Moving Toward the Rule of Law in the Face of Corruption: Re-examining the Big-Bang*

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Abstract

We investigate the claim that the establishment of property rights in an economy in transition would create its own demand for the enforcement of laws to protect those rights. Our model contains a government seeking activities to accomplish certain objectives that depend on public support for the enforcement of the rule of law. It also contains agents who interpret the activities of the government as signals as to the intent of the government to enforce the rule of law. The agents use the signals in their choice of whether to support the objectives of the government. With both the government and the agents playing an active role, we establish conditions under which the activities chosen by the government will maximize its benefits and, at the same time, maximize the constituency in support of enforcement. These conditions provide a basis for the argument for the implementation of the big-bang policy in economies in transition. However, when these conditions do not hold, we show that in pursuing its own goals, the government reduces support for the enforcement of the rule of law, which, in our model, leads to an increase in corruption. Two characteristics play an important role in these conditions: the initial level of corruption in the economy and the types of activities the government chooses to undertake. We present four examples to determine the relative importance to our conclusions of each of these characteristics.

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1. Introduction

The fall of communism in 1989-1991 inspired many western economists to propose procedures by which the formerly centrally planned economies might be transformed into market economies. Relatively early-on, two distinctly different points of view emerged as to how to accomplish the transition, one characterized as the "big-bang"[1] and the other as "gradualism." Proponents of both views, while counseling different sequences of reforms and optimal time paths over which the reforms should be implemented, envisioned the same end result: the former communist countries would leave the world of central planning, becoming, at the end of the process of transition, recognizable market economies. The debate over speed and timing was a debate over method: the end-point, a functioning market economy, was assumed to be attainable by all, independent of method.

While no one would deny that market economies depend on certain institutional frameworks, for example, a functioning legal structure, one of the most controversial aspects of the big-bang approach was the claim that privatization needed to occur almost immediately, even before a functioning legal system was in place to govern property rights. The basis of the claim was straightforward: ownership would create its own demand for laws to protect that ownership. Thus, the proponents of the big-bang approach did not argue that enforced legal structures were unnecessary for the transition from plan to market, but rather that they would be created as a result of the rapid change in ownership structure.[2] The most highly visible country to implement the big-bang approach was Russia. Yet, Russia is also highly visible as a country where the "rule of law" is weak. Is it possible that rapid mass privatization, in advance of the institutional structures of a market economy, created a climate that deterred, and might continue to deter, the creation of effective legal structures, thus undermining the appropriateness of the big-bang approach?

Awareness of the importance of the role played by institutions in market economies has been

[1] "Shock therapy" was another phrase used synomously with big-bang.

[2] For example, see Shleifer and Vishny (1998, p. 253): "In fact, some have argued that Russia has been mistaken in beginning with economic reforms and delaying political and institutional reforms .... But this evaluation ignores a critical interaction between economic and political reforms, namely that economic reforms create pressure for political reforms."

keen since North (1990) and is emphasized, for example, in Djankov and Murrell (2002). The focus on legal institutions and their importance, though not directed toward economies in transition, is also highlighted, for example, in papers by La Porta, Lopez-de-Silanes and Shleifer (1999), and La Porta, Lopez-de-Silanes, Shleifer and Vishny (1998). In addition, the attack on the Washington Consensus spearheaded by Stiglitz (1999) forcefully argued that institutional development needed to precede other reforms, including privatization.

Models of the transition of planned economies to market economies generally have taken as given that convergence to market economies will be achieved. Some of these models are Aghion and Blanchard (1994), Boycko, Shleifer and Vishny (1995), Dwatripont and Roland (1995), and Katz and Owen (1993, 2000). No one has yet provided a theoretical argument showing the convergence of a country without a strong legal structure to one with a strong legal structure. However, recently, a number of papers have appeared that look at the question of the possible forestalling effect of too-rapid and too-early mass privatization on the subsequent development of adequate legal protections in a transition economy. These include Hoff and Stiglitz (2004), Polishchuk and Savvateev (2004), and Sonin (2003). The forestalling effect investigated in these works is the lack of public support for the enforcement of property rights, or simply for the rule of law.

Hoff and Stiglitz (hereafter HS) propose a model in which agents, who control firms, must decide either to strip assets or to add value to their firm. Allowing for different types of agents and a voting scheme that permits agents to choose between the rule of law or continuing in a lawless regime, they show that there is an equilibrium in which agents may not vote to impose the rule of law. Polishchuk and Savvateev (hereafter PS) consider a model in which agents must decide how to split resources between production and appropriation. They show that production inefficiency and economic inequality, in combination, cause wealthier agents to be against full protection of property rights. Sonin (hereafter S) considers a model with agents of varying wealth who may invest part of that wealth to protect their property rights. He shows that wealthier agents prefer incomplete protection of these rights. To the degree that support for the enforcement of the rule of law yields that enforcement, and that this enforcement is a necessity in a market economy, the conclusions reached in these papers weaken the position advocated in the big-bang approach.

In HS, the government plays no direct role in the optimization issues faced by the agents, but passively ratifies their choices. In PS and S, comparisons of equilibria with and without property

rights are made from the viewpoints of the agents: involvement of the government in the choice to establish these rights is not considered. On the other hand, in all three models, it is assumed that the government has exhibited its power by already having granted property rights, and may further exercise its power by enforcing the rule of law. This suggests that the government has its own objectives to achieve, and that the realization of these objectives depends on public support. In our model we acknowledge this, and move the government from a passive player to an active participant in the determination of society's support for the rule of law.

The model we present captures the interaction between a government and agents when the government has an objective to attain. Both the government and the agents play an active role in our work. Through activities it undertakes, the government provides signals that the agents use to evaluate the probability that the government will move to enforce the rule of law. Based on these evaluations, the agents decide whether to be law abiding or not. Thus, through its activities, the government affects the choice of the agents as to whether to steal or not. Significantly, the agents' decisions must be made prior to knowing whether or not the rule of law will be enforced. We take the level of honesty established in society in the face of this uncertainty to be a measure of support for the rule of law: the greater the level of honesty, the larger the constituency for the rule of law. The government's interest in the rule of law is presumed to derive from the benefits its receives from it. For example, the government may wish to attract FDI or may wish to be accepted into international organizations such as the WTO or the EU. Knowing that corruption might impede its chances of success, a government might undertake activities to influence the agents in such a way that corruption is reduced, thereby increasing support for the government's goal. Thus, in our model, the collective choice of the agents has an impact on the benefits the government receives. Given this interaction, we examine the strategic choice of the government to achieve its desired objective.

In our paper we show the conditions under which activities performed by the government will maximize the benefits to the government and, at the same time, maximize the constituency in support of the rule of law. This result supports the argument for the big-bang. The support, however, depends on the particular characteristics of the country involved, namely, the initial confidence that agents have in the government, the type of activities the government chooses to perform, and the ability of the government to pay for those activities. When these characteristics

are properly aligned, success in attaining the government's objectives coincides with society's full support for the establishment of the rule of law.

We also show conditions under which the attainment of the government's objectives is not consistent with full support for the rule of law. In this case, the pursuit of the government's objectives leaves some corruption, and when the level of corruption in society is sufficiently elevated, these conditions yield an argument that weakens the case for the big-bang. We later argue that the Russian experience exemplifies these circumstances.

Of the various characteristics that distinguish the two situations described above, two stand out as particularly important in our analysis: the initial level of corruption in society and the types of activities the government chooses to undertake. By presenting four examples, we investigate the relative importance to our conclusions of each of these characteristics separately, as well as jointly. We demonstrate that the initial level of corruption in society has the most dramatic impact on society's subsequent support for the rule of law.

In part 2 we present our model. Results are contained in part 3 and four examples are presented in part 4. A discussion of our results appears in part 5.

2. The Model

We consider a country defined by a government (G), a legal system, agents and firms. G has at its disposal a variety of activities. As a consequence of the activities it implements, a level of corruption is established, which has an impact on the benefits G receives from its activities. These activities are costly and are financed by taxing firms. We assume that G has already pursued a policy that has resulted in agents having received control rights over firms. However, the legal system is incomplete in that the enforcement of contracts, in part or in whole, is uncertain.

Each agent controls one firm, and having observed the activities of G, decides whether or not to steal funds from her firm. Collectively, a percentage of the agents will choose to steal, and this percentage is called the level of corruption in the country. We assume that G's benefits are monotonically related to this level of corruption. Thus, we assume that G's interest in reducing corruption is driven by the benefits it gets from this reduction but not the reduction per se. Subject to its taxing ability, G seeks a level of activities to maximize its benefits. The choice of the optimal level of activities yields a corresponding level of corruption in the society. This level of corruption,

or its complement, the level of honesty, the end product of the interaction between G and the agents, is the focus of our analysis. We seek to determine the conditions under which it is in G's interest to eradicate corruption.

2.1. Government

We assume G's many activities are ordered and brought into correspondence with a variable, $y \geq y_{\min}$. We refer to y as the level of activities undertaken by G and assume that its initial level is $y = y_0 \geq y_{\min}$ and that $y \in [0, \infty]$. For each level of y chosen, a level of corruption is induced. We denote this level as $1 - p(y)$ where $p(y)$ is the proportion of agents in the society who choose to be honest. We assume that the benefits to G of choosing y depend on y through $p(y)$. We denote this benefits function as $B[p(y)]$ and assume that it is a monotonic increasing function of $p(y)$. The cost associated with the implementation of y is $C(y)$, which is assumed to be convex with $C(y) \geq 0$ for $y \geq y_{\min}$, $C(y_0) = 0$ and $C'(y) > 0$ for $y \geq y_0$. (For later convenience, we think of $C(y)$ as cost per capita.) Also, each y chosen by G yields tax revenues to G which we denote by $T(y)$. We assume that G has the power to tax all funds that are not stolen.

2.2. Legal System

Our model is a one period model in which all decisions are made at the beginning of the period and the resolution of all uncertainty occurs at the end. The incomplete legal system makes it uncertain to the agents as to whether there will be complete enforcement of contracts at the end of the period. We assume that at the end of the period complete enforcement either will or will not be established. By complete enforcement we mean that if an agent stole at the beginning of the period, she would be caught at the end and would have to relinquish all money stolen. Otherwise, she would not be caught and she would keep what she had stolen.

Because G is ultimately involved in whether or not enforcement ensues, each agent must assess G's intent in this direction. We assume that y, G's level of activities, is a signal for G's intensions. Thus, based on y, each agent forms a subjective probability $\pi(y)$ that complete enforcement will occur at the end of the period. We refer to this outcome as the establishment of the rule of law. We assume that each agent assesses y in the same manner, i.e., $\pi(y)$ is common to all agents. We assume further that the correspondence between the activities and the variable y implies that $\pi(y)$

is a non-decreasing, differentiable, function of y. Because these probabilities are used by the agents in their decisions to steal or not, G's choice of y indirectly affects the proportion of agents who choose to be honest, i.e., $p(y)$.

2.3. Agents: Determination of $p(y)$

We assume there is a single agent controlling each firm and this agent is indexed by the value $\tau, \tau \in [0,1]$, which represents the proportion of the firm's assets the agent would steal if she choose to steal. Also, we denote by $H[\tau; y]$ the proportion of agents that would steal no more than τ from their firms if G chose y as its level of activities. We assume that this family of distributions $H[\tau; y]$ has a partial derivative $\frac{\partial H[\tau;y]}{\partial \tau} = h[\tau; y]$, which is a proper density with $h[\tau; y] = 0$ for $\tau \notin [0, \overline{\tau}(y)]$, $\overline{\tau}(y) \leq 1$. The upper bound $\overline{\tau}(y)$ reflects the possible activities in which G, for example, cracks down on large thieves, thereby reducing the range of thefts possible. We assume that $\overline{\tau}(y_{\min}) = 1$, $\overline{\tau}(\infty) = 0$, and $\overline{\tau}'(y) \leq 0$. Furthermore, we assume that by undertaking more activities, G can induce the society to become more "honest," i.e., $\frac{\partial H[\tau;y]}{\partial y} \geq 0$ for $\tau \in [0, \overline{\tau}(y))$ and $\frac{\partial H[\tau;y]}{\partial y} = 0$ for $\tau \notin [0, \overline{\tau}(y))$.

Agent τ may or may not steal. If agent τ chooses to steal, she steals τ percent of the firm's value, $\tau \in [0, \overline{\tau}(y)]$, leaving $(1 - \tau)$ percent of the firm to continue to the end of the period. Each agent, honest or not, retains $\delta \leq 1$ percent of the value of the firm at the end of the period, the remaining $(1 - \delta)$ percent going to G as taxes. The interest rate is set at zero. We assume that for each choice of y by G, each agent knows the probability $\pi(y)$ that contracts will be completely enforced at the end of the period, i.e., that the rule of law will prevail. All firms have an initial value f, which, at the end of the period is either $f(1 + k_H)$ or $f(1 + k_L)$, $k_H > k_L > -1$, $k_H > 0$, depending on whether the end-of-period state is the rule of law, or not, respectively. The rates k_H and k_L represent the rates of increase per dollar value of the firm in the two instances. We assume that each agent is an expected value maximizer. We first establish the explicit form for the percentage of honest agents (and thereby the level of corruption) that follows from G's choice of y. Let $r(y) = \frac{\pi(y)}{1-\pi(y)}$ be the odds ratio and let $\beta = \frac{\delta(1+k_H)}{1-\delta(1+k_L)}$.

R1. (a) If $\delta(1 + k_L) < 1$ and $\pi(y) \neq 1$, then $p(y) = H[\beta r(y); y]$.

(b) If either $\delta(1 + k_L) \geq 1$ or $\pi(y) = 1$, then $p(y) = 1$.

Proof. Part (a): If agent τ chooses to be honest, then her expected value is $\delta[\pi(y)f(1 + k_H) +$

$(1-\pi(y))f(1+k_L)]$.[3] If agent τ chooses to steal, she steals $f\tau$ at the outset of the period, reducing the value of the firm to $f(1-\tau)$. Having assumed that the agent receives zero if the final state is the rule of law, if agent τ chooses to steal, she expects $(1-\pi(y))[f\tau+\delta f(1-\tau)(1+k_L)]$. Since agent τ will choose to be honest if her expected revenue from being honest is at least as large as her expected revenue from stealing, agent τ will choose to be honest if $\delta[\pi(y)f(1+k_H)+(1-\pi(y))f(1+k_L)]$ $\geq (1-\pi(y))[f\tau+\delta f(1-\tau)(1+k_L)]$. Simplifying, we have $\delta\pi(y)f(1+k_H) \geq (1-\pi(y))[f\tau-\delta f\tau(1+$ $k_L)] = f\tau(1-\pi(y))[1-\delta(1+k_L)]$. This inequality is the same as $r(y)\delta(1+k_H) \geq \tau[1-\delta(1+k_L)]$. Since $\delta(1+k_L)<1$, the last inequality is $\beta r(y) \geq \tau$. It follows from the definition of $H[\tau;y]$ that the proportion of agents that will be honest is given by $H[\beta r(y);y]$. This is what was called $p(y)$.

Part (b): In the proof of part (a) we came to the inequality $\pi(y)\delta(1+k_H) \geq (1-\pi(y))f\tau[1-$ $\delta(1+k_L)]$ for agent τ to be honest. If either $\delta(1+k_L) \geq 1$ or $\pi(y)=1$, the right-hand-side of this inequality is non-positive for all $\tau \in [0,\overline{\tau}(y)]$ and the result follows.♣

As we see in R1, the percentage of honest agents depends on two consequences of G's selection of y. The first consequence is the indirect consequence through $r(y)$, and the second is the direct effect on H of y. An implication is that if $r(y)$ did not depend on y, but H did, G's choice would still alter the level of corruption. Similarly, if H were not affected by y but $r(y)$ were, then G's choice would again affect the level of corruption.

For a given y, $H[\beta r(y);y]$ decreases as either β or $r(y)$ decrease. It follows that the level of corruption will rise for a given level of y if either β or $r(y)$ falls. In particular, β will be smaller, the smaller the values of δ and k_H. Since δ is $1-$ the tax rate, the rule above establishes a connection between taxation and corruption. That is, corruption will increase with an increasing tax rate, albeit in a non-linear fashion. The value of $(1+k_H)$ represents the added value to the firm due to the establishment of the rule of law. In weak economies we would expect k_H to be small, and thus not provide a great incentive for agent τ to remain honest.

The functional form of $\pi(y)$ and thus $r(y)$, taken as given in this model, reflects the agents' perceptions of the relationship between G's actions at the outset of the period and the enforcement of the rule of law at the end of the period. This perception is partially rooted in the confidence that the society has that its government's activities will lead to the enforcement of the rule of law.

[3] We assume that any investment required by the agent would have to be made at the outset of the period and would be the same whether the agent chooses to steal or not. Otherwise, it would expose the intent of the agent.

Normally this confidence will differ from country to country, so we would expect corruption to vary accordingly.

The restriction that $\delta(1+k_L) < 1$ implies that the firm's performance would be sufficiently poor, should the rule of law not prevail, so as to be an unattractive outcome to some agents. When this restriction does not hold, part (b) shows that no matter the outcome at the end of the period, no agent would steal. For the remainder of the paper we consider the more interesting case in which some level of corruption could exist, i.e., we assume $\delta(1+k_L) < 1$.

2.4. Determination of $T(y)$

G needs revenue to finance its activities. The tax revenues, on the other hand, are not available to G until the end of the period so G must plan on the basis of expected tax revenues. We think of these expected revenues as collateral for the loan G might take at the beginning of the period to finance its activities.

For each $\tau \leq \beta r(y)$ and y fixed, agent τ chooses to be honest and the tax rate $(1-\delta)$ is applied to the expected value of the firm. This equals $(1-\delta)[\pi(y)f(1+k_H) + (1-\pi(y))f(1+k_L)]$. Since each honest agent has the same expected value, the proportion of agents that have this expected tax bill is $(1-\delta)p(y)[\pi(y)f(1+k_H) + (1-\pi(y))f(1+k_L)]$. For each $\tau > \beta r(y)$ and y fixed, the agent chooses to steal. If the rule of law prevails, the agent forfeits all money to G; thus, with probability $\pi(y)$, G receives $f\tau + f(1-\tau)(1+k_H)$. If on the other hand, the rule of law doesn't prevail, the agent only pays taxes on the part of the firm she did not steal and, with probability $1-\pi(y)$, G gets the amount $(1-\delta)f(1-\tau)(1+k_L)$. Therefore, if agent τ steals, G expects from this agent $\pi(y)[f\tau + f(1-\tau)(1+k_H)] + (1-\pi(y))[(1-\delta)f(1-\tau)(1+k_L)]$. Since this expected value depends on τ, we must sum over all values of $\tau > \beta r(y)$. The expected tax revenue in this case becomes $\pi(y)(1-p(y))[f\mu_C + f(1-\mu_C)(1+k_H)] + (1-\pi(y))(1-p(y))[(1-\delta)f(1-\mu_C)(1+k_L]$ where μ_C is the conditional mean value of τ given that agent τ chooses to steal. In sum, for G's level of activities fixed at y,

$$\begin{aligned} T(y) &= fp(y)(1-\delta)[\pi(y)(1+k_H)] + (1-\pi(y))(1+k_L)] \\ &\quad + f(1-p(y))[\pi(y)(1+(1-\mu_C)k_H + (1-\pi(y))(1-\delta)(1-\mu_C)(1+k_L). \end{aligned}$$

2.5. G's problem

We assume that G is seeking an optimal level of activities y^* to maximize its benefits, which in turn depend on the level of honesty (corruption) in society. G's level of activities prior to seeking y^* was assumed to be y_0, and, at that value, the corresponding level of corruption was $1 - p_0$. We further assume that G is constrained by having to pay for its activities from tax revenue, and that should there be more than one optimal level of activities, G would choose the least costly.[4] We now state G's problem: G chooses y^* such that

$$\begin{aligned} y^* &= \min\{\arg\max_{y \geq y_{\min}} B[p(y)]\} \\ s.t.\ T(y) &\geq C(y) \\ p(y) &= H[\beta r(y); y] \\ p_0 &= H[\beta r(y_0); y_0] \\ y_0 &\geq y_{\min}. \end{aligned}$$

3. Results

We define y_M to be the smallest value of y such that $p(y) = 1$. If $p(y) < 1$ for all values of y, then $y_M = \infty$.

R2. (a) $p'(y) \geq 0$ for $y \geq y_{\min}$.

(b) If $\pi'(y) > 0$ for $y \geq y_{\min}$ then $p'(y) > 0$ for $y_{\min} \leq y < y_M$.

Proof. (a) $p'(y) = \frac{dH[\beta r(y);y]}{dy} = h[\beta r(y); y]\beta r'(y) + \frac{\partial H[\beta r(y);y]}{\partial y}$. Since $h[\cdot; y]$ is a density, it is non-negative for all y. Also, $r'(y) = \frac{\pi'(y)}{[1-\pi(y)]^2}$ is non-negative since π is non-decreasing in y. Finally, by assumption, $\frac{\partial H[\beta r(y);y]}{\partial y} \geq 0$ for all $y \geq y_{\min}$ and part (a) follows.

(b) Since y_M is the smallest value of y for which $p(y) = 1$, it satisfies $\beta r(y_M) = \overline{\tau}(y_M)$. Since H is continuous for any $y_{\min} \leq y < y_M$, $\beta r(y) < \overline{\tau}(y)$, i.e., $\beta r(y) \in [0, \overline{\tau}(y))$. Thus, $h[\beta r(y); y] > 0$ and since $\pi'(y) > 0$, so is $r'(y)$ and part (b) follows.♣

This result shows that an increase in G's level of activities produces an increase in the level of honesty in society. This is consistent with our earlier remarks that the variable y is in correspondence with a sequence of ever-more-beneficial activities. Also, in the last proof, we see that a change

[4] Other sources of revenue for G, for example, foreign assistance, we interprete as reducing the cost of G's activities.

in society's level of honesty has two sources. The first source is the impact of G's activities on the agents' subjective evaluation of the future and the second is the direct impact of G's activities in reducing criminal behavior. The absence of either of these effects alone would not be enough to alter the results of R2.

R3. Let $y_M < \infty$. Then $\pi(y_M) < 1$, i.e., $\pi(y_M) < p(y_M)$.

Proof. Since y_M satisfies $\beta r(y_M) = \overline{\tau}(y_M)$, it follows that $\beta \frac{\pi(y_M)}{1-\pi(y_M)} = \overline{\tau}(y_M)$. Thus, $\pi(y_M) = \frac{\overline{\tau}(y_M)}{\overline{\tau}(y_M)+\beta} < 1$ and the result follows.♣

In this model $\pi(y)$ is formulated and used by the agents in choosing to be honest or not. The proportion who choose to be honest, $p(y)$, results from the collective choice of the agents, all using the same $\pi(y)$. This result shows that for full support for the rule of law to be achieved at the end of the period, it is not necessary for all agents to be certain that this will happen. In fact, depending on various parameters, β in particular, $\pi(y^*)$ could be very small. In an expected value sense, if the rewards in a lawful society are high enough, a small probability will be enough for all agents to pursue these rewards.

We next define the feasible set of y values as $I = \{y : T(y) \geq C(y),\, y \geq y_{\min}\}$ and we let $\max I$ be the largest $y \in I$. For the remainder of the paper we assume $y_M < \infty$.

R4. If $B(p)$ is a strictly increasing function of p, and if $\pi'(y) > 0$ for $y \geq y_{\min}$, then

(a) the unique maximum y^* exists and satisfies

(1) $y^* = \max I$ if $\max I < y_M$,

(2) $y^* \geq y_0$,

(3) $y^* = \min\{y : y \in I,\, y > y_M\}$ if $\max I > y_M$ and if $y_M \notin I$,

(4) $y^* = y_M$ if $y_M \in I$.

(b) If $y^* \neq y_M$, then the constraint is binding, i.e., $C(y^*) = T(y^*)$.

Proof. (a) Given our assumptions, it is easily seen that $T(y) \leq f(1 + k_H)$ for all y. Since $C(y)$ was assumed to be a convex strictly increasing function of y, there will be a finite value of y beyond which $T(y) < C(y)$. Thus, $\max I < \infty$. Furthermore, $T(y_0) \geq 0$ and $C(y_0) = 0$ so $y_0 \in I$. Thus, it follows that I is not empty, $\max I$ is finite, and $\max I \geq y_0$. Since $\pi'(y) > 0$ for $y \geq y_{\min}$, it follows from R2 that $p(y)$ is strictly increasing for $y_{\min} \leq y \leq y_M$ and since $B[p(y)]$ is strictly increasing in $p(y)$, when $\max I < y_M$ the benefits function achieves its unique maximum at $y^* = \max I$. Furthermore, since $\max I \geq y_0$, $y^* \geq y_0$.

Since $p(y) = 1$ for all $y \geq y_M$, $B[p(y)]$ is constant over this interval. So, when $\max I \geq y_M$, the unique minimum cost of activities that achieves the maximum benefits is $y^* = \min\{y : y \in I, y \geq y_M\}$. This minimum is y_M when $y_M \in I$.

(b) If $y_M \notin I$ and $\max I < y_M$, then $y^* = \max I$ must occur at the highest value of y such that $T(y) \geq C(y)$, i.e., when $T(y) = C(y)$. If $\max I > y_M$ and if $y_M \notin I$, then $y^* = \min\{y : y \in I, y > y_M\}$ must occur at the smallest value of $y > y_M$ such that $C(y) \geq T(y)$, i.e., when $T(y) = C(y)$.♣

The solution to G's problem as exhibited in R4 shows the importance of the relationship of elements in the feasible set I to the particular values y_0 and y_M. The first of these values is a given initial condition, and the second depends on other parameters through the distribution $H[\cdot; y]$. Neither I, y_0 nor y_M depend on the benefits function $B(p)$. Thus, the solution would remain the same for any benefits function so long as it were strictly increasing with respect to $p(y)$. Since this property of the benefits function seems appropriate for many countries, R4 implies that a comparison of countries should focus on the cost and taxation functions as well as on the initial conditions, i.e., on the feasible set I.

A unique solution to G's problem always exists as we see in R4 and, so long as $B[p(y)]$ is increasing in $p(y)$, the level of corruption will not increase, that is, $p(y^*) \geq p_0$. We note that in the economies in transition, the initial conditions of the governments seeking to establish market economies were varied. Some countries had stronger links to a democratic past, it is said, while others did not. We can think of p_0 as a surrogate for such features. Larger values of p_0 can be thought of as providing a running start to the creation of the rule of law.

Results in R4 part (a) imply that if the $\max I \leq y_M$, y^* will be between y_0 and y_M. The value y_M will be close to y_0 if $r(y)$, or equivalently $\pi(y)$, increases rapidly with y. This would happen if society believed that the actions taken by G at the outset of the period would, with high probability, lead to the rule of law at the end of the period; that is, if society trusted its government to proceed to this end. High trust would imply that y_0 and y_M were close, implying further that the rule of law, or something close to it, would be established.

Part (b) shows that even though benefits are constant for $y \geq y_M$, it is possible that the minimum cost, non-budget-breaking solution, will exceed y_M. In this case, and all other cases except for the one excluded in part (b), the tax revenues will exactly equal the costs of implementing the

activities, i.e., the constraint will be binding. In the exceptional case when $y_M \in I$, the minimum cost solution need not yield a binding constraint.

R5. (a) If $\max I \geq y_M$, then it is in G's interest to undertake enough activities to result in a lawful society, i.e., $p(y^*) = 1$.

(b) If $C(y_M) \leq (1-\delta)f[\pi(y_M)(1+k_H) + (1-\pi(y_M))(1+k_L)]$ then $y_M \in I$, $y^* = y_M$, and it is in G's interest to undertake enough activities to yield a lawful society, i.e., $1 - p(y^*) = 0$.

Proof. (a) From R4, it follows that if $\max I \geq y_M$ then $y^* \geq y_M$. Thus $p(y^*) = p(y_M) = 1$ and G's optimum activity level yields a completely lawful society.

(b) Since $p(y_M) = 1$, $T(y_M) = (1-\delta)f[\pi(y_M)(1+k_H) + (1-\pi(y_M))(1+k_L)]$. So, if $C(y_M) \leq (1-\delta)f[\pi(y_M)(1+k_H) + (1-\pi(y_M))(1+k_L)]$, then $C(y_M) \leq T(y_M)$. Thus, $y_M \in I$ and from R4, $y^* = y_M$ and the level of corruption is $1 - p(y_M) = 0$.♣

The model we are discussing is meant to capture important features of the big-bang. R5 part (a) demonstrates conditions under which a major claim made by supporters of the big-bang holds; specifically, that a constituency supporting the rule of law would form from agents in the society who had earlier received control rights to firms. Here we see the situation in which, after such rights have been granted, G's interaction with the agents in fact yields a lawful society. This support for the big-bang must be qualified by the given condition that $\max I \geq y_M$. This condition would hold, cet. par., if costs were smaller than tax revenues over a larger range of y values. Thus, for example, if the country were receiving external aid to subsidize its activities, and used the aid for these purposes, this would tend to diminish the costs of the activities and more likely create the required condition of this result. This was undoubtedly part of the intent of the donors of such monies. We can think of this situation as what happened between the IMF and Russia or between the EU and the eastern European countries that recently jointed the EU. It was clear in these cases that external funding was to aid G in choosing activities that would improve society. In Russia, for example, it appears that these external funds were not used in all cases as the international agencies intended, or that the tax revenues were not sufficient to satisfy the required condition.

Part (b) of R5 shows a specific condition that lends support to the big-bang argument. This condition states that when the cost function rises slowly enough so as not to exceed the bound $(1-\delta)f[\pi(y_M)(1+k_H) + (1-\pi(y_M))(1+k_L)]$ at $y = y_M$, an honest society would result. This reinforces the point raised above that when external funding does indeed reduce the cost of G's

activities, it can have a major effect on society. When the cost rises sufficiently quickly, the impact on society can be quite different, as we next show in R6.

R6. (a) If $\max I < y_M$, then it is in G's interest not to undertake enough activities to rid society of corruption, i.e., $1 - p(y^*) > 0$.

(b) If $C(y_M) > (1-\delta)f[\pi(y_M)(1+k_H) + (1-\pi(y_M))(1+k_L)]$ and if $\pi(y)$ is concave, then $\max I < y_M$, $y^* < y_M$, and it is in G's interest not to undertake enough activities to rid society of corruption, i.e., $1 - p(y^*) > 0$.

Proof. (a) From R4, when $\max I < y_M, y^* < y_M$. Thus, $p(y^*) < 1$ and some corruption remains, i.e., $1 - p(y^*) > 0$.

(b) Using the argument in the proof of R5 part (b), we have at y_M, $C(y_M) > T(y_M)$ or $y_M \notin I$. That $\pi(y)$ is concave implies that $T(y)$ is concave for $y \geq y_M$. Since $C(y)$ is convex and is strictly increasing, it follows that $C(y) > T(y)$ for $y \geq y_M$ or that $\max I < y_M$. This implies that $y^* < y_M$ and again that $1 - p(y^*) > 0$.♣

Here the argument given earlier in support of the big-bang is considerably weakened. The more $\max I$ is below y_M, the greater is the level of corruption. Greater levels of dishonesty in society are interpreted here as less support for the rule of law. On the other hand, from R4 part (a), we know that the level of corruption must be less than $1 - p_0$. Thus, depending on the size of this initial condition, one country might have a built-in-support for the rule of law whereas another might not. We next investigate these impacts on corruption, as well as other properties of this model, through examples.

4. Examples

We present four examples to illustrate our model. In these examples we vary the assumptions made about $H[\tau; y]$ and the initial conditions. However, the following specifications hold for all the examples. With no loss of generality we let $f = 1$. If the rule of law prevails at the end of the period, we assume that all firms benefit from this improved climate by an increase in value of 33%; otherwise, all lose an equal percentage. The taxation rate is 25%. In sum, we let $f = 1$, $k_H = 1/3$, $k_L = -1/3$, and $\delta = 3/4$. It follows that $\beta = \frac{\delta(1+k_H)}{1-\delta(1+k_L)} = 2$. We assume that $y_{\min} = 1$, thus establishing the minimum unit of G's activities, and we interprete $y - 1$, $y \geq 1$, as the proportional increase in G's level of activities. Since we assume G has already established property rights in

our model, i.e., undertaken some activities, we set $y_0 = 1.1$. We further assume that the agents' subjective probabilities take the form $\pi(y) = \frac{a(y-1)}{1+a(y-1)}$, $y \geq 1$, where a is chosen to satisfy the initial conditions. We note that $\pi(y)$ is a concave function. Next we assume that the cost function $C(y) = 0$ for $y_{\min} \leq y \leq y_0$ and is $c(y - y_0)$ for $y > y_0$. $B(p)$ is assumed to be a monotonic strictly increasing function of $p(y)$ throughout.

4.1. Example 1

We assume that G's activities affect $\pi(y)$ but not $H[\tau; y]$ directly. Specifically, we assume the density of τ is uniform on $[0, 1]$ for all values of $y \geq 1$. Thus $H[\tau; y] = \tau$ for $\tau \in [0, 1]$, $H[\tau; y] = 0$ for $\tau \leq 0$ and $H[\tau; y] = 1$ for $\tau > 1$. Last, we assume that the rate of corruption at the outset of the period is $1 - p_0 = .9$. Using these specifications we now can locate the solution y^* to G's problem.

We first determine a to satisfy the initial conditions. Since $p(y) = H[\beta r(y); y]$ our asumptions imply $p(y) = \beta a(y - 1)$. Thus, a must satisfy $2a(1.1 - 1) = .1$ or $a = 1/2$. Then y_M satisfies $\beta r(y) = 1$ or $y - 1 = 1$, i.e., $y_M = 2$.

We next evaluate $C(y)$ and $T(y)$ at y_M. $C(y_M) = c(y_M - y_0) = c(.9)$. $T(y_M) = (1-\delta)f[\pi(y_M)(1+k_H) + (1 - \pi(y_M))(1 + k_L)] = 1/4[(1/3)(4/3) + (2/3)(2/3)] = 2/9$. If we let the breakeven cost in this example, c_{B1}, be the marginal cost that makes $C(y_M) = T(y_M)$, then $c_{B1} = 20/81 = .247$. Thus, from R5, $y^* = y_M = 2$ if $c \leq .247$. From R6, if $c > .247$, then $y^* < 2$ and it is not in G's interest to undertake enough activities to eliminate all corruption.

At the outset of the period we assumed that the initial activity level was $y_0 = 1.1$. For this level, the percentage of agents that chose to be honest was assumed to be $p_0 = .1$. This implied that $\pi(y) = \frac{\frac{1}{2}(y-1)}{1+\frac{1}{2}(y-1)}$ and we can compute the $\pi(y)$ value that links y_0 to p_0, i.e., $\pi(y_0)$. This value is .048. Thus, in this example, at the outset of the period, the agents are extrememly pessimistic as to the outcome of the rule of law barring any further activities by G. If $c \leq c_{B1}$, then G would undertake the activity level $y_M = 2$ which would cause the agents to reevaluate their probabilities as $\pi(y_M) = 1/3$. This value, held by all agents, is sufficient in this example to cause all agents to choose to be honest.

4.2. Example 2

In this example we retain the assumptions about the distribution of τ made in Example 1, but we increase the percentage of agents who choose to be honest at the outset of the period, letting $p_0 = .25$. Recomputing, we have $a = 1.25$, $y_M = 1.4$, $C(y_M) = c(.3)$, and $T(y_M) = .222$. The breakeven cost, c_{B2}, that makes $C(y_M) = T(y_M)$ is $c_{B2} = .741$.

The results of Example 2 compared to Example 1 show the important role played by the initial degree of corruption in a society. Since the breakeven cost represents the marginal cost at which society would be completely rid of corruption, we can use this figure to compare the different examples. As we see in Example 2, c_{B2} is three times as large as c_{B1}, so that more costly activities undertaken by G could still produce a lawful society.

Thus, the increase in p_0 has a dramatic effect on reducing the level of corruption in society. Examples 1 and 2 assume that the activities undertaken by G do not affect the attributes of crime directly, i.e., do not affect the distribution of τ. If the activities did affect this distribution directly, would it be true that the importance of the initial condition would diminish in comparison? The next two examples address this question.

4.3. Example 3

We now return to the assumption that $p_0 = .1$ but change the assumptions about $H[\tau; y]$. Here we allow G to also affect the distribution of τ. We assume that the density of τ values is uniform on $[0, y^{-1}]$ for $y \geq 1$, i.e., $h[\tau; y] = y$, $\overline{\tau}(y) = y^{-1}$ and $y_{\min} = 1$. By increasing the level of activites y, G reduces the possibility of larger crimes. This example captures the idea that G could institute a campaign against its bigger thieves or those perceived to be its bigger thieves (as in Russia witness the campaign against the oligarchs and in the U.S. against the Enrons, etc.). Thus, $H[\tau; y] = y\tau$ for $\tau \in [0, y^{-1}]$, $H[\tau; y] = 0$ for $\tau \leq 0$ and $H[\tau; y] = 1$ for $\tau \geq y^{-1}$. The value of a is computed from $\beta a y(y_0 - 1) = p_0$ or $a = \frac{1}{2.2}$. Then, y_M must satisfy $\frac{2}{2.2} y(y-1) = 1$ or $y_M = \frac{1}{2}[1 + \sqrt{1 + 4.4}] = 1.662$. $C(y_M) = c(1.662 - 1.1) = c(.562)$ and $T(y_M) = .205$. The breakeven marginal cost in this example is $c_{B3} = \frac{.205}{.562} = .365$. By allowing G to undertake activities to directly affect the distribution of τ, y_M, the level of activities needed to rid the society of corruption, has been reduced from 2 in Example 1 to 1.662. The level of pessimism at the outset of the period, as measured by the agents' subjective probability, remains essentially the same with $\pi(y_0) = .043$, but the level of π in this case

needed to achieve a completely honest societ is $\pi(y_M) = .231$, substantially lower than in Example 1.

If G's marginal cost were actually $c = .3$ and if, as in Example 1, the activities that G chose did not affect the distribution of τ, then since $c_{B1} < .3$, the result of G's activities would not rid the society of corruption. However, at the same marginal cost, and if G's activities had a direct affect on the distribution of τ as in this example, then $c = .3 < c_{B3} = .365$, implying that for the same expenditure G would be able to maximize its benefits and also create a corruption-free society.

Comparing the results of Examples 1 and 3, we find c_{B3} is 1.5 times c_{B1}. Since the initial conditions are the same in both examples, as is everything except for the assumptions concerning the distribution of τ, we conclude that the increase in c_{B3} is due to the change in this assumption. We find that, at a fixed level of expenditure, a set of activities that also impacts crime directly is more likely to produce a corruption-free society than a set which has only indirect effects. Examples 1 and 2 show that the initial conditions matter, and now Examples 1 and 3 show that the type of activities matter. Example 4 is meant to illustrate the relative sizes of these two effects.

4.4. Example 4

In this example we retain the asumptions about the distribution of τ made in Example 3, but we increase the percentage of agents who choose to be honest at the outset of the period, letting $p_0 = .25$ as in Example 2. Recomputing, we have $a = 1.136$, $y_M = 1.331$, $C(y_M) = c(.231)$, $T(y_M) = .212$, so that $c_{B4} = \frac{.212}{.231} = .918$. In this example when the initial conditions are more favorable and when G's activities both directly and indirectly affect the distribution of τ, the breakeven value c_{B4} is close to 1. Recalling that $f = 1$ at the outset of the period, unless marginal cost is truly excessive, G's optimum choice would lead to a corruption-free society. The change in the initial condition from that in Example 3 results in c_{B4} being 2.5 times c_{B3}. Recall that the same comparison between Examples 1 and 2 yielded c_{B2} being 3 times c_{B1}. The changes in the breakeven values when the types of activities varied yielded c_{B3} being 1.5 times c_{B1} at low initial conditions and c_{B4} being 1.25 times c_{B2} at higher initial conditions. These examples suggest that the initial conditions are more important to the outcome than the types of activities that G undertakes.

5. Discussion and Conclusions

Our model depends on a number of assumptions that we now discuss. In evaluating the level of honesty, $p(y)$, we assumed that k_H, k_L, and δ, the parameters making up β, were constants, not depending on either τ, the agent's "index of thievery," or y, G's level of activities. Had we assumed $\beta = \beta(y)$, the results would have remained essentially the same. Assuming that $\beta = \beta(\tau)$ would have introduced some additional complexity into the model but, again, would have led to similar results.

We assumed that the agents, using as a signal the level of activities undertaken by G, evaluated G's progression to the rule of law through the subjective probability $\pi(y)$. Implicitly, we assumed that the functional form of π was fixed in society. One could have assumed that an activity that G might undertake, say of a propagandistic nature, would influence the way agents evaluated the signal, changing the form of π. For example, countries with high levels of corruption, which find it extremely costly to reduce this corruption, might have as their only recourse to try to modify public opinion through π. Extending the model to allow the functional form of π to also depend on y remains.

We assumed that, should the rule of law be established at the end of the period, there would be strict enforcement. This enforcement took the form in the model of the assumption that all monies would be forfeited by the thief under this circumstance. Less restrictive assumptions could have been made, including random enforcement, without altering the general conclusions presented.

We assumed that G's problem was a one-period problem. Obviously, over time, governments change, as do costs and benefits. Thus, following the reasoning of our model, it would not be surprising to find fluctuations in support for the rule of law without any guarantee of convergence. This is another area for future investigation.

A few other points bear mentioning. We have assumed that there is a time gap between the formation of support for the rule of law and its subsequent enforcement. But there is no guarantee that even full support for the rule of law by a society at one moment in time will lead to the establishment of the rule of law at a later time. Since governments, as well as economic climates, change, the conclusion that full support for the rule of law results in its complete enforcement cannot always hold. Furthermore, if we accept the fact that G can influence society by its activities, G could choose to be duplicitous by raising support for the rule of law with no intention of implementing

it. How long would it take for such behavior to be found out?

Our model was chosen in order to provide a basis of argument for or against the method of big-bang reforms. In general, we found that the question of the appropriateness of the big-bang policy could only be answered after the initial conditions of the country under study had been determined, and we showed how this might be done. Our model, however, stands alone and is separate from the issue of the big-bang. Many G's derive benefits dependent on the level of honesty of their societies. For example, increases in FDI have been shown to correlate with decreases in corruption (See Wei (2000)).

In the same vein, countries that had the possibility of acceding to the European Union were promised many benfits if they imposed and enforced a rule of law, that is, if they brought their laws into compliance with those of the EU. Thus, all these countries had the promise of benefits that would increase with the level of honesty of society. However, neither the costs of enforcing the rule of law, nor the initial conditions of these countries, were identical. Thus, our model offers an explanation as to why countries would have differing successes in complying with the EU's acquis and hence why the EU gave them different entry dates.

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