r-b)\left(1 - e^{-dT}\right) &= \frac{db(e-g-b/2)}{\Omega}. \end{aligned}$$

However, if $r < \bar{r}$, given by (15), the left-hand side is always smaller than the right-hand side, so that k never reaches k_T.

Proof of Propositions 7 follows from the proofs of Propositions 5 and 6.

Proof of Proposition 8. Suppose the number of firms is $n \in [1, \infty]$. If a firm expects to lobby at time T, its investment problem is

$$\max_{\{I_\tau\}_\tau} \int_t^T \left((r-b)k_\tau - \frac{z}{2}I^2\right) e^{-\delta(\tau-t)}d\tau + [V(k_{i|\tau=T}, 0) - L_i]\, e^{-\delta(T-t)} \text{ s.t. (1).}$$

[34] We here 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.

The problem, and its solution, is exactly as in the proofs of Propositions 2 and 4, except that the terminal condition for the shadow value of k, p, is now

$$p_T = \frac{\partial\left(V(k_{i|\tau=T}, 0) - L_i\right)}{\partial k_{i|\tau=T}} = \frac{r - b + (1-\gamma)\,\Omega/n}{d+\delta}. \quad \textbf{(A6)}$$

The last equality follows because, resting at the Nash bargaining solution, i must at the lobby stage receive its default payoff, $V(k_{i|\tau=T}, b)$, plus $(1-\gamma)/n$ of the total surplus, given by (A4). The derivative of this sum (w.r.t. k_T) is equal to the right-hand side of (A6). With this, the solution to the differential equation (A1) must be

$$p = \frac{r-b}{\delta+d} + p_T e^{-(\delta+d)(T-t)} - \frac{r-b}{\delta+d}e^{-(\delta+d)(T-t)}.$$

Substituting for p_T,

$$\begin{aligned} p &= \frac{r-b}{\delta+d}\left(1 - e^{-(\delta+d)(T-t)}\right) \\ &\quad + e^{-(\delta+d)(T-t)}\left[\frac{r-b+(1-\gamma)\,(b-\eta)\,/n}{d+\delta}\right] \\ \Rightarrow I_n &= \frac{p}{z} = \frac{r-b}{z\,(\delta+d)} + \frac{(1-\gamma)\,\Omega/n}{z\,(d+\delta)}e^{-(\delta+d)(T-t)}. \end{aligned}$$

With these investments, we can solve (1) for k to get

$$\dot{k} = I_n - dk \Rightarrow \partial\left(ke^{dt}\right)/\partial t = I_n e^{dt} \Rightarrow ke^{dt} = \int_{-\infty}^{\tau} I_n e^{dt} d\tau + c_2,$$

where c_2 is a constant (given by the initial capital level). Substituting for I_n and solving for k gives

$$\begin{aligned} ke^{dt} &= \int_{-\infty}^{\tau}\left[\frac{r-b}{z\,(\delta+d)}\right. \\ &\quad \left. + \frac{(1-\gamma)\,(b-\eta)\,/n}{z\,(d+\delta)}e^{-(\delta+d)(T-t)}\right]e^{dt}d\tau + c_2 \\ \Rightarrow k &= \frac{1}{zd}\left(\frac{r-b}{\delta+d}\right) + \frac{(1-\gamma)\,\Omega/n}{z\,(d+\delta)\,(\delta+2d)}e^{-(\delta+d)(T-t)} + c_2 e^{-dt}. \end{aligned}$$

For the firm ever to switch to lobbying, the total surplus, given by (A4), must be strictly positive for the largest possible k, i.e., when $T \to \infty$. This requires

$$\begin{aligned} \lim_{T\to\infty} k_T &= \frac{1}{zd}\left(\frac{r-b}{\delta+d}\right) + \frac{(1-\gamma)\,(b-\eta)\,/n}{z\,(d+\delta)\,(\delta+2d)} \\ &> \frac{s}{m} = \frac{b(e-g-b/2) - (b-\eta)(r-b)}{z\delta\,(d+\delta)\,(b-\eta)} \\ \Rightarrow r - b &> \frac{db(e-g-b/2)}{(d+\delta)\,\Omega} - \frac{\delta d\,(1-\gamma)\,\Omega/n}{(d+\delta)\,(\delta+2d)}. \end{aligned}$$

Proof of Proposition 9. The proof follows from the remark in the proof of Proposition 5.

Proof of Proposition 10. The socially optimal investments for $t < T$ are given by

$$\begin{aligned} &\max_{I_\tau}\int_t^T\left((r+u_G'-b)k_\tau - \frac{z}{2}I^2\right)e^{-\delta(\tau-t)}d\tau \\ &\quad + \left[V(k_{i|\tau=T}, 0) + (g-e)\,K\,(k, 0)\right]e^{-\delta(T-t)} \text{ s.t. (1)}, \end{aligned}$$

where $(g-e)\,K\,(k, 0)$ is the government's continuation value at T. Similarly to (A1), the first-order conditions are

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

The terminal condition is $p_T = \partial(V(k_{i|\tau=T}, 0) + (g-e)\,K(k,0))/\partial k_{i|\tau=T} = (r+g-e)/(d+\delta)$. The solution for p is

$$p = \frac{r+u_G'-b}{\delta+d} + p_T e^{-(\delta+d)(T-t)} - \frac{r+u_G'-b}{\delta+d}e^{-(\delta+d)(T-t)}.$$

Substituting in for I gives

$$\begin{aligned} p &= \frac{r+u_G'-b}{\delta+d}\left(1 - e^{-(\delta+d)(T-t)}\right) \\ &\quad + \left(\frac{r+g-e}{d+\delta}\right)e^{-(\delta+d)(T-t)} \\ \Rightarrow I_* &= \frac{p}{z} = \frac{r+u_G'-b}{z\,(\delta+d)} + \frac{g+b-e-u_G'}{z\,(d+\delta)}e^{-(\delta+d)(T-t)} \\ &= \frac{r+u_G'-b}{z\,(\delta+d)} + \frac{\Omega}{z\,(d+\delta)}e^{-(\delta+d)(T-t)}. \end{aligned}$$

Similarly to before, solving for k gives (where c_{2g} is a constant, given by the initial k_0)

$$\begin{aligned} \partial\left(ke^{dt}\right)/\partial t &= \dot{k}e^{dt} + dke^{dt} = I_* e^{dt} \\ \Rightarrow k &= \frac{r+u_G'-b}{zd\,(\delta+d)} + \frac{g+b-e-u_G'}{z\,(d+\delta)\,(\delta+2d)}e^{-(\delta+d)(T-t)} \\ &\quad + c_{2g}e^{-dt}. \end{aligned}$$

A switch to lobbying is eventually optimal if the surplus (A4) is positive when k_T is as large as possible, i.e., when $T \to \infty$:

$$\begin{aligned} \lim_{T\to\infty} k_T &= \frac{r+u_G'-b}{zd\,(\delta+d)} + \frac{g+b-e-u_G'}{z\,(d+\delta)\,(\delta+2d)} \\ &> \frac{s}{m} = \frac{b(e-g-b/2) - \Omega(r-b)}{z\delta\,(d+\delta)\,\Omega} \\ \Rightarrow r - b &> \frac{db(e-g-b/2)}{(d+\delta)\,\Omega} - \frac{d\delta\Omega}{(d+\delta)\,(\delta+2d)} - \frac{\delta u_G'}{\delta+d}. \end{aligned}$$

Proof of Proposition 11. When taking the derivative of (12), we can ignore the effects on I and k because (these depend on *future* policies, not current policies):

$$\begin{aligned} \frac{\partial u_G}{\partial(-1/x)} &= -f\,(1+\beta)c^2k/2 + eck, \\ \frac{\partial u_G}{\partial c} &= -ek/x + f\ (c/x)\,(1+\beta)\,k, \\ \frac{\partial u_G}{\partial \beta} &= fkc^2/2x > 0. \quad \textbf{(A7)} \end{aligned}$$

The first derivative is taken with respect to $(-1/x)$ instead of x for convenience only (the two derivatives are obviously of the same sign). Clearly, the values of a larger x and a smaller c are increasing in e and decreasing in f. There are two alternative ways of obtaining interior solutions: The derivatives could be set equal to some marginal cost of adjusting the penalties,[35] or the derivative could be set equal to zero given some boundary constraint on $c \in [\underline{c}, \overline{c}]$, $x \in [\underline{x}, \overline{x}]$ and $\beta \in [\underline{\beta}, \overline{\beta}]$.[36] In each case, Proposition 11 follows.

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 bribery were to continue forever, because 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

$$\begin{aligned} &\left[f(1+\beta)\frac{c}{x} - \frac{e}{x}\right] K(k,b) + \left(\frac{u_G}{k}\right)\frac{\partial K(k,b)}{\partial c} \\ &\left[ec - f(1+\beta)\frac{c^2}{2}\right] K(k,b) + \left(\frac{u_G}{k}\right)\frac{\partial K(k,b)}{\partial(-1/x)} \qquad \textbf{(A8)} \\ &\left[\frac{fc^2}{2x}\right] K(k,b) + \left(\frac{u_G}{k}\right)\frac{\partial K(k,b)}{\partial \beta}, \text{ where} \end{aligned}$$

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

For each of the first-order conditions (A8), the first bracket is simply the derivative in the short-term case (A7). 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 from the previous proof. As we mentioned 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 $\beta \in [\underline{\beta}, \overline{\beta}]$.

REFERENCES

Ades, Alberto, and Rafael Di Tella. 1999. "Rents, Competition, and Corruption." *American Economic Review* 89 (4): 982–93.

Austen-Smith, David. 1997. "Interest Groups: Money, Information, and Influence." In *Perspectives on Public Choice*, ed. D. C. Mueller. New York. Cambridge University Press, 296–321.

[35] 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 $\kappa_\beta'(\beta) > 0$.

[36] For example, the optimal x would then be $x = \overline{x}$ if

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

and $\underline{x}$ otherwise.

Banerjee, Abhijit. 1997. "A Theory of Misgovernance." *Quarterly Journal of Economics* 112 (4): 1289–1332.

Bardhan, Pardhan. 1997. "Corruption and Development: A Review of Issues." *Journal of Economic Literature* 35: 1320–46.

Bardhan, Pardhan, and Dilip Mookherjee. 1999. "Relative Capture of Local and Central Government." CIDER Working Paper.

Bardhan, Pardhan, and Dilip Mookherjee. 2000. "Capture and Governance at Local and National Levels." *American Economic Review Papers & Proceedings* 90 (2): 135–39.

Becker, Gary, and George G. Stigler. 1974. "Law Enforcement, Malfeasance and the Compensation of Enforcers." *Journal of Legal Studies* 3 (1): 1–19.

Bennedsen, Morten, and Sven E. Feldmann. 2006. "Informational Lobbying and Political Contributions." *Journal of Public Economics* 90 (4–5): 631–56.

Bennedsen, Morten, Sven E. Feldmann, and David Dreyer Lassen. 2009, "Strong Firms Lobby, Weak Firms Bribe: A Survey-Based Analysis of the Demand for Influence and Corruption." Mimeo, Melbourne Business School.

Boycko, Maxim, Andrei Shleifer, and Robert W. Vishny. 1995. *Privatizing Russia*. Cambridge, MA: MIT Press.

Campos, Nauro, and Francesco Giovannoni. 2007. "Lobbying, Corruption and Political Influence." *Public Choice* 131 (1): 1–21.

Campos, Nauro, and Francesco Giovannoni. 2008. "Lobbying, Corruption and Other Banes." William Davidson Institute WP 930.

Choi, Jay Pil, and Marcel P. Thum. 2004. "The Economics of Repeated Extortion." *Rand Journal of Economics* 35 (2): 203–23.

Dal Bó, Ernesto, Pedro Dal Bó, and Rafael Di Tella. 2006. " '*Plata o Plomo?*': Bribe and Punishment in a Theory of Political Influence." *American Political Science Review* 100 (1): 41–53.

Dekel, Eddie, Matthew O. Jackson, and Asher Wolinsky. 2009. "Vote Buying: Legislatures and Lobbying." *Quarterly Journal of Political Science* 4 (2): 103–28.

De Soto, Hernando. 1989. *The Other Path*. New York: Harper and Row.

Djankov, Simeon, Rafel La Porta, Florencio Lopez-De-Silanes, and Andrei Shleifer. 2002. "The Regulation of Entry." *Quarterly Journal of Economics* 117 (1): 1–37.

Fjeldstad, Odd-Helge. 2003. "Fighting Fiscal Corruption: Lessons from the Tanzania Revenue Authority." *Public Administration and Development* 23 (2): 165–75.

Fjeldstad, Odd-Helge. 2006. "Corruption in Tax Administration: Lessons from Institutional reforms in Uganda." In *International Handbook on the Economics of Corruption*, ed. S. Rose-Ackerman. Cheltenham, UK: Edward Elgar, 484–511.

Grossman, Gene, and Elhanan Helpman. 2002. *Special Interest Politics.* Cambridge, MA: MIT Press.

Kang, David C. 2002. *Crony Capitalism: Corruption and Development in South Korea and the Philippines*. Cambridge, UK: Cambridge University Press.

Kaufmann, Daniel, Aart Kraay, and Massimo Mastruzzi. 2003. "Governance Matters III: Governance Indicators for 1996–2002." World Bank Policy Research Working Paper No. 3106, Washington, DC.

Lambsdorff, Johann Graf. 2002. "Corruption and Rent-seeking." *Public Choice* 113 (1–2): 97–125.

Li, Shaomin, and Judy Jun Wu. 2007. "Why China Thrives Despite Corruption?," *Far Eastern Economic Review* 170 (3): 24–8.

MacIntyre, Andrew. 2001. "Investment, Property Rights, and Corruption in Indonesia." In *Corruption: The Boom and Bust of East Asia*, ed. Josê Edgardo Campos. Manila: Ateneo University Press, 25–44.

Malesky, Edmund J., and Krislert Samphantharak. 2008. "Predictable Corruption and Firm Investment: Evidence from a Natural Experiment and Survey of Cambodian Entrepreneurs." *Quarterly Journal of Political Science* 3 (3): 227–67.

Olken, Benjamin, and Patrick Barron. 2009. "The Simple Economics of Extortion: Evidence from Trucking in Aceh." *Journal of Political Economy* 117 (3): 417–52.

Olson, Mancur. 1965. *The Logic of Collective Action*. Cambridge, MA: Harvard University Press.

Rose-Ackerman, Susan. 1975. "The Economics of Corruption." *Journal of Public Economics* 4: 187–203.

Rose-Ackerman, Susan. 1978. *Corruption: A Study in Political Economy*. New York: Academic Press.

Sachs, Jeffrey D., and Andrew M. Warner. 1995. "Economic Reform and the Process of Global Integration." *Brookings Papers on Economic Activity* 1: 1–118.
Shleifer, Andrei, and Robert Vishny. 1993. "Corruption." *Quarterly Journal of Economics* 108 (3): 599–617.
Svensson, Jakob. 2003. "Who Must Pay Bribes and How Much?" *Quarterly Journal of Economics* 118 (1): 207–30.
Svensson, Jakob. 2005. "Eight Questions about Corruption." *Journal of Economic Perspectives* 19 (5): 19–42.
Treisman, Daniel. 2007. "What Have We Learned about the Causes of Crossnational Corruption from 10 Years of Empirical Research?" *Annual Review of Political Science* 10: 211–44.
Wacziarg, Romain, and Karen Horn Welch. 2008. "Trade Liberalization and Growth: New Evidence." *World Bank Economic Review* 22: 187–231.
Wade, Robert. 1982. "The System of Administrative and Political Corruption: Canal Irrigation in South India." *Journal of Development Studies* 18: 287–328.
World Bank. 1998. "New Frontiers in Diagnosing and Combating Corruption." PREM Notes No. 7, Washington, DC: World Bank.