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# IMF Working Paper

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## The Persistence of Corruption and Slow Economic Growth

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**IMF Working Paper**

Research Department

**The Persistence of Corruption and Slow Economic Growth**

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**Abstract**

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There is increasing recognition that corruption has substantial, adverse effects on economic growth. But if the costs of corruption are so high, why don't countries strive to improve their institutions and root out corruption? Why do many countries appear to be stuck in a vicious circle of widespread corruption and low economic growth, often accompanied by ever-changing governments through revolutions and coups? A possible explanation is that when corruption is widespread, individuals do not have incentives to fight it even if everybody would be better off without it. Two models involving strategic complementarities and multiple equilibria attempt to illustrate this formally.

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## I. MOTIVATION, INTUITION, AND RESULTS

There is increasing recognition that corruption and other aspects of poor governance and weak institutions have substantial, adverse effects on economic growth. But if the costs of corruption are so high, why do countries seem to be unable to improve their institutions and root out corruption? Why do many countries appear to be stuck in a vicious circle of widespread corruption and low economic growth, often accompanied by ever-changing governments through revolutions and coups?

Economists and policymakers have long recognized that institutions matter in determining economic performance.<sup>2</sup> The modern economic literature on rent-seeking has analyzed the relationship between trade distortions, rent-seeking behavior, and economic inefficiencies (Krueger, 1974). North (1990) has argued that weak property rights may worsen a country's economic performance. Murphy et al. (1991) have suggested that countries where talented people are allocated to rent-seeking activities will tend to grow more slowly. The recent availability of indices of corruption has stimulated a flurry of empirical studies (for example, Kaufmann et al., 1999; Keefer and Knack, 1995; and Mauro, 1995) which have generally concluded that the economic costs of corruption and weak governance are substantial. In the policy arena, several initiatives have been undertaken in an effort to reduce corruption: one such example is the 1997 OECD Convention on Combating Bribery of Foreign Public Officials in International Business Transactions. International organizations have also become much more openly involved in promoting good governance.<sup>3</sup>

Despite a fairly clear understanding of the causes and consequences of corruption, and renewed attention on the part of policymakers, countries' relative degree of corruption has proved to be remarkably persistent. Some countries appear to be stuck in a bad equilibrium characterized by pervasive corruption with no sign of improvement. Interestingly, other countries experience corruption to an extent that seems to be much lower, and persistently so.

One reason why rooting out corruption is so difficult may be that when corruption is widespread, it just does not make sense for individuals to attempt to fight it, even if everybody would be better off if corruption were to be eliminated. Consider for example the case of a civil servant in an administration where everybody, including his superiors, is very corrupt. It would be difficult for this civil servant to decline offers for bribes in exchange for

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<sup>2</sup> Similarly, political scientists have long recognized that economic variables affect institutional performance (Hibbs, 1973).

<sup>3</sup> A web guide and access point to many publications regarding the IMF's approach to promoting good governance and other policy initiatives (including the OECD Convention) is available at <http://www.imf.org/external/np/gov/guide/eng/index.htm>

favors, because his superiors may expect a portion of the bribe for themselves.<sup>4</sup> By contrast, in bureaucracies that are generally honest, a real threat of punishment deters individual civil servants from behaving dishonestly. This is an example of a strategic complementarity, whereby if one agent does something it becomes more profitable for another agent to do the same thing. Models involving strategic complementarities lead to multiple equilibria—in this case a good equilibrium with low corruption, and a bad equilibrium with pervasive corruption.

Several authors have pointed to strategic complementarities as a major factor in determining a country's institutional efficiency and economic performance. Putnam (1993) has argued that a *tragedy of the commons* may explain the institutional and economic failure of some Italian regions. Strategic complementarities have previously received attention in the context of formal models of corruption, but have not been explicitly related to economic growth. Andvig and Moene (1990) and Tirole (1996) have emphasized that the expected profitability of corruption from an individual point of view is a positive function of the degree to which a society as a whole or a group within society is corrupt.<sup>5</sup> They have shown that this may lead to multiple self-fulfilling equilibrium levels of corruption. Murphy et al. (1993) have shown that increasing returns in rent-seeking activities may generate multiple equilibria in rent-seeking and income *levels*.

Strategic complementarities are consistent with the observation that the degree of institutional efficiency is extremely persistent over time. Putnam (1993) shows that the ranking of Italian regions by “civicness” is almost the same today as it was a century ago.<sup>6</sup> In

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<sup>4</sup> Wade (1982) provides a classic description of a bureaucracy in which corruption was systemic and bribes were shared among various civil servants at all levels in the hierarchy.

<sup>5</sup> Andvig and Moene (1990) explore the implications of the assumption that the probability a corrupt official will be reported to higher authorities is a decreasing function of the proportion of his colleagues who are also corrupt. Tirole (1996) analyzes the interaction between the reputation of a group and its individual members. As an individual's actions cannot be perfectly observed, their reputations depend partly on the past behavior of the group to which they belong. Individuals who belong to a group with a bad reputation for being corrupt will therefore have a strong incentive to be corrupt too. This perpetuates corruption within a group. Sah (1991) explains differences in crime participation rates across otherwise similar societal groups on the basis of a learning model in which it is easier to observe members of one's own group. See also Cadot (1987), Dawid and Feichtinger (1996), and Huang and Wu (1994).

<sup>6</sup> Putnam (1993) defines “civicness” as the extent to which citizens cooperate rather than free-ride, and interact as equals rather than as patrons and clients. He measures “civicness” as a composite index of objective measures such as the number of recreational and cultural associations. He finds this index to be significantly associated with both bureaucratic efficiency and income levels.

the cross-country context, indices of corruption or institutional strength, which are available for the past two or three decades, also tend to be very stable over time.

This paper presents two models based upon strategic complementarities, in an attempt to formalize the general observation that some countries seem to be stuck in a bad equilibrium characterized by widespread corruption and slow economic growth. The two models are complementary, as they view corruption from slightly different angles.

The first model (Section II) displays multiple equilibria in corruption and growth—a result that has not been obtained in previous work in the context of a modern growth model. Individuals allocate their time between productive work activity and theft from government expenditure. In turn, the services resulting from government expenditure enter the production function as in Barro (1990). The model draws on a strategic complementarity similar to that analyzed by Murphy et al. (1993): if many people steal, then the probability of any one of them being caught will be low. Thus there will be a “good” equilibrium characterized by absence of corruption and high rates of investment and growth; and a “bad” equilibrium characterized by pervasive corruption and low investment and growth. Slow growth and low investment in the bad equilibrium result from (i) the waste of labor hours spent on unproductive transfer of resources, in the spirit of the initial literature on rent-seeking, and (ii) a low marginal product of capital, because a lower proportion of government expenditure reaches the production processes of which it is an input.

The second model (Section III) displays multiple equilibria in corruption, political instability, and economic growth. One of its objectives is to suggest that corruption and political instability may be two sides of the same coin.<sup>7</sup> The novelty of the model resides in its linking corruption and politicians’ horizons and drawing the implications of this link for economic growth. The model considers a game among politicians, each of whom has to decide what kind of private bribe collection system he wishes to set up. In doing so, politicians have to take into account the fact that if they hurt the economy, then citizens will not reelect them, so that they will no longer be able to collect bribes in the future.<sup>8</sup> The strategic complementarity

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<sup>7</sup> More generally, this is an illustration of how various aspects of institutional inefficiency (in this case, corruption and political instability) are mutually reinforcing. This has already been emphasized by Krueger (1993) and De Soto (1989) with respect to corruption and red tape: they argue that corrupt bureaucrats will intentionally introduce new regulations and red tape in order to be able to extract more bribes by threatening to deny permits.

<sup>8</sup> This is somewhat analogous to the question of whether collusion is sustainable among firms facing a given demand curve, which has been thoroughly investigated in the industrial organization literature. In that setting, individual firms trade off long-term benefits from joint monopoly pricing against short-term benefits obtained by deviating and capturing the whole market for one period. The spirit of the present analysis is somewhat related to the industrial organization of different corruption systems as in Shleifer and Vishny (1993).

in the model can be described in intuitive terms as follows. Individuals A and B are members of the same government. Suppose that A is very corrupt and has established a private bribe-collection system for his own gain. The need to pay substantial bribes reduces entrepreneurs' incentives to invest and imposes a significant burden on economic growth. Citizens realize that economic growth is being harmed by the corrupt government, though they may not know exactly who is soliciting bribes. Therefore, they decide not to reelect the government. This shortens B's horizon, making him more inclined to extract a large share of current output and to disregard any ensuing adverse effects on future output. In other words, B will seek to obtain a large slice of the cake today and disregard policies aimed at increasing the size of the cake tomorrow, since he knows that the government he participates in will soon be ousted. If, on the other hand, A does not collect bribes, then—following similar reasoning—B will also refrain from doing so.

Not surprisingly, these models do not provide magic bullets or precise policy conclusions, but they do yield some interesting results. One broad conclusion, as is often the case with models involving strategic complementarities and multiple equilibria, is that gradual reforms are less likely to work than more ambitious, comprehensive reforms. Another conclusion is that countries left to their own devices may be unable to get out of the vicious circles they seem to be stuck in. This may strengthen the case for outside bodies or nongovernmental organizations to press governments to undertake ambitious reforms.

Comparative static exercises also suggest that, other things equal, countries are more likely to end up in a bad equilibrium with low growth and widespread corruption when they have low productivity and a large public sector.<sup>9</sup> These results are consistent with empirical evidence that, on the basis of indices of corruption produced by rating agencies, richer countries tend to be perceived as having lower corruption (Mauro, 1995), and a widely held view that large public sectors and pervasive government intervention may be associated with greater corruption (Tanzi, 1998). Policies aimed at improving transparency also help curb corruption and improve growth. The remainder of this paper presents the two models and, in Section IV, provides a few concluding remarks.

## II. A MODEL OF MULTIPLE EQUILIBRIA IN CORRUPTION AND ECONOMIC GROWTH

A continuum of individuals indexed by  $i \in [0,1]$  are assumed to maximize

$$\int_0^{\infty} e^{-\rho t} \left( \frac{c_{it}^{1-\sigma} - 1}{1-\sigma} \right) dt$$

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<sup>9</sup> Throughout this paper “a country is more likely to end up in a bad equilibrium” is used as shorthand for “there is a larger set of parameters for which the country ends up in the bad equilibrium.”

where  $c_i$  is consumption by individual  $i$  and  $\sigma$  is the inverse of the intertemporal elasticity of substitution. Population is assumed constant and is normalized to one. At each instant, individuals have one unit of labor services available, and they allocate it between productive work,  $L$ , and theft from the government,  $S$ .

$$L_i + S_i = 1, \quad L_i \geq 0, \quad S_i \geq 0 \quad \forall i$$

Government expenditure enters the production function as an input, as in Barro (1990). However, government expenditure may be appropriated by rent-seekers, who are then able either to consume the proceeds or to invest them in their own firm. Real world examples of individuals appropriating government expenditure include the following. Civil servants may be persuaded to shirk on their official jobs and, instead, work for (or do favors to) somebody's private business. A policeman who is paid to protect all the shops in a neighborhood may be given a bribe to look after one shop only. Funds that are earmarked for public infrastructure projects end up in the private pockets of corrupt individuals. The cement that was going to be used to build a highway may be stolen and used by corrupt individuals to build their villa at the seaside instead. One of the most extreme real-world examples of theft of productive public infrastructure, according to Abbott (1988, p.172), involves Luckner Cambonne, a member of the elite which ruled Haiti under the Duvaliers. He apparently had his workmen pull up and carefully store the entire rail system linking Port-au-Prince to Verrettes via St. Marc; he then sold the 150 kilometers of railroad as scrap metal and pocketed the money for himself.

The total amount of resources which had been intended as government expenditure but are instead extracted by individual  $i$  is

$$S_i G \phi(\bar{S}), \quad \phi'(\cdot) > 0, \quad 0 < \phi(\bar{S}) < 1 \quad \forall \bar{S} \in [0, 1)$$

where  $\bar{S} = \int_0^1 S_i$ . In other words, that amount depends on the time that  $i$  spends stealing,  $S_i$ , and

on the amount of productive government expenditure available,  $G$ .  $\phi(S)$  represents the proportion of stolen resources that the rent-seeker actually keeps. The latter is assumed to be a positive function of  $\bar{S}$ , the total rent-seeking activity in the economy.<sup>10</sup> This "strength in numbers" feature of rent-seeking reflects the idea that when many people steal, the probability

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<sup>10</sup> This analysis ignores congestion effects in the theft technology. One might argue that the marginal product of rent-seeking ought to be lower, the higher the total amount of theft activity, as the amount of  $G$  available for each rent-seeker to steal falls when everybody is stealing from  $G$ . As long as this effect becomes predominant only at high levels of total theft activity, one may conjecture that the qualitative results of the present analysis would not be affected.

of any one of them being caught is low.<sup>11</sup> Such an effect is here modeled in a nonstochastic context by assuming that the more theft activity is taking place, the lower the proportion of stolen resources that the police will be able to recover. This *strategic complementarity* in the individuals' decision on the time to be spent stealing is a necessary condition for multiple equilibria.<sup>12</sup>

The production function for firm  $j$  is

$$Y_j = K_j^{1-\alpha} L_j^\alpha \{G[1 - \bar{S} \phi(\bar{S})]\}^\alpha$$

where  $K_j$  is the capital stock belonging to firm  $j$ . The function is similar to that in Barro (1990), with  $G$  representing productive government expenditure. As mentioned above,  $\bar{S} \phi(\bar{S})$  is the amount stolen which therefore fails to reach the production processes for which it was intended as an input.<sup>13</sup> Following Barro (1990), it is assumed that the government's policy is to set government expenditure to be a constant fraction of output,  $(G/Y)$ , and to maintain a balanced budget, that is  $\tau=G/Y$ , where  $\tau$  is the (constant) tax rate.<sup>14</sup>

Capital belonging to individual  $i$  evolves according to

$$\frac{d K_i}{dt} = (1 - \tau)[w L_i + r K_i] - C_i + S_i G \phi(\bar{S})$$

The equilibrium wage,  $w$ , and rental rate on capital,  $r$ , are given by the marginal products of labor and capital, respectively:

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<sup>11</sup> See Murphy et al. (1993).

<sup>12</sup> See Cooper and John (1988).

<sup>13</sup> It is assumed that  $\bar{S} \phi(\bar{S}) < 1$ .

<sup>14</sup> Barro (1990) shows that it is optimal for the government to set government expenditure to be a *constant* proportion of output.

$$w = \frac{\partial Y_j}{\partial L_j} = \alpha K^{1-\alpha} L^{\alpha-1} G^\alpha [1 - \bar{S} \phi(\bar{S})]^\alpha = \alpha \frac{Y}{L}$$

$$r = \frac{\partial Y_j}{\partial K_j} = (1 - \alpha) K^{-\alpha} L^\alpha G^\alpha [1 - \bar{S} \phi(\bar{S})]^\alpha$$

It can be shown that the rate of growth equals

$$\gamma = \frac{1}{\sigma} \{ (1 - \tau)(1 - \alpha) L^{\frac{\alpha}{1-\alpha}} \left( \frac{G}{Y} \right)^{\frac{\alpha}{1-\alpha}} [1 - \bar{S} \phi(\bar{S})]^{\frac{\alpha}{1-\alpha}} - \rho \}$$

and that  $\partial \gamma / \partial L > 0$ .<sup>15</sup> It can also be shown that the investment rate is unambiguously a positive function of  $L$ . The higher the extent to which people are engaged in productive work rather than rent-seeking, the higher the marginal product of capital and thus the growth rate. In fact, (a) more labor is supplied and (b) more productive government expenditure reaches the processes where it is an input.<sup>16</sup> It is now necessary to find the equilibrium values of  $L$ . Each individual compares the net wage,  $\alpha(1 - \tau)(Y / L)$ , with the marginal product of rent-seeking,  $G\phi(\bar{S})$ .

Using the fact that  $(G/Y) = \tau$ , the comparison is between  $\alpha(1 - \tau)\tau^{-1}L^{-1}$  and  $\phi(1 - L)$ . There will be a corner solution at  $L=1$  (the “good” equilibrium) if<sup>17</sup>

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<sup>15</sup> The welfare of the representative consumer is monotonic in the growth rate. The expression for welfare can be rearranged so that  $L$  affects it only through the growth rate. The proof is the same as for the Barro (1990) model. Thus, higher  $L$  unambiguously implies higher welfare.

<sup>16</sup> It can be shown that the growth rate would be a monotonically positive function of  $L$  even if the investment rate were exogenously given and constant, because  $L$  affects positively the  $Y/K$  ratio through mechanisms (a) and (b).

<sup>17</sup> Any corner solution is stable.  $L=0$  (where everybody would be dead anyway) is not an equilibrium, because at that point the wage is extremely high, and higher than the marginal product of rent-seeking, so that people would wish to increase their supply of productive work.

$$\alpha \frac{(1-\tau)}{\tau} > \phi(0)$$

For example, this is always an equilibrium when  $\phi(0) = 0$ , that is, in the case where, if nobody is stealing, then the police is able to recover everything which an individual who deviates from the equilibrium attempts to steal.

There will be internal solutions if and where it is the case that

$$\alpha \frac{(1-\tau)}{\tau} (1-S)^{-1} = \phi(S)$$

For simplicity, consider the case where  $\phi(\cdot)$  takes the linear functional form

$$\phi(S) = a + bS, \quad S \in [0,1)$$

which implies that there are always two (possibly real) internal solutions for L. It is assumed that

$$a \geq 0, \quad b > 0, \quad a + b < 1$$

in order to ensure that

$$0 < \phi(\bar{S}) < 1 \quad \forall \bar{S} \in [0,1)$$

There will be a corner solution (the good equilibrium) at  $L=1$  if

$$\alpha \frac{(1-\tau)}{\tau} > a$$

There will be two internal solutions (which may be real numbers) where

$$\alpha \frac{(1-\tau)}{\tau L} = a + b(1-L)$$

The solutions to this quadratic equation are

$$L_1 = \frac{a+b + [(a+b)^2 - 4\alpha b(1-\tau)/\tau]^{1/2}}{2b}$$

$$L_2 = \frac{a+b - [(a+b)^2 - 4\alpha b(1-\tau)/\tau]^{1/2}}{2b}$$

$L_1$  is an unstable equilibrium, whereas  $L_2$  is stable. This can be shown by considering how a small deviation from the equilibrium average amount of work chosen (versus rent-seeking) affects the individual supply of work. Starting from  $L_1$ , an increase (decrease) in the average amount of work will lead the individual to increase (decrease) his or her supply of work, thus reinforcing the initial change. On the other hand, starting from  $L_2$ , an increase (decrease) in the average amount of work will lead the individual to decrease (increase) his or her supply of work, thus counteracting the initial change.<sup>18</sup>

More precisely, the proof that  $L_1$  is unstable, whereas  $L_2$  is stable, is as follows. Consider now how an increase in  $L$  affects the difference between the wage and the individual marginal product of rent-seeking, that is, the expression

$$\alpha(1-\tau) K^{1-\alpha} L^{\alpha-1} G^{\alpha} [1-S(a+bS)]^{\alpha} - G(a+bS)$$

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<sup>18</sup> It is assumed that, owing to convex adjustment costs, people can alter their levels of work versus rent-seeking activity only gradually. Therefore, were there to be a change in the total amount of theft activity, individuals would not be able to jump to  $L=0$  or  $L=1$  immediately. In a deterministic model such as the present one, these adjustment costs do not affect the maximization problem.

at the internal equilibrium points  $L_1$  and  $L_2$ . That is, we are interested in the sign of the derivative with respect to  $L$  of the expression immediately above. The government's policy is to choose a tax rate  $\tau$  and to maintain a balanced budget,  $\tau = (G/Y)$ . As the average amount of work versus rent-seeking rises, output rises, because more productive work is supplied and a higher proportion of  $G$  actually reaches the productive process. As  $Y$  rises, total tax revenue rises and the government raises  $G$  by the same amount.  $G$  is an expenditure flow and can thus be raised instantaneously. Therefore, when analyzing the stability of equilibria, it is necessary to take into account that an increase in average  $L$  will cause an increase in  $G$ . On the other hand,  $K$  cannot change instantaneously. Substituting for  $(G/K)$  in the expression immediately above, factoring out  $G$ , and recalling that at an equilibrium point the wage is equal to the marginal product of rent-seeking, the derivative of the expression above with respect to  $L$  can be shown to be positive at  $L_1$  and negative at  $L_2$ . Thus, starting from  $L_1$  ( $L_2$ ), an increase in  $L$  leads the net wage to rise above (fall below) the marginal product of rent-seeking and therefore causes each individual to supply more (less) labor, thus reinforcing (counteracting) the initial increase in the average amount of work. This completes the proof that  $L_1$  is unstable, while  $L_2$  is stable.

There are several possible cases, depicted in Figure 1:

- If the wage is always above the marginal product of rent-seeking (MPRS), then the only solution is the corner solution,  $L=1$ . (Panel A)
- If there are two real solutions to the quadratic equation above, that is, two intersections between the curves representing the wage and the marginal product of rent-seeking, then there are three possible situations:
  - if  $L_2 < L_1 < 1$ , then there is a stable internal solution ( $L_2$ ), an unstable internal solution ( $L_1$ ) and the corner solution,  $L=1$  (Panel B); this case is characterized by the presence of multiple equilibria;
  - if  $1 < L_2 < L_1$ , then the only solution is the corner solution,  $L=1$  (Panel C);
  - if  $L_2 < 1 < L_1$ , then the only solution is the (stable) internal equilibrium,  $L_2$  (Panel D).

$L_2$  will be referred to as the “bad” equilibrium and  $L=1$  as the “good” equilibrium. In analyzing the comparative statics, three questions may be addressed: (A) Are there any real internal solutions? (Does the bad equilibrium exist?)<sup>19</sup> (B) What is the likelihood of ending up at the bad equilibrium rather than at the good one? (How high is  $L_1$ ?) And (C) How bad is the bad equilibrium? (How low is  $L_2$ ?)

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<sup>19</sup> Real internal solutions exist iff  $(a + b)^2 - 4b\alpha(1 - \tau) / \tau \geq 0$ .

In order to have a richer comparative statics exercise, one can specify the function  $\phi(S)$  as

$$\phi(S) = \theta(a + bS)$$

where increases in the parameter  $\theta$  (hitherto set to  $\theta=1$  for simplicity) represent increases in the profitability of rent-seeking. Reductions in  $\theta$  could be caused, for example, by improvements in the state's ability to protect public expenditure.<sup>20</sup>

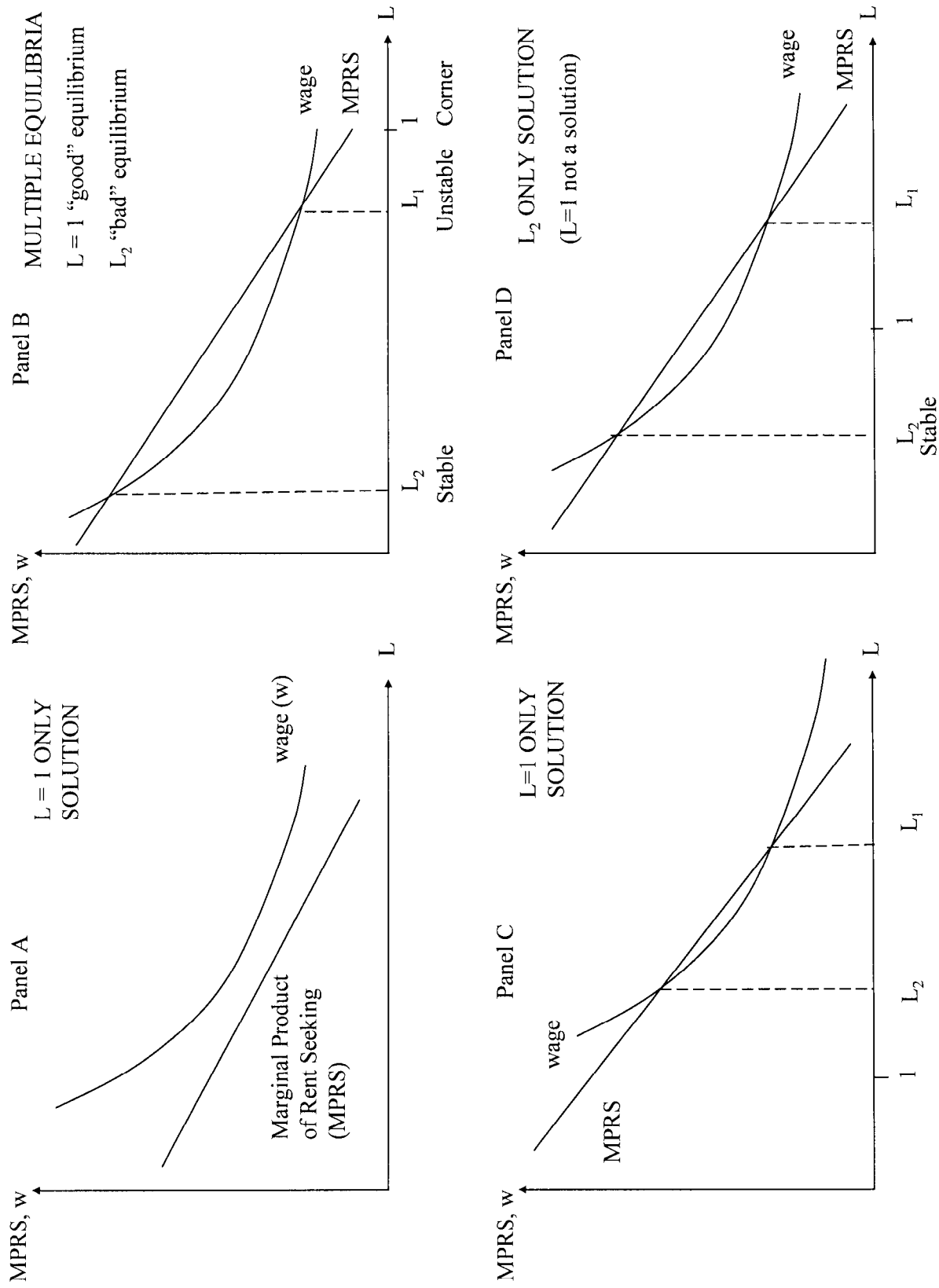
It can be shown that increases in  $\tau$  make the existence of real internal solutions more likely; cause  $L_1$  to become higher, which may be interpreted as an increase in the likelihood of ending up at the bad equilibrium; and worsen welfare in the bad equilibrium.<sup>21</sup> Thus, in all of these respects, increases in taxation (and commensurate increases in government spending) are likely to be deleterious—other things equal—for corruption and economic performance. The effects of an increase in  $\tau$  operate through a number of mechanisms: (a) there is more  $G$  available to be stolen; and (b) higher taxes lower the net wage; a third effect of an increase in  $\tau$  tends in the opposite direction: (c) a higher  $G$  raises the marginal product of labor. However, (b) predominates over (c), so that also an increase in  $\tau$  will unambiguously have undesirable effects. Decreases in  $\alpha$  make the existence of real internal solutions more likely and increase the likelihood of ending up at the bad equilibrium, but improve welfare in the bad equilibrium. Finally, variables that enter  $\phi(S)$  also affect the likelihood that the bad equilibrium will exist and that the economy will end up there, and contribute to determining how bad the bad equilibrium is. Increases in  $\theta$  make the existence of real internal solutions more likely, cause  $L_1$  to become higher, and worsen welfare in the bad equilibrium. Increases in  $a$  make it more likely that there will be internal solutions and raise the likelihood of ending up at the bad equilibrium, but have ambiguous effects on  $L_2$ . Changes in  $b$  have ambiguous effects on (A), (B) and (C), depending on the other parameters.

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<sup>20</sup> The model could be extended to analyze the problem of a government choosing the amount of productive expenditure and the amount of expenditure devoted to protecting property rights (e.g. public expenditure on the police force).

<sup>21</sup> All comparative static exercises in this paper are essentially based upon taking simple derivatives. They are omitted for the sake of brevity but are available upon request.

Figure 1



### III. MULTIPLE EQUILIBRIA IN CORRUPTION, POLITICAL STABILITY, AND GROWTH

The previous model embedded strategic complementarities in a well-established framework for analyzing economic growth in an infinite-horizon setting, but abstracted from issues related to changes in government. This section develops a simpler, two-period model, which emphasizes the role of different politicians within a government, and analyzes the possibility of government collapse. In this second model, countries where politicians act noncooperatively will experience greater corruption, lower political stability, and lower economic growth.

The government consists of a group of politicians, indexed by  $i=1, N$ . At the start of the first period, each politician  $i$  decides whether he should set up a system of bribe collection for his own private benefit, and how high a bribe rate,  $\tau^i$ , he should levy. Once set up, the system and the bribe rate remain in place until the end of the second period.<sup>22</sup> Citizens can observe the total bribe rate,  $\tau$ , where

$$\tau = \sum_{i=1}^N \tau^i$$

as well as all other aggregate variables. However, they cannot observe who extracts the bribes, that is, they do not know each individual politician's  $\tau^i$ , as long as  $\tau^i < \tau_M$ .<sup>23</sup> If an individual politician levies a bribe higher than  $\tau_M$ , it is assumed that there will be a harsh punishment such that  $\tau_M$  is effectively an upper bound on the bribe rate in this model. Loosely speaking, policies aimed at increasing transparency may be interpreted as attempts to reduce  $\tau_M$ .<sup>24</sup> At the end of the

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<sup>22</sup> According to the *New York Times* (November 8, 1992, sec.6, pg. 31), the administration of former Brazilian president Fernando Collor de Mello, described as a highly complex and efficient system of corruption, "they established goals: by month x, we are going to net \$500 million." According to Wade (1982), each level of the hierarchy in the administration of the irrigation system in South India obtained a fixed percentage of the total bribe. Together with the systematic evidence on the persistence of institutional efficiency, these examples suggest that once a corruption machine is set up, it takes time to change the way it operates.

<sup>23</sup> When a given politician amasses a fortune (by levying  $\tau_M$  or more), citizens will realize that this individual is corrupt. According to the *New York Times* (November 8, 1992), former President Collor's acquisition of a palatial residence triggered a corruption scandal in Brazil (which culminated in Collor's impeachment).

<sup>24</sup> Many international institutions and nongovernmental organizations (NGOs) have emphasized the importance of transparency in the fiscal and monetary accounts, and in the conduct of business more generally. See again the IMF's web site. A partial listing of NGOs that have been active in this area includes Transparency International and recent initiatives  
(continued...)

first period, the citizens decide whether or not to reelect the government (or whether or not to have a revolution). For simplicity, both citizens and politicians have isoelastic utility, and there is no discounting, that is, citizens utility equals

$$\frac{c_1^{1-\sigma} - 1}{1-\sigma} + \frac{c_2^{1-\sigma} - 1}{1-\sigma}$$

where  $c_1$  and  $c_2$  are consumption in the first period and second period, respectively, and  $\sigma$  is the inverse of the intertemporal elasticity of substitution. The production function is assumed to be linear, with technological parameter  $a$ : when a citizen saves  $s$  (and invests it), output  $y$  amounts to  $y = as$ .

### A. The Citizens' Problem

(i) When they do not oust the government, citizens obtain lifetime utility equal to:

$$\frac{[e(1-\tau) - s]^{1-\sigma} - 1}{1-\sigma} + \frac{[as(1-\tau)]^{1-\sigma} - 1}{1-\sigma}$$

where  $e$  is a citizen's initial endowment. From the first-order condition, citizens save

$$s = \frac{e(1-\tau)}{1 + [a(1-\tau)]^{1-\frac{1}{\sigma}}}$$

(ii) When they do oust the government, citizens obtain:

$$\frac{[e(1-\tau) - s]^{1-\sigma} - 1}{1-\sigma} + \frac{[as(1-\lambda)]^{1-\sigma} - 1}{1-\sigma}$$

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by Global Witness and Mr. George Soros encouraging multinational corporations (notably oil and other natural resource companies) to publish how much they pay in royalties, taxes, and fees to each country they deal with. While in the model  $\tau_M$  is the highest bribe rate *an individual politician* can get away with, it is likely that this bribe rate would be reduced by policies aimed at improving transparency more generally.

where  $\lambda$  is an efficiency loss (assumed to be multiplicative for simplicity) due to having no government or a less experienced (and therefore less competent) government. If the incumbent government is overthrown by means of a revolution, it is likely that production will be disrupted. Savings are

$$s = \frac{e(1-\tau)}{1 + [a(1-\lambda)]^{1-\frac{1}{\sigma}}}$$

It can be shown that the citizens will oust the government if and only if  $\lambda < \tau$ .

### B. The Politicians' Problem

(i) If the government is not ousted, politician  $i$  obtains lifetime utility equal to:

$$\frac{[e\tau^i]^{1-\sigma} - 1}{1-\sigma} + \frac{[e_p + a s \tau^i]^{1-\sigma} - 1}{1-\sigma}$$

where  $e_p$  is the politician's endowment in the second period.<sup>25</sup>

(ii) If the government is ousted, politician  $i$  obtains:

$$\frac{[e\tau^i]^{1-\sigma} - 1}{1-\sigma} + \frac{[e_p]^{1-\sigma} - 1}{1-\sigma}$$

### The Cooperative Solution

Suppose that the politicians decide to hire an agent whose job is to set the total bribe rate so as to maximize their utility, with the requirement that each politician receive the same bribe rate. Then the agent will choose between (a) the maximum  $\tau_i$  compatible with reelection,  $\lambda/N$ , which yields lifetime utility

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<sup>25</sup> The politicians are assumed to have an endowment in the second period so that their marginal utility of consumption would not be infinite, were they to be ousted. One could assume that both citizens and politicians obtain an endowment (possibly the same) in both periods. The current formulation is chosen merely so as to simplify notation.

$$\frac{[e \frac{\lambda}{N}]^{1-\sigma} - 1}{1-\sigma} + \frac{\{e_p + a \frac{\lambda}{N} [\frac{e(1-\lambda)}{1+[a(1-\lambda)]^{1-\sigma}}]\}^{1-\sigma} - 1}{1-\sigma} \quad (*)$$

for each politician; and (b) the maximum  $\tau_i$  compatible with the politicians not being caught,  $\tau_M$  (assumed larger than  $\lambda/N$ ), which yields lifetime utility

$$\frac{[e \tau_M]^{1-\sigma} - 1}{1-\sigma} + \frac{[e_p]^{1-\sigma} - 1}{1-\sigma} \quad (**)$$

for each politician. Thus, the cooperative solution will be  $\tau^i = \lambda/N \forall i$  if utility is higher under (a) than it is under (b). If, on the other hand, utility is lower under (a) than it is under (b), then the agent will choose  $\tau^i = \tau_M \forall i$ .

### C. Non-cooperative Solutions

Only symmetric solutions will be considered in what follows. To simplify solution of the game among politicians, politicians are assumed to be able to observe the bribes charged by other politicians. No equilibrium can be such that  $\tau < \lambda$ , because if all politicians  $j \neq i$  were levying any bribe rate below  $\lambda/N$ , then politician  $i$  would be able to levy more than  $\lambda/N$  without making the government collapse. No symmetric equilibrium can be such that  $\lambda < \tau < N\tau_M$ , because if all politicians  $j \neq i$  were levying any bribe rate above  $\lambda/N$ , then politician  $i$  would know that the government was going to collapse regardless of his actions, and he would therefore levy  $\tau_M$ .<sup>26</sup>

#### *The bad equilibrium*

One Nash equilibrium is where all politicians levy a bribe rate equal to  $\tau_M$ . In fact, if all politicians  $j \neq i$  are levying a bribe rate equal to  $\tau_M$ , then politician  $i$  also wants to levy  $\tau_M$ , because he knows that the government is going to collapse anyway. In this bad equilibrium, the investment rate and the growth rate are low, the government is ousted, and the bribe rate is as high as it can possibly be.

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<sup>26</sup> Under certain extreme conditions, politician  $i$  would be able to save the government from collapsing by accepting a bribe lower than  $\lambda/N$ , and still be better off than by levying  $\tau_M$ . However, this would not be a *symmetric* equilibrium.

### *The good equilibrium*

Another Nash equilibrium is where all politicians levy a bribe rate equal to  $\lambda/N$ , but only under certain parameter assumptions. Supposing that all politicians  $j \neq i$  are levying  $\lambda/N$ , politician  $i$  faces the choice between the utility levels in the expressions labeled (\*) and (\*\*) above. If the parameters are such that the utility level in (\*) is higher than it is in (\*\*), then politician  $i$ , too, is better off levying  $\lambda/N$  than he would be levying  $\tau_M$ , implying that  $\lambda/N$  is a Nash equilibrium. In this good equilibrium, the investment rate and the growth rate are relatively high, the government is reelected, and the bribe rate is relatively low. If, on the other hand, the utility level in (\*) is smaller than it is in (\*\*), then there is no good equilibrium.

Thus, if the utility level in (\*) is higher than that in (\*\*), the model displays multiple equilibria; if the utility level in (\*) is smaller than that in (\*\*), only the bad equilibrium exists. It can be shown that savings, growth, and the welfare of both citizens and politicians are higher in the good equilibrium than in the bad one.

The strategic complementarity in the model can be described in intuitive terms, as follows. If the individual politician decides to set a high bribe rate, he hurts the economy and makes it less likely that the other politicians will be reelected. By doing so he reduces the expected length of their horizons. As a consequence, all other politicians will be more inclined to levy a high bribe rate too. Thus, an individual politician's decision to be corrupt shortens the other politicians' horizons. It makes them more willing to obtain a large slice of the cake today, disregarding the size of the cake tomorrow, as they know they will not be reelected. This mechanism makes multiple equilibria possible. The model is consistent with the empirical observation that corruption, political instability, and low investment and growth tend to be correlated.<sup>27</sup>

Comparative static exercises suggest that economic, institutional, and political variables, and even preferences contribute to determining whether a good equilibrium can exist, and how high welfare is under the two types of equilibria. A good equilibrium will exist if utility is higher under (\*) than it is under (\*\*). This is more likely to happen when  $\tau_M$  is low, that is, when it is easy to catch corrupt politicians. A lower  $\tau_M$  also improves citizens' welfare in the bad equilibrium. As mentioned above, a variety of policies may be interpreted as tending to reduce  $\tau_M$ . For example, policies aimed at increasing transparency could make it more difficult for individual politicians to hide their bribe revenues. For a given  $\lambda$  and  $\tau_M$ , a decrease in  $N$  also raises the likelihood that the good equilibrium will exist and improves the bad equilibrium. The fewer the members of the elite, the more likely is a good equilibrium to exist and the lower the

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<sup>27</sup> One could think of writing down another version of this model as an infinitely repeated game. Each individual politician decides what bribe rate to levy. At the same time, the citizens decide whether or not to oust the government. There will be an efficiency loss for a few periods if the government collapses. There will be a bad equilibrium, but also a good equilibrium in which the politicians adopt a "trigger" strategy: they levy the cooperative-level bribe, as long as all other politicians have done the same in the past; citizens reelect the government.

total bribe rate in the bad equilibrium. A sufficient condition for an increase in  $\lambda$  to raise the likelihood that a good equilibrium will exist is that  $\lambda < 0.5$  and  $\sigma > 1$ . Thus, under these reasonable parameter assumptions, an increase in  $\lambda$  (the productivity loss attached to ousting the government) raises the likelihood that the good equilibrium will obtain, but lowers citizens' welfare in both the good and the bad equilibrium. When discounting is introduced in the model, increases in the extent to which second-period utility is discounted reduce the likelihood that the good equilibrium will exist. Finally, it can be shown that utility is likely to be higher under (\*) than it is under (\*\*), and therefore a cooperative solution is more likely, when  $a$  (the technological efficiency parameter) is high. This is consistent with empirical evidence based upon subjective indices, which shows that corruption tends to be higher in poor countries than it is in rich countries (Mauro, 1995).

#### IV. CONCLUDING REMARKS

This paper is motivated by the observation that some countries appear to be stuck in a vicious circle of widespread corruption and low economic growth, often accompanied by ever-changing governments through revolutions and coups. Indeed, previous studies have shown that there is a close association between corruption and slow growth, as well as between corruption and political instability; and that countries' relative degree of corruption is highly persistent over the years. Nevertheless, despite increasing recognition that corruption has substantial adverse effects on economic growth, governments seem to be unable to break that vicious circle.

A possible explanation analyzed in this paper is that when corruption is widespread, individuals do not have incentives to fight it even if everybody would be better off without it. The paper has presented two models that rely on strategic complementarities to obtain multiple equilibria. The first model embeds the strategic complementarity of Murphy and others (1993) into the Barro (1990) model of economic growth with government expenditure in the production function. When other people are stealing from the government, an individual will base his decisions not only on a lower marginal product of working in legal activities, but also a higher marginal product of stealing (because the chances that he will be caught are lower). As a result, it will be profitable for him to allocate more time to rent-seeking, and less time to productive activities. The model thus obtains multiple equilibria in corruption and growth. The second model brings political instability into the picture by focusing on the interaction among politicians and the impact of one politician's corruption on another politician's corruption through the probability of reelection of the government. By doing so, it obtains multiple equilibria in corruption, political instability, and economic growth.

The two models are similar in their reliance on strategic complementarities, but they also view corruption from different angles. The first model emphasizes the role of individuals stealing from the government, and may be interpreted as allowing for both petty corruption (paying a bribe to obtain a driver's license) and grand corruption (paying a bribe to build a highway with sub-standard materials). The second model emphasizes the role of (individual members of) the government stealing from the public, and may be interpreted as focusing squarely on grand

corruption. The models are presented together because both views of corruption seem to be relevant, consistent, and complementary.

One broad policy implication is that gradual reforms are less likely to work than more ambitious, comprehensive reforms. Another implication is that, without outside intervention, government may be unable to break the vicious circle their countries seem to be stuck in. This may strengthen the case for outside bodies or nongovernmental organizations to press governments to undertake ambitious reforms.

Comparative static exercises show that, other things equal, countries are more likely to end up in a bad equilibrium with low growth and widespread corruption when they have low productivity and a large public sector. These results are consistent with empirical evidence that, on the basis of indices of corruption produced by rating agencies, richer countries tend to be perceived as having lower corruption, and a widely held view that large public sectors and pervasive government intervention may be associated with greater corruption. Moreover, policies aimed at improving transparency and more generally disseminating information that may ultimately lead the public to identify corrupt members of the government are helpful in controlling corruption and creating the conditions for rapid economic growth.

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