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POLICY COMPROMISES: CORRUPTION AND REGULATION IN A DEMOCRACY

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This paper evaluates the extent of regulation in a democracy with corruption. Elected politicians can restrict entry of firms in exchange for bribes from entrepreneurs. Full liberalization implies free entry and allocative efficiency. Voters re-elect politicians based on observed performance. We demonstrate that voters agree to tolerate corruption and inefficient regulation; that efficient policies can be promoted by productivity growth; that productivity growth reduces the cost of providing wage incentives; and that corruption is procyclical and economic policy is countercyclical in a corrupt democracy.

1. INTRODUCTION

IT OFTEN appears that democratic societies must live with inefficient regulation of economic activity and high levels of corruption for extended periods of time. This paper proposes a theoretical model to evaluate the extent to which entry regulation can persist over time and to analyze how democratic societies might, by designing appropriate incentives, demise of inefficient regulation, reduce corruption, and encourage honest politics. We argue that sustained economic growth is an important factor in putting incentives right – it reduces corruption directly and lowers the cost of building institutions of good governance – and that business cycle shocks can cause procyclic movements in corruption levels.

Entry regulation often takes the form of comprehensive systems of industrial licensing. Bhagwati (1993, pp. 49–50) documents a leading example of this phenomenon in India where industrial licensing "... sought to regulate domestic entry and import competition, ... to penalize unauthorized expansion of capacity, ... and indeed to define and delineate virtually all aspects of investment and production through a maze of Kafkaesque controls." Elected governments constructed that maze from 1950 onwards and it started to be dismantled in the 1990s, in efforts initiated by yet other elected governments. Similar systems developed in other countries in the region, such as Bangladesh and Pakistan (see e.g. Srinivasan, 2000). State monopolies and entry restrictions are also common in other parts of the world. This includes most Latin American countries as well as, until recently,

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specific industries in the United Kingdom, Italy, and France. In a commentary on the United States, Stigler (1975, p. 19), moreover, notes "[t]he state is now the giver of many valuable rights . . . I suspect that a careful study would display vast caprice, much venality, and a number of calluses on applicants' knees and navels." It is also common practice in most parts of the world to allow entry into specific professions to be heavily regulated. This ranges from taxi services and accountancy to the legal profession and medicine. In yet other cases, entry to economic activities is restricted indirectly by the costs of complying with multiple legal requirements. This is extensively documented by de Soto (1990) in his seminal study of the legal obstacles that a would-be entrepreneur has to go through to operate a firm legally in Peru. He shows that it would take more than 300 days of work at a cost of 32 times the monthly minimum wage to get the permits and approvals needed to set up a small two-sewing-machine clothing factory in a Lima shanty town. No wonder that many would-be entrepreneurs prefer to stay informal or are tempted to pay bribes to get the paperwork done faster. The corruption potential in economies with excessive entry regulation is enormous. It is, therefore, not surprising to find that corruption levels and measures of entry regulation are closely related. As illustrated in Figure 1 for a sample of 85 countries from around the world, there exists a very strong (positive) correlation between corruption, as measured inversely by the control of corruption index constructed by Kaufmann et al. (2005), and the number of bureaucratic procedures entrepreneurs have to complete to operate a small firm legally, as recorded by Djankov et al. (2002). Paldam (2002) and Treisman (2000) document an equality-strong correlation between corruption and lack of economic freedom.

The tight connection between regulation of economic activity and corruption motivates our main hypothesis: entry restrictions are implemented

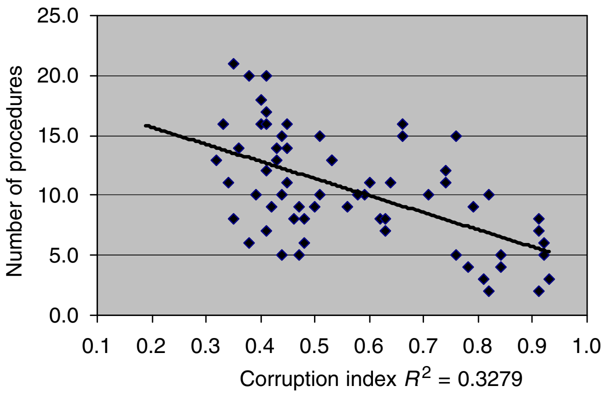

Figure 1. The relationship between corruption (measured inversely on a scale from 0 to 1) and the number of procedures entrepreneurs have to complete to operate legally.

and maintained by corruptible politicians because of their corruption potential. The relevant vested interests – businesses that benefit from protection, bureaucrats who enjoy the power of enforcing regulation, and politicians who can sell more favors in a regulated economy – make it difficult to initiate reforms. The general public loses out.

This is not to deny that entry regulation can serve a social purpose. It is, for example, often argued that regulation of professions such as medicine and law is desirable because it ensures the quality of services. Likewise, the licensing systems introduced in South Asia and the industrial policies followed by the Asian Tigers and Japan are often linked to desirable social objectives such as accelerated industrialization or creation of dynamic comparative advantage. Yet, these policies often persist long after the original rationale has been forgotten, and it is hard to reconcile de Soto's (1990) findings with any sense of social optimality. What seems to be happening in many of these cases is that entry regulation, introduced for whatever reason, outgrows its original purpose and is eventually maintained primarily because of the rents it creates.

We propose a model of policy compromise that can be used to analyze the extent of regulation and corruption in a representative democracy. The model is designed to explain why and when corruption and inefficient regulation can persist in a democracy in which the majority loses out. The major contribution of the analysis is to link the level of corruption to economic factors such as productivity growth and business cycle shocks. This allows us to study possible feedback effects from economic fundamentals to politics. In that way, we gain an insight into the mechanisms through which economic growth can reduce corruption levels and lower the cost of building institutions of good governance. This approach complements the existing literature that focuses mostly on the effect of corruption and inefficient policies on economic growth.[1]

In the model, governments can regulate entry into the production sector by withholding production licenses. Output and wages increase, and profits decline with the number of licenses, or the degree of liberalization. This sets the stage for social conflict. Workers earn wages and would like to see the licensing system abolished. Entrepreneurs would like a license for themselves but see other applicants denied as it allows them to earn super-normal profits. Politicians are elected by majority rule. Once in office, they can restrict the number of licenses and charge for the ones they issue. This is the source of corruption. Their bribe income depends on having the licensing system in place. The majority of the population is workers. They attempt to

[1]See, for example, Blackburn et al. (2006), Krusell and Rios-Rull (1996), Murphy et al. (1991), and Parente and Prescott (2000). Some recent work explicitly considers the two-way relationship between corruption and growth. Blackburn et al. (2008), for example, show that the level of income can have a significant impact on the level of corruption by placing an economy in particular development regimes.

control politicians by holding them accountable for their actions while in office. To this end, they set performance standards, and vote a politician out of office if his performance fails to comply with the standard, as in Ferejohn (1986).

We show that the constrained efficient policy is, typically, a compromise between the preferred policy of the politician and his constituency. The compromise implies that voters agree to elect and re-elect politicians proven to be corrupt. High levels of corruption go hand in hand with inefficient economic policy: corruption and inefficient regulation are two sides of the same coin. This is due to the fact that the politician is – up to a point – able to extract more bribes by restricting economic activity below the socially optimal level. Regulation decreases output levels *and* generates corruption at the same time. Output and corruption are therefore endogenous variables, and we must look to other factors to understand why they differ across time and space.

We are particularly interested in the role of economic factors, such as productivity growth and business cycle shocks, in this process. We show that productivity growth has a benign impact: it reduces corruption, promotes economic efficiency, and reduces the cost of building efficiency-enhancing institutions. The reason is subtle. The scope for corruption grows with GDP, and so politicians prefer to postpone collecting their bribe in a growing economy. To this end, they have to hang on to office, and pander to their constituency by lifting restrictions. This allows voters to reduce corruption. Institutional reforms that increase the value of political office can, in principle, promote economic efficiency. Good institutions, however, are costly to introduce and maintain. We show that it is cheaper to reduce corruption via wage incentives in faster growing economies. We stress the generality of the principle. We demonstrate it with respect to salaries paid to politicians, but a similar logic applies to the design of legal institutions or monitoring systems. We also show that (real) business cycle shocks induce countercyclical regulation policies, with few licenses being issued during a boom and many during a recession. The reason is that politicians want to be re-elected in recessions, and collect their bribes during booms. For the latter purpose, they impose excessive regulation that lowers output and resembles Keynesian "fine-tuning" of aggregate fluctuations.

Our model provides a unified framework for understanding a number of stylized facts about corruption and economic performance. Paldam (2002), Treisman (2000), and others have documented a number of such facts. These include a negative correlation between corruption and income, a positive correlation between corruption and entry regulation (lack of economic freedom), and a negative correlation between corruption and measures of democracy. Our model suggests that the two first stylized facts can be interpreted as equilibrium outcomes arising from the interaction between corruptible politicians and their citizens. High corruption levels go hand in hand with low levels of GDP because corrupt politicians must restrict economic activity to extract bribes from the private sector. Moreover, in our model voters can reduce corruption in societies with more effective electoral accountability. This provides a possible explanation for the negative correlation between corruption and democracy. Finally, Mauro (1995) reports that corruption is negatively correlated with economic growth. This correlation is often interpreted as representing a causal effect running from corruption to growth. Our model, in contrast, suggests that part of the correlation may, in fact, be due to the beneficial impact of growth on corruption. This is consistent with the findings of Paldam (2002). He shows that economic growth reduces corruption in a cross-section of 83 countries. Ultimately, growth and corruption must be jointly determined, and so our analysis only captures half the equation. Combining the positive feedback loop from growth to corruption identified in our model with standard reasons why corruption reduces growth, self-reinforcing social dynamics emerge: growth reduces corruption, which in turn increases growth. This can lead to multiple equilibria in which countries sort themselves into clusters of high growth and low corruption and vice versa.[2] This may explain why it has proven hard to find a robust causal link between growth and corruption in the data using linear estimation techniques (see Aidt et al., 2008).

The theoretical literature on corruption and regulation is vast, and we shall not attempt to summarize it here.[3] Two direct links with the previous literature should, however, be pointed out. First, our concept of corruption is similar to the ''grabbing hand view'' of government advocated by Shleifer and Vishny (1993, 1994). According to this view, corruption arises when non-benevolent politicians realize that inefficient regulation can be in their personal interest. The basic point is that politicians have temporary monopoly rights to political favors and may use this position to distort economic policy to generate large rents for themselves. We add to this strand of literature by embedding the grabbing hand hypothesis within the context of a representative democracy and study how electoral accountability interacts with economic factors in restraining the grabbing hand. Second, our model is related to Coate and Morris (1999) and Persson et al. (1997). Persson et al. (1997) analyze fiscal policy choices in situations where the government can divert tax revenues away from public spending and is limited in this pursuit only by electoral accountability and ''separation of powers'' among different political bodies. Coate and Morris (1999) show how inefficient policies can persist over time once they have been implemented. In our model, inefficiencies can also persist over time when electoral accountability is sufficiently weak. In contrast to Coate and Morris

[2]See Blackburn et al. (2008) for a growth model with self-reinforcing social dynamics that can lead to multiple steady states.

[3]The literature is surveyed by Aidt (2003), Bardhan (1997), and Rose-Ackerman (1999).

(1999) and Persson et al. (1997), our analysis is based on a complete specification of technologies, endowments, and preferences. This is what allows us to evaluate the impact of economic factors on the quality of policy making.

The rest of the paper is organized as follows. In section 2, we set out the economic model. In section 3, we describe the political system. In section 4, we analyze policy outcomes in a stationary economy and show why corruption can persist. In section 5, we extend the model to allow for the possibility that the licensing system can serve a social purpose. We do this by introducing a negative production externality. In section 6, we study the role of productivity growth and wage incentives in reducing corruption. In section 7, we study regulation policy and corruption in an economy that is subject to business cycle shocks. In section 8, we conclude and discuss some limitations of the model.

2. THE ECONOMY

We consider an economy with a continuum of individuals, indexed by j, with measure 1.[4] The size of the population is constant. Time is discrete, indexed by $t = 0, 1, 2, \ldots$ Each individual has one unit of labor each period. A homogeneous consumption good, y, is produced every period. Individuals live forever, consume their net income each period, and derive no utility from leisure. Utility is linear in consumption. The discount factor is $\beta \in (0, 1)$.

At any point in time, an individual can be either a worker or an entrepreneur. Workers supply labor to a competitive labor market. Entrepreneurs run firms and supervise workers. The firm owned by entrepreneur j produces with the following production technology:

$$y_{jt} = A_t s_{jt}^{1-\alpha} \ell_{jt}^{\alpha}, \quad 0 < \alpha < 1, \tag{1}$$

where ℓ_{jt} denotes the labor input hired by entrepreneur j; s_{jt} denotes the time spent on supervision by entrepreneur j; and A_t is the level of technology, common to all firms. Profits are retained by the entrepreneur who runs the firm.

A would-be entrepreneur needs to obtain a license to operate a firm from the government. The politician running the government can choose the number of licenses and determine who gets them. A license confers the right, but not the obligation, to operate a firm for *one* period. License holder j chooses how much time to spend on supervision, $s_{jt} \in [0, 1]$, and supplies the remaining part of her time endowment to the labor market. Non-license holders have no choice of occupation. They work full time for a firm and earn the real wage, w_t. The real wage adjusts to clear the labor market each

[4]The specification of the economy is inspired by Lucas (1978).

period. Let $\lambda_t \in [0, 1]$ be the number of licenses issued in period t. We lose nothing by assuming that licenses are held by individuals $j \in [0, \lambda_t]$.

The state of the economy at time t is summarized by $e_t = (A_t, \lambda_t)$. In our analysis, A_t is exogenous, while λ_t is endogenously determined (see section 3). Let $n_t \leq \lambda_t$ be the number of firms operating in period t. National income is $Y_t = \int_0^{n_t} y_{jt} dj$. For any sequence of states $\{e_0, \ldots, e_t, \ldots\}$, with $e_t \geq 0$, an *equilibrium* of the economy is a sequence $\{\ldots, (n_t, Y_t, w_t), \ldots\}$ such that all individuals and firms optimize, and the labor market clears each period. We write $\pi_{jt} = y_{jt} - w_t \ell_{jt}$ as the equilibrium profit level of firm j at time t. At a symmetric equilibrium, $\pi_{jt} = \pi_t$.

Proposition 1 establishes that the equilibrium is stationary: the number of firms, employment, and incomes depend only on the current state of the economy.

Proposition 1. Let $e_t = (A_t, \lambda_t)$ be the state of the economy at time t. An equilibrium exists whenever $e_t > 0$. Let $\lambda_H = (1 - \alpha)$. Then equilibrium quantities and incomes are functions of the current state of the economy only

$$n(e_t) = \min[\lambda_t, \lambda_H], \quad Y(e_t) = A_t n(e_t)^{1-\alpha}(1 - n(e_t))^{\alpha},$$

$$w(e_t) = \alpha \frac{Y(e_t)}{1 - n(e_t)}, \quad \pi(e_t) = (1 - \alpha) \frac{Y(e_t)}{n(e_t)}.$$

Furthermore, $\pi(e_t) = w(e_t)$ if and only if $\lambda_t \geq \lambda_H$; otherwise, $\pi(e_t) > w(e_t)$. For all e_t, the number of workers is greater than or equal to α. National income, Y_t, is maximized at $n_t = \lambda_H$. Wages increase and profits decrease with λ_t whenever $\lambda_t < \lambda_H$. National income, wages, and profits increase with A_t for all $\lambda_t \in (0, 1]$.

Proof. See Appendix A. ■

When the number of licenses issued is less than λ_H, all licenses are fully utilized and they carry a scarcity rent, i.e. $\pi_t > w_t$. The number of firms is $n_t = \lambda_t$ and the licensing system imposes a binding constraint on entry and output: the economy is allocative inefficient. When the number of licenses is greater than (or equal to) λ_H, the economy is fully liberalized. Licenses are no longer scarce and some are not utilized in equilibrium. The number of firms is $n_t = \lambda_H$ and each license holder is indifferent between being a full-time entrepreneur or a full-time worker, i.e. $\pi_t = w_t$. Liberalization achieves allocative efficiency and maximum national income. Workers welcome this, while entrepreneurs do not, as they see profits decline. This distributional impact is central to our analysis. However, we stress that the interpretation of the core conflict of interest is broader than suggested by the labels "workers and entrepreneurs." What is important for the analysis is the conflict of interest between those with access to rents and those who are excluded. An increase in productivity (A_t) increases national income, wages, and profits proportionally. Liberalization is contentious, but productivity growth is not.

3. A REPRESENTATIVE DEMOCRACY

We wish to study the determination of entry regulation and corruption in societies with representative democracy. In a representative democracy, voters delegate decisions to elected politicians, who, once in office, are free to design the licensing system as they see fit. Voters can respond after the fact and hold the politician accountable for past decisions, as in Ferejohn (1986). Proposition 1 shows that the fraction of workers is at least α. We assume that $\alpha > 1/2$ and so the majority of the population are workers. For simplicity, we refer to the worker-voters as the voters.[5] Formally, the incumbent politician runs against a challenger in the election held at the end of each period. He is re-elected for another term if he gains a majority. At the beginning of his tenure, voters announce an election rule, $\eta_t(\cdot)$, specifying the probability of re-election as a function of the policy choice.[6] We restrict attention to rules that specify a *performance standard*, λ_t^s:

$$\eta_t(\lambda_t; \lambda_t^s) = \begin{cases} 1 & \text{iff } \lambda_t \geq \lambda_t^s, \\ 0 & \text{otherwise.} \end{cases} \tag{2}$$

A stationary election rule specifies a constant standard λ^s.

The fact that a license to run a firm can have economic value suggests that it can be sold at a price. The incumbent politician has a temporary monopoly on the sale of licenses and is tempted to sell government property for personal gain.[7] Each period, the incumbent chooses λ_t, and the price, b_t, at which he sells each license. Accordingly, the politician's *bribe income* is

$$B_t = \lambda_t b_t. \tag{3}$$

Lemma 1 evaluates the bribe function, relating the number of licenses to the maximum surplus that can be extracted.

[5]Although entrepreneurs can also vote, it is without loss of generality that we focus exclusively on the voting behavior of workers.

[6]We specify the performance standard in terms of the number of licenses for convenience. Alternatively, however, we could specify the standard in terms of a particular corruption level and interpret the election rule as saying that politicians who are too corrupt are not re-elected. These two formulations are identical to the most general formulation in which voters define the election rule in terms of utility levels.

[7]This is the definition of corruption given by Shleifer and Vishny (1993).

Lemma 1. The incumbent politician prices each license at b_t where

$$b_t = \max\left[A_t\left((1-\alpha)\left(\frac{1-\lambda_t}{\lambda_t}\right)^{\alpha} - \alpha\left(\frac{\lambda_t}{1-\lambda_t}\right)^{1-\alpha}\right), 0\right]. \tag{4}$$

The politician's bribe income, $B_t(\lambda_t, A_t) = \lambda_t b_t$, is maximized at

$$\lambda_t = \lambda_L \equiv \tfrac{1}{2}\left(2 - \alpha - \sqrt{(4-3\alpha)\alpha}\right), \tag{5}$$

with $0 < \lambda_L < \lambda_H$. λ_L is independent of A_t while the maximized bribe income is proportional to A_t.

Proof. See Appendix A. ■

In the absence of elections, the politician extracts the maximum bribe, $B(\lambda_L, A_t)$, every period by setting $\lambda_t = \lambda_L$. Because $\lambda_L < \lambda_H$, the bribe-maximizing policy imposes excessive regulation. The intuition follows from Proposition 1. A license is valuable only if it is scarce. Liberalization reduces scarcity and the price each license commands.

Politicians care about holding public office for many reasons. Two of these are money and power. For sure, power allows them to make money, because they can sell government property and earn B_t. In addition, politicians, typically, like power for its own sake and consume the ego-rent $m > 0$ by being in office. An alternative interpretation of m is that it represents the integrity of the politicians: politicians with a high m are less tempted, as we shall see, by the prospect of earning unofficial incomes. Thus, the payoff of the politician in office at time t is

$$u_t^p = m + B_t. \tag{6}$$

We normalize the payoff of politicians out of office to zero. We assume that there is an unlimited supply of potential politicians willing to serve.[8] Politicians apply the same discount factor as citizens.

We can now define the game between politicians, workers, and would-be entrepreneurs, as it unfolds over time. Workers earn the market wage and get utility $u_t^w = w_t$. Entrepreneurs have to pay the bribe, b_t, to obtain their license. Lemma 1 implies that entrepreneurs get per-period utility $u_t^e = \pi_t - b_t = w_t$. We note that workers and entrepreneurs obtain the *same* utility, net of bribes. Entrepreneurs are willing to pay the bribe when asked, but pay enough to want the system abolished ex post.

The timing of events is as follows. At the beginning of each period, a politician is already in office. Voters announce a performance standard, λ_t^s.

[8] Alternatively, we could allow politicians to return to the private sector if they lose office. Doing so complicates the analysis without adding substantive new insights. Details are available on request.

Next, the politician chooses how many licenses to issue and at what price. Would-be entrepreneurs can accept or reject the offer of a license at the announced price.[9] Once bribes and licenses have been exchanged, production takes place. Finally, at the end of each period, an election is held. The outcome of the election is determined by the policy implemented by the incumbent relative to the standard. After that, the sequence of events repeats itself.

The natural solution concept is subgame-perfect Nash equilibrium. Strategies in a subgame-perfect Nash equilibrium can depend in complex ways on the history of policy choices. We restrict attention to election rules that depend only on the current policy choice and focus on those that are constrained efficient. That is, we require that voters, for any sequence of productivity levels $\{A_0, \dots, A_t, \dots\}$, set the performance standard such that their lifetime utility is maximized subject to the sequence of incentive-compatibility constraints – that politicians want to comply to the standard at each t rather than being voted out of office – and subject to equilibrium in the private sector.

4. POLICY COMPROMISES

From Proposition 1, we know that the level of technology together with the policy choice determine all variables of economic interest at each t. Outcomes, hence, depend critically on the sequence of technology levels or, more generally, on the nature of technological progress. We start by analyzing constrained efficient outcomes in a stationary economy.

Proposition 2. Suppose $A_t = A > 0$ for all t. Define

$$\hat{\lambda} = \max\{\lambda | B(\lambda) = (1-\beta)B(\lambda_L) - \beta m\}. \tag{7}$$

The constrained efficient licensing policy is $\lambda_t = \lambda$ at each t with

1. $\lambda = \lambda_H$ whenever $\hat{\lambda} \geq \lambda_H$;
2. $\lambda = \hat{\lambda}$ whenever $\lambda_L < \hat{\lambda} < \lambda_H$.

Proof. Let $\lambda^s > \lambda_L$ be a stationary performance standard. The value function of the incumbent politician is

$$v(\lambda_t) = m + B(\lambda_t) + \beta\eta(\lambda_t, \lambda^s) \max v(\lambda_{t+1}). \tag{8}$$

[9] We could assume that the surplus is being split by means of Nash bargaining, as in Besley and McLaren (1993). This would bring out the underlying conflict of interest between workers and entrepreneurs more clearly. However, because this is not important for the results, we focus on the simpler case where the politician has all the bargaining power.

If the politician chooses a policy below the standard, he is replaced by the challenger at the next election and his continuation payoff is zero. Alternatively, he can choose a policy at or above the standard and be re-elected. The payoffs associated with these two options are denoted $v^D(\cdot)$ and $v^C(\cdot)$, respectively. Formally,

$$\lambda_t < \lambda^s \Rightarrow v^D(\lambda_t) = m + B(\lambda_t), \tag{9}$$

$$\lambda_t \geq \lambda^s \Rightarrow v^C(\lambda_t) = m + B(\lambda_t) + \beta \max v(\lambda_{t+1}). \tag{10}$$

The politician chooses $\lambda_t = \lambda^s$ if and only if the following conditions are satisfied:

$$v(\lambda^s) = \max_{\lambda_t} v^C(\lambda_t), \tag{11}$$

$$v(\lambda^s) \geq v^D(\lambda_L) = m + B(\lambda_L), \tag{12}$$

where $v(\lambda^s) = [m + B(\lambda^s)]/(1 - \beta)$ is the value of keeping office forever and $\lim_{\lambda \to 1^-} B(\cdot) = -\infty$. If these conditions fail, the politician implements $\lambda_t = \lambda_L$. Condition (11) is satisfied whenever $\lambda^s > \lambda_L$ because $B'(\cdot) \leq 0$ for $\lambda \geq \lambda_L$. Condition (12) – the incentive-compatibility constraint – ensures that the incumbent conforms to the standard. It is satisfied whenever

$$B(\lambda^s) \geq (1 - \beta)B(\lambda_L) - \beta m. \tag{13}$$

The function $B(\cdot)$ is strictly decreasing in the interval $(\lambda_L, 1]$. Voters' utility increases with λ. They choose the standard, λ^s, to be as high as possible subject to condition (13). If $\beta m \geq (1 - \beta)B(\lambda_L)$, then $\lambda = \lambda_H$; otherwise, $\lambda = \hat{\lambda}$, where $\hat{\lambda}$ is the solution to $B(\lambda) = (1 - \beta)B(\lambda_L) - \beta m$ for $\lambda \in (\lambda_L, \lambda_H)$. ■

Proposition 2 shows that, in the best-case scenario, full liberalization and honesty can be sustained in a representative democracy, but only if the following condition is satisfied:

$$B(\lambda_L) \leq \frac{\beta m}{1 - \beta}. \tag{14}$$

Condition (14) says that the maximum bribe that can be collected $[B(\lambda_L)]$ is less than the payoff to perpetual honesty and permanent tenure. It can be read as a "folk theorem": for m large enough, economic policy in a representative democracy is efficient. The intuition is clear. A politician, who values office highly, is more anxious to please his constituency. A similar role is played by the discount factor.

More often, condition (14) fails, and society must compromise between disparate interests. In this case, the constrained efficient policy is $\hat{\lambda} \in (\lambda_L, \lambda_H)$. The majority of voters want full liberalization ($\lambda_t = \lambda_H$). Politicians want to preserve regulation to protect their bribe income. They prefer to implement

$\lambda_t = \lambda_L$ every period, but realize that doing so jeopardizes re-election prospects. The compromise solution ($\hat{\lambda}$) satisfies neither side. Voters agree to live with inefficient regulation and corruption. A "zero-tolerance" rule is counterproductive: it suffices to note that the performance standard $\lambda^s = \lambda_H$ will lead to $\lambda = \lambda_L$ and every politician will fail to get re-elected, as in Coate and Morris (1999). Politicians conform to the standards set by voters because they want to be re-elected. An implication, then, is that inefficient regulation and corruption can persist in democratic societies: they are the two sides of the same coin of policy compromise. Because inefficient regulation reduces national income, corrupt societies tend, moreover, to be poor. This provides a compelling explanation for one of the best-documented stylized facts about corruption and development.

5. SOCIALLY OPTIMAL LICENSING SYSTEMS

Above we adopted the view that *any* licensing system is allocative inefficient. The only reason for delegating regulatory power to a corruptible politician is therefore that a government is needed to secure private contracts and ensure that markets can operate. In some cases, however, regulation of production, at least up to a point, can serve a social purpose. Consider, for example, a natural monopoly. It is often optimal for a government to change the regulatory conditions imposed on such a monopoly *after* its investments have been sunk. Realizing this ex ante, under-investment will result. As argued by Newbery (1999, ch. 2), a licensing system that insulates the natural monopoly from such political pressures can mitigate this problem and promote efficiency. Entry regulation can also be of social value if it helps create dynamic comparative advantage. This rationale is sometimes attributed to industrial licensing in Southeast Asia. Finally, regulation of production has a social rationale in the presence of externalities, asymmetric information, and other market failures that require government intervention.

In this section, we extend the basic model to capture a range of such situations. Doing so also provides a stronger rationale for why voters delegate the right to issue licenses to a corruptible politician in the first place. We assume that production is associated with a negative externality and that the per-period external cost is increasing and convex in the number of firms, $d_t = d(n_t)$. We continue to focus on a stationary economy, and we omit time subscripts in what follows. Assuming a utilitarian social welfare function, $V(n) = (1 - n)w(n) + n\pi(n) - d(n)$, the socially optimal number of firms (licenses) is given by the solution to $\partial Y/\partial n = \partial d/\partial n$ and denoted by $n = \lambda^*$. The presence of the externality implies that the competitive equilibrium is inefficient and that $\lambda^* < \lambda_H$.

While the motivation of the politician is not directly affected by this, voters internalize the externality when they set the performance standard.

Ideally, they want the politician to implement the licensing system that maximizes the wage bill net of the external cost, i.e. $(1-n)w(n)-d(n)$. Using the expression for $w(n)$ from Proposition 1, we see that this is maximized at $n=\lambda_w$, where λ_w satisfies $\alpha(\partial Y/\partial n)=\partial d/\partial n$. Because the wage share of GDP is less than one, workers do not perceive the full cost of a reduction in output. They, therefore, find it optimal to restrict entry below the socially optimal level, i.e. $\lambda_w<\lambda^*$. This affects the nature of the policy compromise, as shown in the next proposition.

Proposition 3. Assume that $\lambda_L<\lambda_w$. Let $\hat{\lambda}$ be defined by equation (7). The constrained efficient licensing policy is $\lambda_t=\lambda$ at each t with

1. $\lambda=\lambda_w$, whenever $\hat{\lambda}\geq\lambda_w$;
2. $\lambda=\hat{\lambda}$, whenever $\lambda_L<\hat{\lambda}<\lambda_w$.
3. The constrained efficient licensing policy is always stricter than the socially optimal policy.

Proof. The proof is similar to that of Proposition 2. The only major difference is that workers solve a slightly more complex problem:

$$\max_{\lambda^s}(1-\lambda)w(\lambda)-d(\lambda)$$

subject to the incentive-compatibility constraint $B(\lambda^s)\geq(1-\beta)B(\lambda_L)-\beta m$. If $\hat{\lambda}\geq\lambda_w$, then the incentive-compatibility constraint is not binding at λ_w. Workers can get their most-preferred licensing system implemented and the politician collects the bribe income $B(\lambda_w)$. If, on the other hand, $\hat{\lambda}<\lambda_w$, the incentive-compatibility constraint binds. Workers set $\lambda^s=\hat{\lambda}$ and politicians comply and collect $B(\hat{\lambda})$. The assumption that $\lambda_L<\lambda_w$ ensures that both cases can arise. The constrained efficient policy is socially in-optimal because $\lambda_w<\lambda^*$. ■

The proposition shows that the policy outcome in an economy in which licensing systems can have social value, typically, continues to be a compromise between what workers want (λ_w) and what the politician wants (λ_L). Now, however, what workers want is not socially optimal. This implies that even when workers do not need to compromise ($\lambda=\lambda_w$), the constrained efficient licensing policy is allocative inefficient. In this case, inefficient regulation arises, not so much because of its corruption potential, but more because the majority of workers forces the politician to over-internalize the externality. In the process of doing so, they allow politicians to sell licenses and collect more bribes than is needed for compliance. On the other hand, when workers are forced to compromise (e.g. because the ego-rent or the discount factor is low), outcomes are isomorphic to those of an economy in which licenses have no social value.

6. GROWTH AND POLITICS

In societies with technological progress (or regress), productivity growth and shocks are important determinants of the quality of economic policy and corruption levels. This is because these economic conditions affect the nature of the policy compromise. As we have seen in the previous sections, policy compromises can arise irrespective of whether licenses have social value or not. Importantly, the impact of technological progress and shocks on the compromise is the same in the two cases. To simplify the analysis, but without any loss of insight, we focus in the analysis below on the case in which licenses have no social value. In this section, we study the role of productivity growth, while section 7 studies the role of productivity shocks.

6.1 Growth and Corruption

Consider an economy with constant productivity growth

$$A_t = (1+g)^t A_0 \quad 0 < g < \frac{1-\beta}{\beta}. \tag{15}$$

From Proposition 1 and Lemma 1, we recall that all economic variables are proportional to A_t:

$$Y_t = A_t Y(\lambda_t), \quad w_t = A_t w(\lambda_t), \quad \pi_t = A_t \pi(\lambda_t), \tag{16}$$

and

$$B_t(\lambda_t) = A_t B(\lambda_t). \tag{17}$$

In the next proposition, we characterize the "best" stationary licensing policy that can be sustained indefinitely in a growing economy. By "best," we mean the policy that maximizes voters' utility subject to incentive compatibility.

Proposition 4. Suppose $A_t = (1+g)^t A_0$, with $0 < g < (1-\beta)/\beta$. Define

$$\bar{\lambda} = \max\{\lambda | B(\lambda) = (1-\beta(1+g))B(\lambda_L)\}. \tag{18}$$

The "best" stationary licensing policy is $\bar{\lambda} \in (\lambda_L, \lambda_H)$. Moreover, $\partial\bar{\lambda}/\partial g > 0$.

Proof. Consider the stationary election rule

$$\eta(\lambda_t, \lambda^s) = \begin{cases} 1 & \text{iff } \lambda_t \geq \lambda^s, \\ 0 & \text{otherwise.} \end{cases} \tag{19}$$

The stationary licensing policy $\lambda = \lambda^s$ is incentive compatible if and only if the politician is willing to implement it at each t, i.e. $v_t^C(\lambda^s) \geq v_t^D(\lambda_L)$ at each t.

This is equivalent to

$$\frac{m}{1-\beta}+\frac{A_tB(\lambda^s)}{1-\beta(1+g)}\geq m+A_tB(\lambda_L) \tag{20}$$

at each t. Rearranging equation (20) yields

$$\frac{\beta m}{1-\beta}+A_tq(\lambda^s)\geq 0, \tag{21}$$

where $q(\lambda^s)=B(\lambda^s)/[1-\beta(1+g)]-B(\lambda_L)$. Because $\lim_{t\to\infty}A_t=\infty$, inequality (21) holds at each t if and only if $q(\lambda^s)\geq 0$. Because $(1-\beta(1+g))\in(0,1)$ and $B'<0$ for $\lambda>\lambda_L$, it follows that $\lambda^s=\bar{\lambda}$, where $\bar{\lambda}$ is defined by condition (18), maximizes wages subject to incentive compatibility at all t and that $\bar{\lambda}\in(\lambda_L,\lambda_H)$. ■

Proposition 4 shows that economic growth has a beneficial impact on the quality of policy and helps societies reduce corruption. A larger economy presents greater temptations and politicians stand to gain more from selling favors. Importantly, however, the scope for corruption grows with GDP. As a consequence, politicians prefer to postpone collecting their bribe in a growing economy. To this end, they have to hang on to office, and pander to their constituency by lifting entry restrictions. This allows voters to reduce corruption and to promote efficient policies without tempting politicians to maximize their bribe income. This result is important because it provides a new rationale for why there might be reverse causality from economic growth to corruption levels. This helps explain why Aidt et al. (2008), Paldam (2002), and Treisman (2000) find that growth reduces corruption.

The proposition characterizes the "best" stationary licensing policy. There are other, non-stationary incentive-compatible paths with monotonically increasing levels of corruption where the limiting value is defined by equation (18). These paths are incentive compatible because the net gain of compliance takes the form $[\beta m/(1-\beta)]+A_tq(\lambda_t)$. The relative importance of the ego-rent is higher when A_t is low.[10] In the early phases of growth, voters can exact much higher standards of performance from their elected leaders and corruption levels are lower. A particularly interesting path is one in which, at time 0,

$$A_tB(\lambda_L)<\frac{\beta m}{1-\beta}. \tag{22}$$

This implies that voters initially can demand full liberalization and that politicians are honest. As time passes, however, the temptation to collect bribes increases. At some t, condition (22) must fail, and voters cannot keep politicians honest any more. At that time, the economy has reached its

[10]These paths can only arise in economies where the ego-rent (m) is less than proportional to the size of the economy (A_t). We find this a plausible condition.

"corruption threshold." Bribe incomes rise steadily thereafter relative to A_t until the limit $B(\bar{\lambda})$ is reached. This may explain why some societies become more corrupt as time unfolds. It also provides an alternative explanation for the observation made by Olson (1982) that societies tend to grow inefficient over time. Moreover, it implies that it is *not* possible to sustain the efficient policy λ_H forever in a growing economy.

It is also possible to observe "corruption reversals." To see this, compare two economies: one that is growing fast and one that is growing more slowly. Suppose that both economies satisfy condition (22) at time 0. The fast-growing economy reaches its corruption threshold first. Corruption will, for a period, be higher in the fast- than in the slow-growing economy. Eventually, however, the corruption level in the slow-growing economy will overtake that of the fast-growing economy. This follows from Proposition 4. As a consequence of the benign incentive effect of growth, corruption will eventually be lower in the fast-growing economy. This logic can explain why the ranking of countries as measured by, say, Transparency International, may change over time. It can also explain why growth in the short run might worsen a country's corruption score, while in the long run, it must improve it.

6.2 Growth and Political Wages

Societies can invest in institutions of governance that promote efficient policies and reduce corruption, as pointed out by, for example, Gradstein (2004). A simple institution that, in principle, can achieve this is a political wage. By a political wage, we simply mean an official salary paid to the politician while in office. Today, it is the norm to pay politicians for their services, although the wages paid to, for example, heads of states are low relative to the compensation packages offered to CEOs of publicly held companies (Besley, 2004). Historically, politicians were, typically, not receiving any remuneration. Members of Parliament in Great Britain were, for example, unpaid until the twentieth century.

A political wage increases the value of political office and this allows voters to demand more efficient policies in return for re-election.[11] Paying political wages is, however, costly. The fact that a corrupt democracy is allocative inefficient implies that there is substantial surplus from which the cost of good institutions could be financed. Yet the question remains: is the population willing to pay the cost of reducing or even eliminating corruption? To answer this question, suppose that the politician is paid the political wage

$$\omega_t = \omega A_t, \tag{23}$$

[11]The role of political wages is emphasized by Becker and Stigler (1974) and Besley and McLaren (1993) among many others. We view it as one example among many of an institution that can increase the value of political office.

where the base wage $\omega \geq 0$ is indexed to the size of the economy. For simplicity, we assume that $m = 0$. Per-period utility of the politician is

$$u_t^p = \theta\omega_t + B(\lambda_t). \tag{24}$$

The parameter θ captures the value placed on official income relative to unofficial (bribe) income.[12] We assume that $\theta \geq 1$. Workers design an incentive package consisting of a political (base) wage ω and a performance standard $\tilde{\lambda}$. The next proposition characterizes the constrained efficient incentive package.

Proposition 5. Assume that $\theta > 1$. Let $\bar{\lambda}$ be the constrained efficient licensing policy with $\omega = 0$. The constrained efficient incentive package is stationary. There exists a $K(\theta) \in (0, 1)$ that is decreasing in θ such that

1. The constrained efficient incentive package is $(\omega(\tilde{\lambda}), \tilde{\lambda})$ with $\tilde{\lambda} \in (\bar{\lambda}, \lambda_H]$ and

$$\omega(\tilde{\lambda}) = \frac{(1 - (1+g)\beta)B(\lambda_L) - B(\tilde{\lambda})}{\theta\beta(1+g)} \tag{25}$$

whenever $\beta(1+g) > K(\theta)$.

2. The constrained efficient incentive package is $(0, \bar{\lambda})$ whenever $\beta(1+g) \leq K(\theta)$.

Proof. See Appendix A. ■

The constrained efficient incentive package trades off the welfare gain of lower corruption and more efficient economic policy with the cost of financing political wages. The growth rate of the economy plays an important role in settling this tradeoff. In economies with a low growth rate $[1 + g \leq (K/\beta)]$, it does not pay to offer political wages at all: it is too expensive because the effective discount factor $[\beta(1+g)]$ of the politician is too low relative to the value attached to official income (θ). In contrast, in fast-growing economies $[1 + g > (K/\beta)]$, political wages are offered and corruption is, as a consequence, reduced.[13] The constrained efficient political wage is defined by equation (25). It can be interpreted as the minimum cost required to get the politician to implement the policy $\lambda_t = \tilde{\lambda}$ at each t. This cost is decreasing in the growth rate of the economy: growth reduces the cost of paying political wages.

[12]The parameter θ can also be interpreted as an inverse measure of the transaction cost of collecting bribes.

[13]It is important that the politician values official income more than bribe income: for $\theta = 1$, $K = 1$, and voters are never willing to pay political wages.

If the relative value of official to unofficial income is sufficiently high, $\theta > 1/[\beta(1+g)]$, voters find it in their best interest to offer the politician an incentive package that reduces corruption to zero and liberalizes the economy fully. We can think of θ as an inverse measure of the transaction cost of bribery. We can then interpret this as saying that societies in which the deadweight cost associated with bribery is large are precisely the sorts of societies in which it is efficient to get rid of corruption all together. The reason simply is that politicians are less tempted to collect bribes when θ is high. This is what reduces the cost of paying political wages. The ego-rent or the integrity of politicians plays a similar role. In societies in which politicians have a high m, it is cheaper for voters to pay political wages. This makes it more likely that zero corruption is constrained efficient. Often, however, it is not optimal to pay for full liberalization simply because θ and m are too low. An implication, then, is that corruption and inefficient policy can persist even in societies where voters strengthen electoral incentives by paying political wages.

The analysis focuses on political wages. Importantly, however, the basic idea applies to other *costly* institutions. This includes penal and monitoring systems, and constitutional rules that introduce checks and balances. Voters are more willing to make investments in good institutions of governance in economies that grow fast: the marginal cost is lower because politicians prefer to postpone collecting their bribe in a growing economy and more so, in a fast-growing one. This result is important because it provides reasons why there might exist a benign feedback effect from economic growth to the quality of the institutions that a society chooses to design. Ultimately, good institutions are likely to have a positive impact on growth. A positive self-reinforcing process may as a consequence be set apace. This can help explain the seesaw dynamics observed by Paldam (2002) in his analysis of cross-country corruption patterns and the multiplicity of growth/corruption regimes identified by Aidt et al. (2008).[14]

7. SHOCKS AND POLITICS

Corruption varies with the business cycle in an economy that is exposed to productivity shocks. It matters greatly for outcomes, however, whether shocks are observed and anticipated by voters or not. We focus on the case where voters do observe the state of the business cycle before they announce their performance standard. To keep it simple, suppose that

$$A_t = \begin{cases} 1+\mu & \text{with probability } p \geq 0, \\ 1 & \text{with probability } 1-p, \end{cases} \tag{26}$$

[14]See Blackburn et al. (2008) for a theoretical analysis of this phenomenon.

and that the shocks are independent over time. The economy is in a boom if $A_t = 1 + \mu > 1$ and, else, in a recession. We can interpret μ as a measure of the amplitude of the cycle. It is optimal to tailor the performance standard to business cycle conditions. Let

$$\lambda(A_t) = \begin{cases} \lambda_B & \text{if } A_t = 1 + \mu, \\ \lambda_R & \text{if } A_t = 1, \end{cases} \tag{27}$$

be the state-dependent performance standard used by voters. We assume that $m < [(1 - \beta - \mu p\beta)B(\lambda_L)]/\beta = \bar{m}$ and that $\omega = 0$ in order to concentrate on the situation with $\lambda_t < \lambda_H$ both in booms and recessions.

Proposition 6. Assume that $m < \bar{m}$. Define

$$\lambda_B = \max\{\lambda | (1 + \mu)B(\lambda_B) = (1 - \beta + \mu(1 - p\beta))B(\lambda_L) - \beta m\}, \tag{28}$$

$$\lambda_R = \max\{\lambda | B(\lambda_R) = (1 - \beta - \mu p\beta)B(\lambda_L) - \beta m\}. \tag{29}$$

The constrained efficient licensing policy is

1. $\lambda_t = \lambda_B$, if $A_t = 1 + \mu$;
2. $\lambda_t = \lambda_R$, if $A_t = 1$.

Moreover, $\lambda_R > \lambda_B$.

Corollary 1 (The corrupt Keynesian). Corruption is procyclical and economic policy is countercyclical, i.e. entry regulation is lax in a recession and strict in a boom.

Proof. Let voters announce the performance standard given in equation (27). If period t is a boom, the value function of the politician is

$$v_t^B = m + (1 + \mu)B(\lambda_B) + \beta \max v_{t+1} \tag{30}$$

and

$$v_t^R = m + B(\lambda_R) + \beta \max v_{t+1} \tag{31}$$

if it is a recession. We note that $v_{t+1} = pv_{t+1}^B + (1 - p)v_{t+1}^R$. We solve for a stationary solution to these two equations:

$$v^B = \frac{B(\lambda_R)\beta(1 - p) + m + (1 + \mu)B(\lambda_B)(1 - \beta(1 - p))}{(1 - \beta)}, \tag{32}$$

$$v^R = \frac{m + B(\lambda_R)(1 - \beta p) + B(\lambda_B)\beta p(1 + \mu)}{(1 - \beta)}. \tag{33}$$

Incentive compatibility requires that $v^B \geq m + (1 + \mu)B(\lambda_L)$ and $v^R \geq m + B(\lambda_L)$. Assuming that $m < \bar{m}$, the constrained efficient performance standard solves $v^B = m + (1+\mu)B(\lambda_L)$ and $v^R = m + B(\lambda_L)$. A simple calculation yields the expressions given in equations (28) and (29). Notice that

$$\frac{(1-\beta+\mu(1-p\beta))}{(1+\mu)} - (1-\beta-\mu p\beta) = \frac{(\beta\mu + p\beta\mu^2)}{(1+\mu)} > 0.$$

Because $B' < 0$, we conclude that $\lambda_R > \lambda_B$. The condition that $m < \bar{m}$ implies that $\lambda_R < \lambda_H$. ■

Proposition 6 shows that economic policy is more inefficient during booms than during recessions.[15] Because inefficient economic policy by itself reduces output, this phenomenon can be interpreted as active Keynesian stabilization policy driven by the desire of corrupt politicians to collect bribes. The other side of the coin, then, is that corruption is procyclical. A booming economy presents greater temptations, and politicians stand to gain more from selling favors. As a consequence, societies must concede more to dishonest politics. The intuition is straightforward. An increase in national income raises the stakes because politicians can potentially extract much larger bribes. They are, therefore, more likely to defect from a given standard. Realizing this, voters are willing to accept more entry restrictions and higher levels of corruption during a boom than during a recession. The distortion in economic policy is increasing in the amplitude of the cycle [μ].

It is important to stress the different incentive effects associated with sustained growth and with business cycle shocks. Economic growth reduces corruption in the long run because voters can exploit the fact that politicians have a *sustained* incentive to postpone taking bribes. Business cycle shocks, on the other hand, tempt politicians to collect bribes when output *levels* are high. Accordingly, even if shocks were permanent, a positive technology shock would increase corruption rather than reducing it. The critical difference is that economic growth implies that the pool from which politicians can extract bribes continues to increase over time. Business cycle shocks, in contrast, essentially represent level shifts.

8. CONCLUSION

We analyze how corrupt politicians may implement and preserve excessively high levels of regulation, and the extent to which voters can control the resulting inefficiency. We show, in Propositions 2 and 3, why we expect to observe compromise politics; in Proposition 4 that economic growth can promote efficient economic policies and reduce corruption; in Proposition 5 that more efficient outcomes can sometimes be attained by an appropriate

[15]If $m > \bar{m}$, the economy is allocative efficient in a recession. It is clear, however, that this would not affect the main insight of Proposition 6. Unless m is so large that voters can get the politicians to implement λ_H irrespective of business cycle condition, economy policy will continue to be countercyclical.

design of performance standards and official rewards to officeholders and that the cost of doing so is lower in fast-growing economies; and in Proposition 6 that economic policy entails excessive stabilization of aggregate fluctuations in a corrupt democracy. Many questions are, however, left unanswered. In particular, we concentrate on situations where growth is exogenous, and not affected by political mistakes or diversion of resources to rent-seeking. In reality, bad policies can have growth effects, by affecting the incentives to invest in, or adopt, new technologies[16] or by making it attractive to engage in rent-seeking (see e.g. Acemoglu and Verdier, 1998; Murphy et al., 1991). This implies, of course, that bad policy choices and corruption itself can have a persistent, negative impact on the economy. At the same time, even corrupt politicians are unlikely to make very bad mistakes, because they would rather take their cut from a growing pie. Another limitation of the model is that it does not allow for any intertemporal tradeoffs between corruption and economic policy. If, for example, corruption can boost short-run economic performance at the cost of future performance, new and interest interactions between corruption and myopic policy choices arise, some of which are studied in Aidt and Dutta (2007).

APPENDIX A

A.1 *Proof of Proposition 1*

For each $\lambda > 0$, individuals $j \leq \lambda$ are license holders, and have the right to choose $s_j > 0$ and employ workers in their firm. Suppose $s_j(e) > 0$. Profit maximization implies

$$\ell_j(e, w) = s_j \left(\frac{\alpha A}{w}\right)^{1/(1-\alpha)}$$

and

$$y_j = A s_j^{1-\alpha} \ell_j^{\alpha} \equiv s_j y(w), \quad \pi_j = (1-\alpha) y_j \equiv s_j \pi(w).$$

A license holder earns $\pi(w)s_j + w(1 - s_j)$, which is maximized at $s_j = 1$ whenever $\pi(w) > w$. In this case, all licenses are used, i.e. $n(e) = \lambda$ and the total supply of labor is $1 - \lambda$. Labor market clearing requires that $\lambda \ell_j(e, w) = 1 - \lambda$. Therefore, equilibrium national income, the wage rate, and profit per firm satisfy

$$Y(e) = A\lambda^{1-\alpha}(1-\lambda)^{\alpha}, \quad w(e) = \alpha \frac{Y(e)}{1-\lambda}, \quad \pi(e) = (1-\alpha)\frac{Y(e)}{\lambda}.$$

From these, we obtain the condition

$$\pi(e) > w(e) \Rightarrow \lambda < (1-\alpha) \equiv \lambda_H.$$

[16]Benhabib and Rustichini (1996) evaluate such feedback effects.

Suppose $\lambda \geq \lambda_H$. Let $n \leq \lambda$. Firms maximize profits and all workers are employed. Equilibrium national income, the wage rate, and profit per firm satisfy

$$Y(A,n) = An^{1-\alpha}(1-n)^{\alpha}, \quad w(A,n) = \alpha\frac{Y(A,n)}{1-n},$$

$$\pi(A,n) = (1-\alpha)\frac{Y(A,n)}{n}.$$

Note that $n > 0 \Rightarrow \pi(A,n) \geq w(A,n)$ from the occupational choice of individuals $j \leq \lambda$; that $n = \lambda_H$ is the unique solution to $\pi(A,n) = w(A,n)$; and that $\pi(A,n) < w(A,n)$ whenever $n > \lambda_H$. This establishes that $\pi(e) = w(e) \Leftrightarrow \lambda \geq \lambda_H$ and that $n(e) = \lambda_H$ for $\lambda \geq \lambda_H$. We see that $1 - n(e) \geq \alpha$ for all e. Finally, write

$$Y(e) = An(e)^{1-\alpha}(1-n(e))^{\alpha} \quad \text{with } n(e) = \min[\lambda, \lambda_H],$$

$$w(e) = \alpha A\left(\frac{n(e)}{1-n(e)}\right)^{1-\alpha}, \quad \pi(e) = (1-\alpha)A\left(\frac{1-n(e)}{n(e)}\right)^{\alpha}.$$

We note that Y, w, and π are monotonically increasing in A; that π and $1/w$ decrease with n; and that Y attains its maximum at $n = \lambda_H$. ■

A.2 Proof of Lemma 1

A license is valid for one period. Its "price," b_t, cannot exceed its value to the holder, i.e.

$$b_t \leq \pi(\lambda_t, A_t) - w(\lambda_t, A_t). \quad \text{(A1)}$$

The politician extracts the entire surplus and, hence, condition (A1) is binding. The total bribe is

$$B(\lambda_t, A_t) = \lambda_t(\pi(\lambda_t, A_t) - w(\lambda_t, A_t)). \quad \text{(A2)}$$

The bribe function is concave and differentiable, with $B(0, A_t) = 0 = B(\lambda_H, A_t)$, $\lim_{\lambda \to 0} B'(0, A_t) = \infty$, and $B'(\lambda_H, A_t) \leq 0$. Hence, the total bribe income is maximized at some $\lambda_L \in (0, \lambda_H)$. Note that λ_L is stationary, and independent of productivity A_t. Thus, we can write $B(\lambda_L, A_t) = A_t B(\lambda_t)$. ■

A.3 Proof of Proposition 5

Assume that $\theta > 1$. Suppose voters announce the incentive package (ω, λ) where λ is a stationary performance standard and ω is the (base) wage. If the politician complies at time t, he gets

$$v_t^C = A_t\theta\omega + A_t B(\lambda) + \beta \max v_{t+1}. \quad \text{(A3)}$$

If he deviates, he gets $v_t^D = A_t\theta\omega + A_t B(\lambda_L)$. The incentive-compatibility constraint at each t then reads

$$B(\lambda) \geq (1 - \beta(1+g))B(\lambda_L) - \theta\beta(1+g)\omega. \tag{A4}$$

Workers design the incentive package by solving the following (stationary) problem:

$$\max_{\lambda,\omega} w(\lambda) - \omega \tag{A5}$$

subject to $B(\lambda) \geq (1 - \beta(1+g))B(\lambda_L) - \theta\beta(1+g)\omega$; $\lambda_L \leq \lambda \leq \lambda_H$; and $\omega \geq 0$. The Lagrangian is

$$L = w(\lambda) - \omega + \upsilon(B(\lambda) - (1 - \beta(1+g))B(\lambda_L) + \theta\beta(1+g)\omega), \tag{A6}$$

where $\upsilon \geq 0$ is the Lagrangian multiplier. Noticing that the solution must have $\lambda > \lambda_L$, the Kuhn–Tucker conditions can be written as

$$\frac{\partial L}{\partial \lambda} = \frac{\partial w}{\partial \lambda} + \upsilon \frac{\partial B}{\partial \lambda} \geq 0 \quad \text{w.c.s.}, \tag{A7}$$

$$\frac{\partial L}{\partial \omega} = -1 + \upsilon\theta\beta(1+g) \leq 0 \quad \text{w.c.s.}, \tag{A8}$$

$$\frac{\partial L}{\partial \upsilon} = B(\lambda) - (1 - \beta(1+g))B(\lambda_L) + \theta\beta(1+g)\omega \geq 0 \quad \text{w.c.s.}, \tag{A9}$$

where w.c.s. means with complementary slack. Suppose that $\omega > 0$. This implies that $\upsilon = 1/[\theta\beta(1+g)] > 0$. Note that $(\partial L/\partial\lambda)(\lambda_L) > 0$ because $(\partial B/\partial\lambda)|_{\lambda_L} = 0$. Moreover, $(\partial L/\partial\lambda)(\lambda_H) = [(1-\alpha)/\alpha]^{1-\alpha}[1 - (1/\theta\beta(1+g))]$. This is positive for $\theta < 1/[\beta(1+g)]$ and non-positive for $\theta \geq 1/[\beta(1+g)]$. Calculate

$$\frac{\partial^2 w}{\partial \lambda^2} + \upsilon \frac{\partial^2 B}{\partial \lambda^2} = \frac{1}{\theta\beta(1+g)}\alpha(1-\alpha)\lambda^{\alpha-2}(1-\lambda)^{-\alpha-1} \times (1 - \lambda + \alpha(1 - \theta\beta(1+g)) - 2) < 0 \tag{A10}$$

for $\upsilon = 1/[\theta\beta(1+g)]$. Denote by $\tilde{\lambda}$ the choice of performance standard. We conclude that $\tilde{\lambda}$ is unique and a maximum. Moreover, $\tilde{\lambda} \in (\lambda_L, \lambda_H)$ for $\theta < 1/[\beta(1+g)]$ and $\tilde{\lambda} = \lambda_H$ for $\theta \geq 1/[\beta(1+g)]$. The corresponding political wage is $\omega(\tilde{\lambda}) = [(1 - (1+g)\beta)B(\lambda_L) - B(\tilde{\lambda})]/[\theta\beta(1+g)]$. Because $B' < 0$, $\omega(\tilde{\lambda}) > 0$ if and only if $\tilde{\lambda} > \bar{\lambda}$. To establish when this is the case, we evaluate

$$\theta\beta(1+g)\frac{\partial w}{\partial \lambda}(\bar{\lambda}) + \frac{\partial B}{\partial \lambda}(\bar{\lambda}). \tag{A11}$$

Tedious calculations show that this is equal to

$$\rho(\bar{\lambda})\bar{\lambda}^{-\alpha}(1-\bar{\lambda})^{\alpha-2},$$

where

$$\rho(\bar{\lambda}) = \left[(\theta\tilde{\beta}-1)\alpha(1-\alpha)+(1-\alpha)(1-\bar{\lambda})-\bar{\lambda}(1-\bar{\lambda})\right], \tag{A12}$$

and $\tilde{\beta}=\beta(1+g)$. Write $\bar{\lambda}(\tilde{\beta})$. We note that $\bar{\lambda}(1)=\lambda_H=(1-\alpha)$, that $\bar{\lambda}(0)=\lambda_L$, and that $\partial\bar{\lambda}/\partial\tilde{\beta}=-B(\lambda_L)\,(\partial B/\partial\lambda)^{-1}>0$ for $\bar{\lambda}>\lambda_L$. We see that $\rho(\bar{\lambda}(1))>0$ for $\theta>1$. Substitution of $\bar{\lambda}(0)=\lambda_L$, where λ_L is given in equation (5), yields after simplification that $\rho(\bar{\lambda}(0))=0$. Notice, moreover, that

$$\frac{\partial\rho(\bar{\lambda}(\tilde{\beta}))}{\partial\tilde{\beta}}=\theta\alpha(1-\alpha)-(1-\alpha-\lambda+(1-\lambda))\frac{\partial\bar{\lambda}}{\partial\tilde{\beta}}.$$

Notice that $[\partial\rho(\bar{\lambda}(\tilde{\beta}))/\partial\tilde{\beta}]|_{\lambda_L}<0$ as $(\partial\bar{\lambda}/\partial\tilde{\beta})|_{\lambda_L}\to-\infty$. Substituting λ_L from equation (5) and simplifying show that $[\partial\rho(\bar{\lambda}(\tilde{\beta}))/\partial\tilde{\beta}]|_{\lambda_H}>0$ for all α and $\theta\geq 0$. Calculate

$$\frac{\partial^2\rho(\bar{\lambda}(\tilde{\beta}))}{\partial\tilde{\beta}^2}=-(1-\alpha-\lambda+(1-\lambda))\frac{\partial^2\bar{\lambda}}{\partial\tilde{\beta}^2}+2\left(\frac{\partial\bar{\lambda}}{\partial\tilde{\beta}}\right)^2>0$$

as $\partial^2\bar{\lambda}/\partial\tilde{\beta}^2=(\partial^2B/\partial\lambda^2)(\partial\bar{\lambda}/\partial\tilde{\beta})B(\lambda_L)(\partial B/\partial\lambda)^{-2}<0$. It follows from the fact that $\rho(\bar{\lambda}(\tilde{\beta}))$ is a strictly convex function of $\tilde{\beta}$ that there must exist a $K\in(0,1)$ such that $\rho(\bar{\lambda}(\tilde{\beta}))>0$ for $\tilde{\beta}>K$ and $\rho(\bar{\lambda}(\tilde{\beta}))\leq 0$ for $\tilde{\beta}\leq K$. Thus, $\tilde{\lambda}>\bar{\lambda}$ if and only if $\tilde{\beta}>K$. Notice that $K=1$ at $\theta=1$ and decreasing in θ for $\theta>1$. Otherwise, $\omega=0$ and $\lambda=\bar{\lambda}$ at the solution to the voters' problem with

$$\upsilon=-\frac{\frac{\partial w}{\partial\lambda}(\bar{\lambda})}{\frac{\partial B}{\partial\lambda}(\bar{\lambda})}<\frac{1}{\theta\beta(1+g)}. \tag{A13}$$

■

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