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Endogenous Corruption in Economic Development

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Abstract

This paper presents an analysis of the joint determination of bureaucratic corruption and economic development. The analysis is based on a simple neo-classical growth model in which bureaucrats are employed as agents of the government to collect taxes from households. Corruption is reflected in bribery and tax evasion as bureaucrats conspire with households to provide false information to the government. Costly concealment of this activity leads to a loss of resources available for productive investments. The incentive for an individual bureaucrat to accept a bribe depends on the number of other bureaucrats who are expected to accept bribes. This strategic interaction in bureaucratic decision making produces multiple (frequency-dependent) equilibria associated with different incidences of corruption. The predictions of the model accord strongly with recent empirical evidence.

1 Introduction

Public sector corruption may be broadly defined as the illegal, or unauthorised, profiteering by public officials who exploit their positions in public office to make personal gains. To many observers, this type of behaviour is an inevitable aspect of state intervention in society. This is due to the fact that any such intervention entails some transfer of responsibilities from the government to a bureaucracy in a principal-agent type relationship. The government (the principal) delegates powers to the bureaucracy (the agent)

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in order to undertake various tasks in the implementation of policies. This transfer of authority endows the bureaucracy with administrative discretion that may be used to capture economic rents through side payments or bribes. These rents may be significant and the incentive to seize them may be tempered only mildly by imperfect mechanisms of prevention based on costly and imprecise monitoring, together with inadequate and inappropriate penalties.[1]

A considerable amount of research, in both economics and political science, has been devoted towards understanding in detail the causes and consequences of bureaucratic corruption.[2] Most of this research has been partial equilibrium in nature, focusing on the microeconomic aspects of incentives, information and enforcement in motivating or deterring corrupt practices which influence efficiency and welfare (e.g., Banerjee 1997; Carrillo 1996; Klitgaard 1988, 1990, 1991; Mookherjee and Png 1994; Shleifer and Vishny 1993; Rose-Ackerman 1975, 1978, 1999). Much less research has been directed towards analysing the joint determination of corruption activities and economic outcomes within the context of fully-specified dynamic general equilibrium models. This is particularly notable given that the macroeconomic consequences of corruption have become an increasing concern to both economists and policy makers who have shared a deepening belief that a fundamental requirement for economic development is high quality governance. In this paper we present an analysis of corruption and growth that lends general support to this presumption, subject to some important qualifications. The predictions of our analysis accord strongly with empirical observations.

By its nature, corruption is a clandestine activity which takes place away from the glare of publicity and which is difficult to measure empirically. Prior to the early 1980s, the lack of reliable data on corruption meant that little was known about the true effects (if any) of bureaucratic malfeasance on economic development. Conflicting views about these effects could neither be supported nor refuted empirically since there was simply no hard evidence available. Given this, it was possible to entertain seriously the idea that corruption might actually be conducive to growth and prosperity. This idea - an application of the theory of the second-best - views corruption as helping to circumvent cumbersome regulations (red tape) in the bureaucratic process (e.g., Huntington 1968; Leff 1964; Leys 1970). Bribes act as "speed money" which is paid to bureaucrats in return for their assistance in overcoming institutional rigidities that cause excessive delays and that work against ef-

[1] In one sense, corruption is a victimless crime for which conventional deterrents may be largely ineffective. In addition, the perpetrators of this crime, as members of the political establishment, may have privelaged in-roads to the legal infrastructure.

[2] For surveys of the literature, see Bardhan (1997, 2000) and Rose-Ackerman (1998).

ficiency.[3] While plausible at first glance, this view may be challenged on a number of conceptual grounds (e.g., Bardhan 1997). For example, although bribery may speed up individual transactions with bureaucrats, both the sizes of bribes and the number of transactions may increase so as to produce an overall net loss in efficiency. In addition, and more fundamentally, the distortions that bribes are meant to mitigate are often the result of corrupt practices to begin with and should therefore be treated as endogenous, rather than exogenous, to the bureaucratic process.

It is now generally accepted that efficiency-enhancing and growth-promoting corruption is very much the exception, rather than the rule. The contemporary wisdom is that the early majority view among international development experts was correct and that corruption is typically bad for development due to its adverse effects on the incentives, prices and opportunities that private and public agents face.[4] This consensus of opinion is based not only on theoretical arguments, but also on a large body of recent empirical evidence. Since the early 1980s, a number of organisations - most notably, Business International Corporation, Political Risk Services Incorporated and Transparency International - have published various cross-country data sets on measures of corruption, derived from survey questionnaires sent to networks of correspondents around the world. These corruption indices rank countries according to the extent to which corruption in public (and political) office is perceived to exist. While differing in their precise construction, the indices are very closely correlated with each other, lending support to the contention that they provide reliable estimates of the actual extent of corruption activity.[5] Their publication has given rise to a flurry of empirical investigations into the relationship between corruption, growth and other variables. These investigations have yielded a number of important findings which we summarise briefly as follows.

First, there appears to be a robust (and significant) negative correlation

[3] More recent expositions of efficiency-enhancing corruption can be found in Lui (1985) and Acemoglou and Verdier (1998). The former suggests that bribes may form part of a Nash equilibrium strategy in a non-cooperative game, where inefficiency in public administration is reduced by the minimisation of waiting costs. The latter suggest that some degree of corruption may be part of an optimal allocation in the presence of incomplete contracts since public officials, though corrupt, can help in the enforcement of property rights. A similar idea is expressed in Acemoglou and Verdier (2000) who argue more generally that corruption may be the necessary price to pay for correcting market failures.

[4] There is also an intermediate view which contends that corruption is neither beneficial nor harmful to efficiency and growth (e.g., Barreto 2000; Beck and Maher 1986; Lien 1986).

[5] For more detailed discussions, see Ades and Di Tella (1997), Jain (1998), Tanzi and Davoodi (1997) and Treisman (2000).

between the level of corruption and economic growth.[6] According to Mauro (1995), the principal mechanism through which corruption affects growth is a change in private investment: an improvement in the corruption index by one standard deviation is estimated to increase investment by as much as 3 percent of output. In a sequel to this analysis, Mauro (1997) studies the implications of corruption for the allocation of public funds, presenting evidence which suggests that corruption distorts public expenditures away from growth-promoting areas (e.g., health and education) towards other types of project (e.g., infrastructure investment) that are less productivity-enhancing. Similar considerations occupy the attention of Tanzi and Davoodi (1997) who find evidence of bureaucratic malpractice manifesting in the diversion of public funds to where bribes are easiest to collect, implying a bias in the composition of public spending towards low-productivity projects (e.g. large-scale construction) at the expense of value-enhancing investments (e.g., maintenance or improvements in the quality of social infrastructure). Thus the abuse of public office may not only reduce the volume of public funds available to the government (through corrupt practices in tax collection), but may also engender a misallocation of those funds.

Second, there is evidence that the relationship between corruption and growth is two-way causal: bureaucratic rent-seeking not only influences, but is also influenced by, the level of development. In a thorough and detailed study by Treisman (2000), rich countries are generally rated as having less corruption than poor countries, with as much as 50 to 73 percent of the variations in corruption indices being explained by variations in per capita income levels. These findings, supported in other studies (e.g., Ades and Di Tella 1999), suggest that cross-country differences in the incidence of corruption owe much to cross-country differences in the level of prosperity.[7]

Third, there is very little empirical support for the "speed money" hypothesis. In Mauro (1995) it is found that the correlation between corruption and growth remains consistently negative in sub-samples of countries where bureaucratic regulations are reported to be particularly cumbersome: this contradicts the prediction of a positive correlation based on the argument that corruption provides a way of by-passing such regulations. Similar findings are obtained by Ades and Di Tella (1997) who conclude that there is little evidence of any beneficial effects of corruption in countries mired with red tape. In addition, Kauffman and Wei (2000) offer empirical support to

[6] Some early evidence of this can be found in Gould and Amaro-Reyes (1983) and United Nations (1989).

[7] Other factors that appear to be significant in determining corruption are the colonial heritage, religious tradition, legal system, federal structure, democratisation and openness to trade of a country.

the argument (alluded to above) that the use of bribes to speed up individual transactions with bureaucrats is largely self-defeating as the number of transactions tends to increase.

By way of illustrating the relationship between corruption and development, we present some summary statistics in Table 1, constructed on the basis of the World Bank's income classification of countries, together with the corruption indices of Business International Corporation (BIC), International Country Risk Guide (ICRG) and Transparency International (TI). The data reveal considerable diversity in the incidence of corruption, with poor countries having a much higher corruption rating than rich countries, irrespective of which index is used. This is indicative of the negative correlation between corruption and development that has been reported in recent empirical studies. In addition to this, there is another notable feature of the data that has received much less publicity - namely, the diversity in corruption levels among countries within the same income group. This is especially pronounced among middle income countries, for which the range of each corruption index is significantly larger than the range for either low income or high income countries. A comparison of the variances of the indices across different groups of countries gives the same impression: the variance for the middle income group is consistently higher than the variance for either the low or high income groups, in spite of the denser and larger sample of middle income countries. To emphasise the point further, Table 2 lists those middle income countries that have a corruption rating similar to the rating of either low income (high corruption) countries or high income (low corruption) countries. The picture that emerges is one of wide diversity in the incidence of corruption among countries in both the lower half and upper half of the middle income distribution.

In contrast to the burgeoning empirical literature, there remains relatively little theoretical research on the dynamic general equilibrium modelling of corruption and growth with the view to explaining the above evidence. Two recent exceptions are the innovative analyses of Ehrlich and Lui (1999) and Sarte (2000). The former develop a model in which corruption opportunities in public office offer the prospects of economic rents that create incentives for individuals to compete for the privelage of becoming bureaucrats. These incentives lead to a diversion of resources away from growth-promoting activities (investments in human capital) towards power-seeking activities (investments in political capital). The latter proposes a framework in which rent-seeking bureaucrats restrict the entry of firms into the formal sector of the economy which has a better system of property rights and law enforcement than the informal sector. When the costs of informality are high, growth is reduced relative to the free-entry case. The main purpose of each of these analyses is to explain why bureaucratic corruption is likely to be detrimental to economic development without delving too deeply into the questions of what gives rise to corruption to begin with and what causes corruption to either persist or decline over time. In view of the recent empirical evidence, however, there is clearly a need to understand both the mechanism by which corruption affects the endogenous forces of development of an economy and the mechanism by which these forces, in turn, affect the incidence of corruption. This is the motivation for the present paper. In particular, we seek to provide an account of the corruption-development feedback nexus with the view to explaining why the incidence of corruption is not only higher in poor countries than in rich countries, but is also more variable among countries at intermediate stages of development.

Our analysis is based on a simple neo-classical growth model in which public agents (bureaucrats) are delegated the responsibility for collecting taxes from private individuals (households) on behalf of the political elite (the government). Bureaucrats have the opportunity to engage in corrupt practices which are difficult to monitor by the government. Specifically, bureaucrats may exploit their powers of public office to collude with households in bribery and tax evasion: a bribe to a bureaucrat holds the promise that the income of a household will be reported falsely and exempted from any tax. Thus our model incorporates the essential features that government intervention requires public officials to gather information and administer policies, and that at least some of these officials are corruptible in the sense of being willing to misrepresent information at the right price. The incentive for a bureaucrat to actually behave in this way depends on economy-wide outcomes which, in turn, depend on the behaviour of other bureaucrats. This strategic interaction in bureaucratic decision making produces a variety of equilibria associated with different incidences of corruption. These equilibria are frequency-dependent in the sense that an individual bureaucrat's expected gain from being corrupt depends on the number of other bureaucrats who are expected to be corrupt.[8] The effect of corruption, itself, is to reduce the amount of resources available for productive investments as bureaucrats seek other (less conspicuous, but costly) ways of disposing of their illegal income. Accordingly, our analysis allows for the joint, endogenous determination of corruption and development in a relationship that is fundamentally two-way causal: on the one hand, the selection of an equilibrium with a particular incidence of corruption is governed by aggregate economic activity; on the other hand, growth in economic activity through capital accumulation is de-

[8] Such equilibria have been established in some partial equilibrium models of corruption (e.g., Andvig and Moene 1990; Cadot 1987).

termined by the equilibrium level of corruption.

The main implication of our analysis is that an economy may find itself in either of three distinct types of development regime: the first, a low development regime, is characterised by a unique equilibrium associated with a high incidence of corruption; the second, a high development regime, is also characterised by a unique equilibrium but one that entails a low incidence of corruption; the third, an intermediate development regime, is characterised by multiple equilibria with varying incidences of corruption. The existence of multiple equilibria means that different levels of corruption may be displayed by countries at similar stages of development. Consequently, and in accordance with the empirical evidence, our analysis is able to explain not only why there is more corruption in poor countries than in rich countries, but also why there is more diversity in corruption among middle income countries. It is also able to account for persistence in both corruption and income inequalities across countries: transition from a low development (high corruption) regime to a high development (low corruption) regime is not inevitable in our model, and it is possible for an economy to remain trapped in the former unless fundamental changes take place.

The remainder of paper is organised as follows. In Section 2 we describe the economic environment in which agents make decisions. In Section 3 we study the incentives of agents to engage in corruption. In Section 4 we establish the existence of alternative equilibria associated with different levels of corruption and development. In Section 5 we offer some concluding remarks.

2 The Environment

Time is discrete and indexed by $t = 0, .., \infty$. There is a constant population of two-period-lived agents belonging to overlapping generations of non-altruistic families. Agents of each generation are divided into two groups of citizens - private individuals (or households), of whom there is a fixed measure of mass m, and public servants (or bureaucrats), of whom there is a fixed measure of mass $n < m$.[9] Households are differentiated according to differences in their labour endowments which determine their relative incomes and their relative propensities to be taxed. Specifically, we assume that a fraction, $\mu \in (0, 1)$, of households are endowed with $\lambda > 1$ units of labour and are liable to

[9] We assume that agents are differentiated at birth according to their abilities and skills. A population of m agents lack the skills necessary to become bureaucrats, while a population of n agents posess these skills. The latter are induced to become bureaucrats by an allocation of talent condition established below.

taxation, while the remaining fraction, $1 - \mu$, are endowed with only one unit of labour and are exempt from paying tax. Taxes are lump-sum and are collected by bureaucrats on behalf of the government which requires funding for public expenditures. Each bureaucrat has one unit of labour endowment and is responsible for collecting taxes from $\frac{\mu m}{n}$ households. Corruption arises from the incentive of a bureaucrat to conspire with a household in concealing information (the household's income) from the government. In doing this, the bureaucrat expects to gain from the receipt of a bribe and the household expects to gain from the non-payment of any tax. We assume that a fraction, $\eta \in (0, 1)$, of bureaucrats are corruptible in this way, while the remaining fraction, $1-\eta$, are non-corruptible, with the identity of each bureaucrat being unobservable by the government.[10] All agents are risk neutral, working (and saving) only when young and consuming only when old. Production of output is undertaken by firms, of which there is a continuum of unit mass. Firms hire labour from households and rent capital from all agents. All markets are perfectly competitive.

2.1 The Government

We envisage the government as providing public services which contribute to the efficiency of output production (e.g., Barro 1990). Expenditure on these services, g_t, is assumed to be a fixed proportion, $\theta \in (0, 1)$, of output. The government also incurs expenditures on bureaucrats' salaries which are determined as follows. Any bureaucrat (whether corruptible or non-corruptible) can work for a firm, supplying one unit of labour to receive a non-taxable income equal to the wage paid to households. Any bureaucrat who is willing to accept a salary less than this wage must be expecting to receive compensation through bribery and is therefore immediately identified as being corrupt. As in other analyses (e.g., Acemoglou and Verdier 1998), we assume that a bureaucrat who is discovered to be corrupt is subject to the maximum fine of having all of his income confiscated (i.e., he is dismissed without pay). Given this, then no corruptible bureaucrat would ever reveal himself in the way described above. As such, the government can minimise its labour costs, while ensuring complete bureaucratic participation, by setting the salaries of all bureaucrats equal to the wage paid by firms to households.[11]

[10] This assumption may be thought of as capturing differences in the propensities of bureaucrats to engage in corruption, whether due to differences in proficiencies at being corrupt or differences in moral attitudes towards being corrupt (e.g., Acemoglou and Verdier 2000).

[11] This has the same interpretation as the allocation of talent condition in Acemoglou and Verdier (2000). The government cannot force any of the n potential bureaucrats to

The government finances its expenditures each period by running a continuously balanced budget. Its revenues consist of the taxes collected by bureaucrats from high income households, plus any fines imposed on bureaucrats who are caught engaging in corruption. We denote by τ_t the lump-sum tax levied on each high income household. Since the government knows how much tax revenue is due in the absence of corruption (since it knows the number of taxable households and since it is responsible for setting taxes), any shortfall of revenue below this amount reveals that corruption is occurring. Under such circumstances, the government investigates the behaviour of bureaucrats using an imprecise monitoring technology. This technology implies that a bureaucrat who is corrupt faces a probability, $p \in (0, 1)$, of avoiding detection, and a probability, $1 - p$, of being found out. The tax-evading household with whom the bureaucrat conspires faces the same probabilities of remaining anonymous and being exposed. By the law of large numbers, these probabilities are also the actual proportions of corruptible agents who succeed and fail in illegal profiteering. For simplicity, we assume that monitoring is costless for the government.[12]

2.2 Households

Each young household of generation t is paid a wage, w_t, from supplying inelastically its labour endowment to a firm. Depending on this endowment, a household is either a low income earner and exempt from paying tax, or a high income earner and liable to pay tax. In each case the household saves its entire net income as (non-consumable) capital which is rented to firms at the market rate of interest, r_{t+1}, in order to finance old-age consumption.

For a household with one unit of labour endowment, w_t is equal to total labour income which is not subject to tax, so that w_t is also equal to net income. Obviously, this type of household has no incentive to engage in tax evasion, and its (expected) lifetime income, or utility, is simply $r_{t+1}w_t$.[13]

For a household with λ units of labour endowment, total labour income is λw_t from which the government requires payment of the lump-sum tax, τ_t. This type of household may conspire with a corruptible bureaucrat in bribery

actually take up public office, but it is able to induce all of them to do so by paying what they would earn elsewhere.

[12] The model could be extended to allow for costly monitoring (and perhaps to allow p to be a function of monitoring expenditures) without altering its main implications. To a large extent, our results would be strengthened in the sense that there would be an additional loss of resources from corruption.

[13] As we shall see, r_{t+1} is a function of currently observable variables and is therefore known to agents at time t.

and tax evasion. In the absence of such corruption, the household expects to earn a net income of $\lambda w_t - \tau_t$. In the presence of corruption, its expected net income depends on the amount of bribe paid to the bureaucrat and the probability of being caught. Let b_t denote the bribe. In return for this, the bureaucrat agrees to dissemble the identity of the household by declaring that it is a low-income type and is therefore not liable to pay tax. With probability p, the household and bureaucrat succeed in their conspiracy and the household's net income is $\lambda w_t - b_t$. With probability $1-p$, their collusion is exposed and the household is forced to pay its tax, implying a net income of $\lambda w_t - b_t - \tau_t$. Given these outcomes, we may write the expected lifetime utility of a high-income household as

$$u_t = \begin{cases} r_{t+1}(\lambda w_t - \tau_t) & \text{if } b_t = 0, \\ r_{t+1}[\lambda w_t - b_t - (1-p)\tau_t] & \text{if } b_t > 0. \end{cases} \tag{1}$$

2.3 Bureaucrats

Each young bureaucrat of generation t is paid the salary w_t from supplying inelastically his unit labour endowment to the government. Each bureaucrat has $\frac{\mu m}{n}$ households under his jurisdiction and is either non-corruptible or corruptible. Like all households, all bureaucrats save their entire income to finance old-age consumption.

By definition, a non-corruptible bureaucrat is never corrupt. The income of such a bureaucrat is always w_t, implying a lifetime utility of $r_{t+1}w_t$.

By contrast, a corruptible bureaucrat may or may not be corrupt. If the latter, then he expects to receive an income of w_t, as above. If the former, then his expected income depends on the bribes that he receives, the chances of being caught, the resources spent on trying to avoid detection and the penalties incurred if he is exposed. In general, corrupt individuals, in order to remain inconspicuous, may hide their illegal income, invest this income differently from legal income and alter their patterns of expenditure.[14] For the purposes of the present analysis, we assume that a corrupt bureaucrat must dispose of all side payments immediately if he is to stand any chance of not being caught: if he holds on to these payments, or invests them himself, then he is certain of being found out, in which case he ends up with nothing. The concealment of bribes is not without cost, however. Specifically, we imagine that illegal income can be invested without detection only on the black market at an interest cost of ρ per unit invested, and only after a

[14]It may even be the case that income from corruption at one level is used to foster corruption at other levels (e.g., to ensure non-interference from the legal authorities). Discussions of these issues can be found in Rose-Ackerman (1996) and Wade (1985), among others.

fraction, $1 - \delta \in (0, 1)$, of this income has been spent on searching for such an opportunity. Legal income, by contrast, can be invested freely at the official market rate. Detection of corruption occurs before a bureaucrat has the chance to dispose of his bribes, but after he has incurred search costs. On being caught, the bureaucrat is fined the amount f_t, equal to the full amount of his earnings. Given this description of events, we may write the initial net income of a corrupt bureaucrat as $w_t + \left(\frac{\mu m}{n}\right)\delta b_t$ with probability p and $w_t + \left(\frac{\mu m}{n}\right)\delta b_t - f_t$ with probability $1 - p$. In the case of the former w_t is invested at the official market interest rate, r_{t+1}, while $\left(\frac{\mu m}{n}\right)\delta b_t$ is invested at the black market rate, $r_{t+1} - \rho$. In the case of the latter $f_t = w_t + \left(\frac{\mu m}{n}\right)\delta b_t$. It follows that the expected lifetime utility of a corruptible bureaucrat is

$$v_t = \begin{cases} r_{t+1} w_t & \text{if } b_t = 0, \\ p\left[r_{t+1} w_t + (r_{t+1} - \rho)\left(\frac{\mu m}{n}\right)\delta b_t\right] & \text{if } b_t > 0. \end{cases} \tag{2}$$

2.4 Firms

The representative firm produces output, y_t, according to the following technology:

$$y_t = A l_t^{\alpha} k_t^{\beta} g_t^{\gamma}, \tag{3}$$

$(A > 0,\ \alpha, \beta, \gamma \in (0, 1),\ \beta + \gamma < 1)$ where l_t denotes labour and k_t denotes capital.[15] The firm hires labour at the competitively-determined wage rate w_t and rents capital at the competitively-determined rental rate r_t. Profit maximisation implies

$$w_t = A\alpha l_t^{\alpha-1} k_t^{\beta} g_t^{\gamma}, \tag{4}$$

$$r_t = A\beta l_t^{\alpha} k_t^{\beta-1} g_t^{\gamma}. \tag{5}$$

3 The Incentive to be Corrupt

Corruption occurs if a high income household and a corruptible bureaucrat find it mutually advantageous (or non-disadvantangeous) to conspire with each other in concealing information from the government. Under such circumstances, there is bribery and tax evasion. In the analysis that follows we study the individual incentives of private and public agents to behave in this way.

A high income household is willing to pay a bribe if its expected utility from doing so is no less than its expected utility from not doing so. The

[15] The parameter restriction $\beta + \gamma < 1$ ensures the existence of a steady state level of capital associated with a strictly concave capital accumulation path.

maximum bribe that such a household is willing to concede is determined by strict equality of this condition. From (1), this maximum bribe payment is deduced as

$$b_t = p\tau_t. \tag{6}$$

Intuitively, the household is prepared to bribe a bureaucrat by no more than what it expects to save in taxes.

Similarly, a corruptible bureaucrat is willing to accept a bribe if he expects to be no worse off from doing this than from not doing this. From (2), this requires that

$$b_t \geq \frac{n(1-p)r_{t+1}w_t}{\mu m\delta p(r_{t+1}-\rho)}. \tag{7}$$

Accordingly, the bureaucrat demands a higher bribe payment the more he expects to lose in legal income if he is caught and the less he expects to gain in illegal income if he is not caught.

For corruption to take place, both (6) and (7) must be satisfied simultaneously. This yields the condition

$$p\tau_t \geq \frac{n(1-p)r_{t+1}w_t}{\mu m\delta p(r_{t+1}-\rho)}. \tag{8}$$

The key feature of this condition is that it depends on the economy-wide variables τ_t, r_{t+1} and w_t. As we shall see, the current tax rate and future interest rate are determined by current events in the economy, while the current wage rate is predetermined. In particular, both τ_t and r_{t+1} are functions of the aggregate level of corruption at time t. This means that the incentive for each corruptible bureaucrat to be corrupt depends on the number of other such bureaucrats who are expected to be corrupt. Consequently, bureaucratic decision making entails strategic interactions which may result in multiple, frequency-dependent equilibria.

We begin to explore the above possibility by first studying the incentives of an individual corruptible bureaucrat to be corrupt under two opposite scenarios - one in which no other corruptible bureaucrat is corrupt and the other in which all other corruptible bureaucrats are corrupt. In conducting the analysis, we make use of some of our earlier results and assumptions. Specifically, we recall that $g_t = \theta y_t$ and observe that, in equilibrium, $l_t = l = (\lambda\mu + 1 - \mu)m$.[16] From (3), (4) and (5), we then have $g_t = \Phi\theta k_t^{\phi}$, $w_t = \Phi l^{-1}\alpha k_t^{\phi}$ and $r_t = \Phi\beta k_t^{\phi-1}$, where $\Phi = (Al^{\alpha}\theta^{\gamma})^{1/(1-\gamma)}$ and $\phi = \frac{\beta}{1-\gamma}$. Thus, as indicated above, w_t is predetermined by the existing stock of capital, k_t. By contrast, r_{t+1} depends on k_{t+1} which, in turn, depends on events at time t by virtue

[16] This latter expression defines equilibrium in the labour market, where the total supply of labour is equal to the labour supply of high income households, $\lambda\mu m$, plus the labour supply of low income households, $(1-\mu)m$.

of the capital market equilibrium condition, $k_{t+1} = s_t$, where s_t denotes the total savings of all agents.

Consider, then, the case in which no corruptible bureaucrat is corrupt. The government obtains the maximum tax revenue of $\mu m \tau_t$ which is used to finance its expenditures on public services, g_t, and bureaucrats' salaries, nw_t. The tax imposed on each high income household is determined from the government's budget constraint as

$$\begin{aligned}\widehat{\tau}_t &= \frac{g_t + nw_t}{\mu m} \\ &= \frac{\Phi(\theta l + \alpha n)}{l \mu m} k_t^{\phi} \equiv \widehat{\tau} k_t^{\phi}.\end{aligned} \tag{9}$$

Given this tax, an individual household would be willing to pay a maximum bribe of $\widehat{b}_t = p\widehat{\tau}_t$ in accordance with (6). Total savings in the economy comprise the total savings of low income households, $(1-\mu)mw_t$, of high income households, $\mu m(\lambda w_t - \widehat{\tau}_t)$, and of bureaucrats, nw_t.[17] Collecting these terms together, and exploiting (9), we may derive the following expression for capital accumulation:

$$\begin{aligned}\widehat{k}_{t+1} &= lw_t - g_t \\ &= \Phi(\alpha - \theta) k_t^{\phi},\end{aligned} \tag{10}$$

where we assume that $\alpha > \theta$.[18] Defining $\widehat{r}_{t+1} = \Phi\beta\widehat{k}_{t+1}^{\phi-1}$, (10) may be used to obtain

$$\widehat{r}_{t+1} = \Phi\beta[\Phi(\alpha - \theta)]^{\phi-1} k_t^{\phi(\phi-1)} \equiv \widehat{R}(k_t). \tag{11}$$

Substituting (9) and (11) into (8), and re-arranging, gives us our final result,

$$\widehat{R}(k_t) \geq \frac{\rho\delta p^2 l \mu m \widehat{\tau}}{\delta p^2 l \mu m \widehat{\tau} - \Phi(1-p)\alpha n} \equiv \widehat{\Omega}. \tag{12}$$

This is the condition for an individual corruptible bureaucrat to be corrupt, given that no other such bureaucrat is corrupt. To make our analysis non-trivial, we assume that $\widehat{\Omega} > 0$.[19]

Now consider the case in which all corruptible bureaucrats are corrupt. The total population of such bureaucrats is ηn and the total population of bribe-paying households is $\eta \mu m$.[20] Among each of these groups, there is

[17] Appropriate restrictions on paramater values ensure that the after-tax income of a household is always positive.

[18] Since α (θ) is the share of labour (government expenditure) in national income, this assumption is justified empirically.

[19] A sufficient condition for this is $\delta p^2 > 1 - p$.

[20] This follows from the fact that each bureaucrat colludes with $\frac{\mu m}{n}$ households.

a fraction, p, of agents who evade detection by the government, while the remaining fraction, $1-p$, are caught. The government's tax receipts from the former are zero, and from the latter are $\left(\frac{\mu m}{n}\right)\tau_t$ per bureaucrat who is also fined the amount $w_t + \left(\frac{\mu m}{n}\right)\delta b_t$. The populations of non-corruptible bureaucrats and non-bribe-paying high income households are $(1-\eta)n$ and $(1-\eta)\mu m$, respectively. From these agents, the government receives $\left(\frac{\mu m}{n}\right)\tau_t$ in tax revenue per bureaucrat. As before, total government expenditure is equal to expenditures on public services, g_t, plus expenditures on bureaucrats' salaries, nw_t. It follows from the government's budget constraint that the tax imposed on each high income household is

$$\begin{aligned}\widetilde{\tau}_t &= \frac{g_t + [1-(1-p)\eta]nw_t - (1-p)\eta\mu m\delta\widetilde{b}_t}{(1-p\eta)\mu m} \\ &= \frac{\Phi\{\theta l + [1-(1-p)\eta]\alpha n\}}{\{1-[1-(1-p)\delta]p\eta\}l\mu m}k_t^{\phi} \equiv \widetilde{\tau}k_t^{\phi}, \end{aligned} \tag{13}$$

The maximum bribe that a household would be willing to pay is deduced from (6) to be $\widetilde{b}_t = p\widetilde{\tau}_t$. Total savings of households comprise the savings of low income households, $(1-\mu)mw_t$, of high income housholds that do not bribe, $(1-\eta)\mu m(\lambda w_t - \widetilde{\tau}_t)$, and of high income households that do bribe, $\eta\mu m[\lambda w_t - \widetilde{b}_t - (1-p)\widetilde{\tau}_t]$.[21] Total savings of bureaucrats consist of the savings of non-corruptible bureaucrats, $(1-\eta)nw_t$, and of corruptible bureaucrats, $\eta np[w_t + \left(\frac{\mu m}{n}\right)\delta\widetilde{b}_t]$. Together with (13), these expressions yield the following process governing capital accumulation:

$$\begin{aligned}\widetilde{k}_{t+1} &= lw_t - g_t - \eta\mu m(1-\delta)\widetilde{b}_t \\ &= [\Phi(\alpha-\theta) - p\eta\mu m(1-\delta)\widetilde{\tau}]k_t^{\phi}, \end{aligned} \tag{14}$$

where we assume that $[\cdot] > 0$. Denoting $\widetilde{r}_{t+1} = \Phi\beta\widetilde{k}_{t+1}^{\phi-1}$, (14) may be used to obtain

$$\widetilde{r}_{t+1} = \Phi\beta[\Phi(\alpha-\theta) - p\eta\mu m(1-\delta)\widetilde{\tau}]^{\phi-1}k_t^{\phi(\phi-1)} \equiv \widetilde{R}(k_t). \tag{15}$$

On substituting (13) and (15) into (8), we then arrive at the result

$$\widetilde{R}(k_t) \geq \frac{\rho\delta p^2 l\mu m\widetilde{\tau}}{\delta p^2 l\mu m\widetilde{\tau} - \Phi(1-p)\alpha n} \equiv \widetilde{\Omega} \tag{16}$$

This is the condition for an individual corruptible bureaucrat to be corrupt, given that all other such bureaucrats are corrupt. It is straightforward to verify that $\widetilde{\Omega} > 0$ if $\widehat{\Omega} > 0$, as we have already assumed.

[21] As above, we can ensure that the net income of a household is always positive by appropriate restrictions on parameter values.

The expressions derived above lead to the following observations. For any given existing stock of capital, k_t, (9) and (13) imply $\widehat{\tau}_t < \widetilde{\tau}_t$ (hence $\widehat{b}_t < \widetilde{b}_t$), (10) and (14) imply $\widehat{k}_{t+1} > \widetilde{k}_{t+1}$, and (11) and (15) imply $\widehat{r}_{t+1} < \widetilde{r}_{t+1}$. Thus taxes (and bribe payments) are lower, capital accumulation is higher and interest rates are lower in the absence of any corruption than in the presence of complete corruption. Intuitively, the prospect of lost tax revenues under corruption means that each high income household is subject to a higher tax liability. In order to avoid this, each of these households is willing to pay a larger bribe. Higher taxes, together with the costly concealment of bribe income, reduces savings and capital accumulation, leading to higher interest rates by virtue of diminishing returns to capital in output production.

4 Equilibria

The foregoing analysis sets out the conditions for an individual corruptible bureaucrat to be either corrupt or non-corrupt, given that all other corruptible bureaucrats are either corrupt or non-corrupt. The analysis also reveals the extent to which corruption at the aggregate level influences economic outcomes, in general, and capital accumulation, in particular. We now proceed to study how the aggregate incidence of corruption, itself, is determined. As we shall see, whether or not corruption forms part of an equilibrium depends on the level of development of the economy. In this way, our model predicts a relationship between corruption and development that is fundamentally two-way causal.

The crucial conditions for determining equilibrium behaviour are given in (12) and (16). Note that both $\widehat{R}(\cdot)$ and $\widetilde{R}(\cdot)$ are decreasing monotonically in k_t. Note also that $\widehat{\Omega} > \widetilde{\Omega}$, while $\widehat{R}(\cdot) < \widetilde{R}(\cdot)$ for all k_t, as indicated above. Given these observations, we may define two critical levels of capital, k_1^c and k_2^c, such that the following hold: $\widehat{R}(k_1^c) = \widehat{\Omega}$, $\widehat{R}(\cdot) > \widehat{\Omega}$ for all $k_t < k_1^c$ and $\widehat{R}(\cdot) < \widehat{\Omega}$ for all $k_t > k_1^c$; and $\widetilde{R}(k_2^c) = \widetilde{\Omega}$, $\widetilde{R}(\cdot) > \widetilde{\Omega}$ for all $k_t < k_2^c$ and $\widetilde{R}(\cdot) < \widetilde{\Omega}$ for all $k_t > k_2^c$. Evidently, $k_1^c < k_2^c$. We are now in a position to establish some key results.

Proposition 1 *For $k_t < k_1^c$, there exists a unique equilibrium in which all corruptible bureaucrats are corrupt.*

Proof. Suppose that $k_t < k_1^c$. Then $\widetilde{R}(\cdot) > \widetilde{\Omega}$ and $\widehat{R}(\cdot) > \widehat{\Omega}$, implying that it pays each corruptible bureaucrat to be corrupt, irrespective of whether other corruptible bureaucrats are corrupt or non-corrupt. The case in which all corruptible bureaucrats are corrupt is an equilibrium outcome since no bureaucrat has an incentive to deviate from corrupt behaviour. Conversely, the case in which all corruptible bureaucrats are non-corrupt is not an equilibrium outcome since each bureaucrat has an incentive to deviate from non-corrupt behaviour. ■

This result demonstrates that low levels of development are associated with high (maximum) levels of corruption.

Proposition 2 *For $k_t > k_2^c$, there exists a unique equilibrium in which no corruptible bureaucrat is corrupt.*

Proof. Suppose that $k_t > k_2^c$. Then $\widehat{R}(\cdot) < \widehat{\Omega}$ and $\widetilde{R}(\cdot) < \widetilde{\Omega}$, implying that it pays each corruptible bureaucrat to be non-corrupt, irrespective of whether other corruptible bureaucrats are non-corrupt or corrupt. The case in which all corruptible bureaucrats are non-corrupt is an equilibrium outcome since no bureaucrat has an incentive to deviate from non-corrupt behaviour. Conversely, the case in which all corruptible bureaucrats are corrupt is not an equilibrium outcome since each bureaucrat has an incentive to deviate from corrupt behaviour. ■

This result demonstrates that high levels of development are associated with low (zero) levels of corruption.

Proposition 3 *For $k_t \in (k_1^c, k_2^c)$, there are multiple equilibria in which all corruptible bureaucrats are either corrupt or non-corrupt.*

Proof. Suppose that $k_t \in (k_1^c, k_2^c)$. Then $\widetilde{R}(\cdot) > \widetilde{\Omega}$ but $\widehat{R}(\cdot) < \widehat{\Omega}$, implying that it pays each corruptible bureaucrat to be either corrupt or non-corrupt, depending on whether other corruptible bureaucrats are corrupt or non-corrupt. The case in which all corruptible bureaucrats are corrupt is an equilibrium outcome since no bureaucrat has incentive to deviate from corrupt behaviour. Likewise, the case in which all corruptible bureaucrats are non-corrupt is also an equilibrium outcome since no bureaucrat has an incentive to deviate from non-corrupt behaviour. ■

This result demonstrates that intermediate levels of development may be associated with either low or high levels of corruption.

We illustrate the above results in Figure 1, from which we are led to distinguish between three types of development regime for the economy. The first - a low development regime - is one in which the incidence of corruption is always at its maximum for any given level of capital below the lower threshold level, k_1^c. The second - a high development regime - is one in which the incidence of corruption is always at its minimum for any given level of capital above the upper threshold level, k_2^c. And the third - an intermediate development regime - is one in which the incidence of corruption may be either at its maximum or at its minimum for any given level of capital between the two thresholds. The intuition is as follows. At low levels of development, taxes are low, interest rates are high and wages are low. This combination of outcomes is such as to ensure that the condition for an individual corruptible bureaucrat to be corrupt - that is, the condition in (8) - is always satisfied, regardless of what other corruptible bureaucrats are doing. Consequently, each and every one of these bureaucrats chooses to be corrupt in a unique equilibrium from which there is no incentive to deviate. Conversely, at high levels of development, there is a combination of high taxes, low interest rates and high wages which is such as to imply that, for each corruptible bureaucrat, the condition in (8) is never satisifed, whatever is the behaviour of other corruptible bureaucrats. Accordingly, each of these bureaucrats chooses not to be corrupt in a unique equilibrium which is robust against defection. In either of these cases, aggregate bureaucratic behaviour does not affect the bribe-taking incentives that deterimine individual bureaucratic behaviour. This is not true, however, at intermediate stages of development. In this case, whether or not the condition in (8) holds is sensitive to the particular configuration of taxes and interest rates associated with a particular level of corruption in the economy as a whole. On the one hand, given that corruption is widespread, then the condition is satisfied and it is in the interests of each corruptible bureaucrat to be corrupt. On the other hand, given that corruption is absent, then the condition is not satisfied and it is in the interests of each corruptible bureaucrat to be non-corrupt. These outcomes define two candidate equilibria that are frequency-dependent and that are equally likely to arise.

The predictions of our model accord well with the empirical observations highlighted earlier: the high incidence of corruption among poor countries is reflected in the unique equilibrium at low levels of development; the low incidence of corruption among rich countries is reflected in the unique equilibrium at high levels of development; and the diverse incidence of corruption among middle income countries is reflected in the multiplicity of equilibria at intermediate levels of development. We are unaware of any other analysis that produces a similar set of results. In the few related studies that currently exist, priority is given to explaining the existence of a generally negative correlation between corruption and growth (e.g., Ehrlich and Lui 1999; Sarte 2000). The same broad relationship is predicted by our own analysis, but for different reasons which also explain why the relationship may be tenuous in some circumstances. In fact, the diversity of outcomes at intermediate levels of development is greater than what we have suggested so far. Each of the equilibria that has been constructed is a pure strategy equilibrium in which all corruptible bureaucrats are either corrupt or non-corrupt. But there also exists a mixed strategy equilibrium in which bureaucratic behaviour is heterogenous - that is, an equilibrium in which a fraction, $\varepsilon \in (0, 1)$, of corruptible bureaucrats are corrupt, while the remaining fraction, $1 - \varepsilon$, are non-corrupt. We establish this in an Appendix by demonstrating that, for each $k_t \in (k_1^c, k_2^c)$, there exists an ε such that the condition in (8) holds with equality. It is therefore possible for a middle income country to be in one of three equilibria where the incidence of corruption is high, low or somewhere in between. To many observers, it is not surprising that the relationship between corruption and development may sometimes be a little fragile. Indeed, there is a widely-held view that, at least in the first instance, development may do little to reduce (and may even foster) corruption as the process of modernisation (including economic, political and social reforms) brings with it new incentives and new opportunities for public agents to engage in corrupt practices. For example, it is often alleged that this has been true in countries undergoing transition from controlled to more market-oriented economies (e.g., Bardhan 1997; Basu and Li 1998).

In addition to the above, our analysis is able to explain why corruption and poverty may co-exist as persistent, rather than transient, phenomena. At low levels of development, the capital accumulation path is given by (14). The steady state level of capital associated with this path is $\widetilde{k}^* = [\Phi(\alpha - \theta) - p\eta\mu m(1-\delta)\widetilde{\tau}]^{1/(1-\phi)}$. If $\widetilde{k}^* < k_1^c$, then an economy that is corrupt and poor to begin with is destined to remain corrupt and poor unless fundamental changes take place so as to dictate otherwise. For example, exogenous shifts in the stock of capital may cause a switch in development regime by pushing the economy above the threshold level. Alternatively, changes in the values of structural parameters may produce a similar turn of events by altering the transition function and the threshold, itself. In both cases a switch in regime is more likely to occur the closer is an economy to k_1^c to begin with. Accordingly, should circumstances change in these ways, then it is those countries at the upper end of the distribution below k_1^c that are most likely to feel the effects, while those in the lower tail remain as they are. Even for the former, however, there is no guarantee that the result would be low corruption and high growth, nor any assurance that the upper threshold, k_2^c, would also be breached. These observations suggest that the divisions between poor and rich, corrupt and non-corrupt, economies are unlikely to vanish quickly or easily, if at all.

5 Conclusions

Public sector corruption is pervasive throughout the world. In one form or another, and to a lesser or greater degree, it has existed, and continues to exist, in all societies. Over the past few years, there has been a growing concern among the academic community and international organisations about the causes and consequences of corrupt behaviour within government bureaucracies. This has been motivated by a strengthening conviction that good quality governance is essential for sustained economic development and that corruption in the public sector is a major impediment to growth and prosperity. Recent innovations at the empirical level have allowed this conviction to be tested, and there is now a large body of evidence to support it. By contrast, there remains relatively little by way of formal theoretical analysis that would lend rigour and precision to the arguments involved. Our objective in this paper has been to provide such an analysis.

We have defined public sector corruption in the usual way as the abuse of authority by bureaucratic officials who exploit their powers of discretion, delegated to them by the government, to further their own interests by engaging in rent-seeking activities. We have also addressed the archetypal form of public sector corruption, whereby a bureaucrat is bribed by a private individual to conspire in the concealment of valuable information from the government. Of course, to the extent that bribery entails a transfer of resources between agents, there need not be any net social costs associated with such behaviour. As with any type of illegal or unauthorised activity, however, there are costs to both individuals and society of deception and secrecy, on the one hand, and detection and prosecution, on the other. In our case corruption results in a loss of resources available for investment such that capital accumulation is depressed. It has been suggested elsewhere that corruption may also result in a misallocation of resources towards inefficient investments with similar consequences. Either way, the costs of corruption are potentially significant, especially since it takes only small changes in the growth rate to produce substantial cumulative gains or losses in output and welfare.

Our analysis respects the notion that bureaucratic corruption not only influences, but is also influenced by, economic development. This two-way causality is reflected in the existence of threshold effects and multiple equilibria which allow us to explain why the incidence of corruption may vary markedly across countries, even if countries share essentially the same structural characteristics. At any point in time, an economy may be located in a low development regime, a high development regime or an intermediate development regime. Cross-country variations in the level of corruption may occur both across and within these regimes. For example, two otherwise identical economies may end up with very different levels of corruption if one of them is in the low regime and the other is in the high regime, or if both of them lie in the intermediate regime. The predictions that follow from this accord well with the empirical observations of a high incidence of corruption among low income countries, a low incidence of corruption among high income countries and a diverse incidence of corruption among middle income countries. The results are also consistent with the idea of persistence in corruption since transition from one regime to another is not inevitable but requires the crossing of a threshold that may be prohibitive. Of course, there are many other factors - besides economic considerations - that may help to explain why corruption levels differ across countries. The recent empirical literature suggests a number of intriguing possibilities. Yet even after controlling for these factors, economic development remains highly significant and is undoubtedly a major determinant.

The relationship between corruption and development is an issue on which much has been written but about which there is still much to learn. To a large extent, measurement remains ahead of theory, though there are signs that the gap is being closed. Our intention in this paper has been to take a futher step in this direction.

Appendix

We establish the existence of a mixed strategy equilibrium in the intermediate development regime. Suppose that, for $k_t \in (k_1^c, k_2^c)$, there is a fraction, $\varepsilon \in (0,1)$ $(1-\varepsilon)$, of corruptible bureaucrats who are corrupt (non-corrupt), with a corresponding fraction, $\varepsilon\eta$ $(1-\varepsilon\eta)$, of high income households who are bribe payers (non-bribe payers). Proceeding in the usual way, we may derive expressions for taxes,

$$\begin{aligned}\overline{\tau}_t &= \frac{g_t + [1-(1-p)\varepsilon\eta]nw_t - (1-p)\varepsilon\eta\mu m\delta\overline{b}_t}{(1-p\pi\eta)\mu m} \\ &= \frac{\Phi\{\theta l + [1-(1-p)\varepsilon\eta]\alpha n\}}{\{1-[1-(1-p)\delta]p\varepsilon\eta\}l\mu m}k_t^{\phi} \equiv \overline{\tau}(\varepsilon)k_t^{\phi},\end{aligned} \tag{17}$$

capital accumulation,

$$\begin{aligned}\overline{k}_{t+1} &= lw_t - g_t - \varepsilon\eta\mu m(1-\delta)\overline{b}_t \\ &= [\Phi(\alpha-\theta) - p\varepsilon\eta\mu m(1-\delta)\overline{\tau}(\varepsilon)]k_t^{\phi},\end{aligned} \tag{18}$$

and interest rates,

$$\overline{r}_{t+1} = \Phi\beta[\Phi(\alpha-\theta) - p\varepsilon\eta\mu m(1-\delta)\overline{\tau}(\varepsilon)]^{\phi-1}k_t^{\phi(\phi-1)} \equiv \overline{R}(k_t,\varepsilon), \tag{19}$$

where $\overline{b}_t = p\overline{\tau}_t$. The condition for a corruptible bureaucrat to be corrupt is

$$\overline{R}(k_t,\varepsilon) \geq \frac{\rho\delta p^2 l\mu m\overline{\tau}(\varepsilon)}{\delta p^2 l\mu m\overline{\tau}(\varepsilon) - \Phi(1-p)\alpha n} \equiv \overline{\Omega}(\varepsilon). \tag{20}$$

It is straightforward to verify that, for a given k_t and a given $\varepsilon \in (0,1)$, $\widehat{\tau}_t < \overline{\tau}_t < \widetilde{\tau}_t$ (hence $\widehat{b}_t < \overline{b}_t < \widetilde{b}_t$), $\widehat{k}_{t+1} > \overline{k}_{t+1} > \widetilde{k}_{t+1}$, $\widehat{r}_{t+1} < \overline{r}_{t+1} < \widetilde{r}_{t+1}$ and $\widehat{\Omega} > \overline{\Omega} > \widetilde{\Omega}$. It is also straightforward to verify that $\overline{\tau}_t = \widehat{\tau}_t$, $\overline{b}_t = \widehat{b}_t$, $\overline{k}_{t+1} = \widehat{k}_{t+1}$, $\overline{r}_{t+1} = \widehat{r}_{t+1}$ and $\overline{\Omega} = \widehat{\Omega}$ if $\varepsilon = 0$, while $\overline{\tau}_t = \widetilde{\tau}_t$, $\overline{b}_t = \widetilde{b}_t$, $\overline{k}_{t+1} = \widetilde{k}_{t+1}$, $\overline{r}_{t+1} = \widetilde{r}_{t+1}$ and $\overline{\Omega} = \widetilde{\Omega}$ if $\varepsilon = 1$. Finally, we note that $\overline{R}(\cdot)$ is increasing in ε, while $\overline{\Omega}(\cdot)$ is decreasing in ε. In terms of Figure 1, these properties imply that, for any given $\varepsilon \in (0,1)$, the curve $\overline{R}(\cdot)$ always lies between the curves $\widehat{R}(\cdot)$ and $\widetilde{R}(\cdot)$, while the line $\overline{\Omega}(\cdot)$ always lies between the lines $\widehat{\Omega}$ and $\widetilde{\Omega}$. It follows that, within the region (k_1^c, k_2^c), there is a single intersection between $\overline{R}(\cdot)$ and $\overline{\Omega}(\cdot)$. This means that, for any given $k_t \in (k_1^c, k_2^c)$, there exists an $\varepsilon \in (0,1)$ such that $\overline{R}(\cdot) = \overline{\Omega}(\cdot)$, implying that each corrutible bureaucrat is indifferent between being corrupt and non-corrupt. This ε is the fraction of corrupt corruptible bureaucrats that supports a mixed strategy equilibrium.

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Table 1
Corruption Across Countries

Index	BIC	ICRG	TI
Total range[1]	1.00-10.00	1.00-6.00	0.00-10.00
Year	1980-83	1991-97	2001
Number of Countries			
Total[2]	59	113	87
Low income	5	33	19
Middle income	37	59	47
Lower middle income	21	43	28
Upper middle income	16	16	19
High income	17	21	21
Range of index			
Low income	1.00-4.00	1.44-4.00	0.40-3.5
Middle income	1.50-10.00	1.03-5.00	2.00-7.50
Lower middle income	1.50-8.75	1.03-5.00	2.00-6.00
Upper middle income	3.25-10.00	1.05-5.00	2.80-7.50
High income	7.50-10.00	4.38-6.00	6.60-9.90
Variance of index			
Low income	2.00	0.55	0.57
Middle income	4.07	0.79	1.40
Lower middle income	4.41	0.67	1.08
Upper middle income	3.44	1.14	1.21
High income	0.33	0.34	0.93

1. Greater levels of corruption are indicated by higher values of the indices.
2. To facilitate comparisons between the indices, oil-exporting countries have been excluded from the BIC and ICRG data sets. Other countries excluded from the BIC index are India, Iraq and Sri Lanka due to questions about the reliability of the data. Italy, which is a major outlier among high-income countries, has been excluded from all indices.

Table 2
Corruption in Middle Income Countries

	BIC index	ICRG index	TI index
Lower middle income countries with corruption levels in range of low income countries	Egypt, Ghana, Liberia, Nigeria	Albania, Algeria, Angola, Bolivia, Botswana, Cameroon, Chile, Colombia, Dominican Rep., Ecuador, Egypt, El Salvador, Georgia, Guatemala, Iran, Ivory Coast, Jamaica, Jordan, Lebanon, Malaysia, Mongolia, Morocco, Panama, Paraguay, Papua New Guinea, Peru, Philippines, Romania, Senegal, Suriname, Syrian Arab Rep., Thailand, Tunisia, Turkey, Zimbabwe	Bolivia, Dominican Rep., Ecuador, Guatemala, Kazakhstan, Latvia, Moldova, Philippines, Romania, Russia, Senegal, Thailand, Ukraine, Uzbekistan
Lower middle income countries with corruption levels in range of high income countries	Angola, Jordan, Nicaragua, Zimbabwe	Bulgaria, Costa Rica, Czech Rep., Latvia, Namibia, Nicaragua, Poland, Slovak Rep.	
Upper middle income countries with corruption levels in range of low income countries	Iran, Mexico	Argentina, Brazil, Croatia, Libya, Malta, Mexico, Oman, Russia, Trinidad&Tobago, Uruguay, Venezuela	Argentina, Venezuela
Upper middle income countries with corruption levels in range of high income countries	Argentina, Chile, Hong Kong, Ireland, Israel, Singapore, South Africa, Uruguay	Greece, Hungary, Portugal, South Africa	Chile, Estonia, Portugal, Taiwan

Figure 1
Equilibrium Corruption