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The Incidence and Persistence of Corruption in Economic Development

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The Incidence and Persistence of Corruption in Economic Development*

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Abstract

Economic development and bureaucratic corruption are determined jointly in a dynamic general equilibrium model of growth, bribery and tax evasion. Corruption arises from the incentives of public and private agents to conspire in the concealment of information from the government. These incentives depend on aggregate economic activity which, in turn, depends on the incidence of corruption. The model produces multiple development regimes, transition between which may or may not occur. In accordance with recent empirical evidence, the relationship between corruption and development is predicted to be negative.

1 Introduction

Public sector corruption is pervasive throughout the world. In one form or another, and to a lesser or greater degree, it exists in all societies, at all stages of development and under all types of politico-economic regime. Over the past few years, the fight against corruption, particularly in developing countries, has become high on the agenda of various international organisations, such as the World Bank and IMF (e.g., Jain 2001; Rose-Ackerman 1997). This has been motivated by a deepening belief that good quality governance is essential for sustained economic development. Recent innovations at the empirical level have allowed this belief to be tested, and there is now a large body of evidence to support it. By contrast, there remains relatively little

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by way of formal theoretical analysis that would lend rigour and precision to the arguments involved. Our objective in this paper is to provide such an analysis.[1]

A broad definition of public sector corruption is 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 illegal, or unauthorsied, rent-seeking activities. To many observers, corruption in public office is an inevitable aspect of state intervention which typically entails some transfer of responsibility from the government to a bureaucracy in a principal-agent type relationship. A considerable amount of research, in both economics and political science, has been devoted towards understanding the micro-foundations of this relationship and the implications for efficiency and welfare (e.g., Banerjee 1997; Carrillo 2000; 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, growth and development within the context of fully-specified dynamic general equilibrium models.

At the empirical level, it is only since the early 1980s that reliable data on corruption has become widely available. Prior to that time, researchers were forced to rely largely on anecdotal evidence obtained from country-specific case studies. This made it difficult to evaluate alternative views about the effects of bureaucratic malfeasance. A seemingly plausible view was that corruption could actually be growth-enhancing by helping to circumvent cumbersome regulations (red tape) in the bureaucratic process: that is, bribes may act as "speed money" which bureaucrats accept in return for overcoming institutional rigidities that work against efficiency (e.g., Huntington 1968; Leff 1964; Leys 1970).[2] As well as being questionable on conceptual grounds (e.g., Bardhan 1997), this view may be challenged on the basis of more recent, more systematic, and more persuasive empirical evidence. This evidence has been obtained using cross-country corruption data compiled since the early 1980s from questionnaire surveys by a number of international organisations (most notably, Business International Corporation, Political Risk Services In-

[1] For surveys of the existing literature, see Bardhan (1997, 2000), Jain (2001) and Rose-Ackerman (1998).

[2] 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.

corporated and Transparency International). While differing in their precise construction, these corruption indices - which rank countries according to the extent to which corruption is perceived to exist - are very closely correlated with each other, lending weight to the argument that they provide reliable estimates of the actual extent of corruption activity.[3] Their publication has given rise to a burgeoning empirical literature on the relationship between corruption, growth and other variables. The main findings of this literature, summarised below, offer little support for the "speed money" hypothesis.

First, and foremost, there is overwhelming evidence of a significant negative relationship between the incidence of corruption and economic growth.[4] 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 the same study it is also observed that the correlation between corruption and growth remains consistently negative in sub-samples of countries where bureaucratic regulations are reported to be particularly cumbersome (a result which contradicts the notion that corruption provides a way of by-passing such regulations). Likewise, Ades and Di Tella (1997) find little evidence of any beneficial effects of corruption in countries mired with red tape, while Kauffman and Wei (2000) conclude that the use of bribes to speed up individual transactions with bureaucrats is largely self-defeating as the number of transactions tends to increase. From a different perspective, 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).

Second, there is evidence to suggest 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

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

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

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), indicate that cross-country differences in the incidence of corruption owe much to cross-country differences in the level of prosperity.[5]

Third, there is also evidence to suggest that corruption and poverty may become so ingrained into the fabric of society as to establish themselves as more-or-less permanent fixtures, rather than being transient phenomena (e.g., Bardhan 1997; Sah 1988). A cursory inspection of the data reveals that many of the most poor and corrupt countries in the past are among the most poor and corrupt countries today.[6] This conjures up the idea of poverty traps and the notion that some countries may be drawn into a vicious circle of low growth and high corruption, from which there is no easy escape.

As indicated earlier, there exists relatively little theoretical research on the dynamic general equilibrium modelling of corruption and development. Two recent exceptions are the analyses of Ehrlich and Lui (1999) and Sarte (2000) who offer different explanations for why bureaucratic malpractice may be detrimental to growth.[7] In what follows we provide a further explanation which delves more deeply into the questions of why corruption may arise to begin with and why corruption may persist (or decline) over time.

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 opportuntity 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

[5] 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.

[6] Examples include Bangladesh, Cameroon, India, Indonesia, Kenya, Nigeria, Pakistan and Uganda. According to the data from Transparency International, these belong to a set of countries that have displayed little, or no, improvement in their corruption and growth records since the early 1980s.

[7] 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 income of a household will be reported falsely and subject to lower tax. The incentive for a bureaucrat to accept a bribe depends on his own income that he forfeits if he is caught. This income includes his salary which is positively related to the stock of capital in the economy. Accordingly, the incentive to be corrupt is higher at lower levels of capital, or lower stages of development.[8] The effect of corruption, itself, is to reduce the amount of resources available for productive investments as bureaucrats incur costs of trying to conceal their illegal income, and as the government incurs costs of trying to detect corrupt behaviour.[9]

Based on the above, our analysis provides an account of the joint, endogenous determination of corruption and development in a relationship that is both negative and two-way causal. This relationship is reflected in the existence of multiple development regimes associated with different incidences of corruption. Depending on parameter values and initial conditions, transition between these regimes may or may not be feasible. In the absence of transition, there are multiple long-run equilibria, including a poverty trap equilibrium in which corruption remains permanently high. These properties of the model allow us to explain why the incidence of corruption may vary markedly among economies. More traditional explanations appeal to cross-country differences in institutions, regulations and social customs which influence bureaucrats' opportunities and incentives for engaging in corrupt practices, as well as shaping public attitudes towards these practices. Such arguments have been criticised for being almost tautological and for failing to account for real-world observations (e.g., Bardhan 1997). Another, more contemporary, explanation is derived from microeconomic models of frequency-dependent equilibria, where the extent of corruption at the group level is a key determinant of the proclivity towards corruption at the individual level (e.g., Andvig and Moene 1990; Cadot 1987; Sah 1988). While grounded more firmly on economic principles, this idea has yet to be embedded in a theory of development and may be challenged for leaving too much to chance: whether or not corruption occurs depends primarily on whether or not it is expected to occur. From a practical perspective, what one would like to know is how an economy might settle in one equilibrium rather than another as a result of the interplay between the fundamental determinants

[8] The implied inverse relationship between the pay of bureaucrats and the incidence of corruption is consistent with the findings of several empirical studies (e.g., Ades and Di Tella 1997; Chand and Moene 1997; Mookerjee 1995).

[9] It is possible to reformulate the model as a model of pure theft, where a bureaucrat simply steals either all or part of the taxes that he collects from a household. While there may be instances in which this occurs, the more prevalent and more widely-studied form of corruption is that involving bribery.

of corruption and growth. According to our own analysis, the limiting outcome of an economy depends predictably on the deep parameters describing preferences and technologies, together with initial conditions. Cross-country differences in the incidence of corruption can occur because of cross-country differences in any of these features. In particular, the extent of corruption may vary even among countries that are identical in every respect, except for their initial circumstances. An economy that is poor and corrupt to begin with may be destined to remain poor and corrupt unless there is a radical change in events. Based on these results, we view our analysis as a promising step towards understanding the persistent differences in income and corruption levels around the world.

The 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 analyse the dynamic general equilibrium interaction between 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 dynastic 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 $n < m$.[10] Households are differentiated according to differences in their incomes which imply differences in their propensities to be taxed. Specifically, we assume that there is a fraction, $\mu \in (0, 1)$, of relatively high-income households that are subject to relatively high taxation, and a remaining fraction, $1 - \mu$, of relatively low-income households that are candidates for relatively low taxation. Taxes are collected by bureaucrats on behalf of the government which requires funding for public expenditures. For simplicity, we suppose that bureaucrats do not pay any taxes. Each bureaucrat is assigned to $\frac{(1-\mu)m}{n}$ low-income households and to $\frac{\mu m}{n}$ high-income 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 his acceptance of a bribe and the

[10] 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.

household expects to gain from its reduced payment of 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.[11] 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.[12]

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 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.[13]

[11] 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).

[12] An interesting issue - one that lies beyond the scope of our analysis - is the extent to which market structure might influence the incidence of corruption. In Bliss and Di Tella (1997), for example, it is shown how greater competition may do little to reduce, and may even foster, corrupt practices. From a development perspective, this may be allied to the observation that, at least in the first instance, transition from a controlled to a more market-oriented economy appears often to be associated with an increase in corruption (e.g., Bardhan 1997; Basu and Li 1998).

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

Taxes are levied at different rates on different groups of household. For simplicity, we assume that taxes are lump-sum. The tax on each low-income household is τ_t, while the tax on each high-income household is $\tau_t + \sigma$, where σ represents an exogenous surcharge. For a given value of σ, the value of τ_t is determined endogenously (residually) from the government's budget constraint. As indicated above, responsibility for the collection of taxes lies with bureaucrats using the authority delegated to them by the government.

Since the government knows how much tax revenue is due in the absence of corruption (since it knows the numbers of both low-income and high-income 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 a costly and imprecise monitoring technology. This technology entails d units of additional expenditure and 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. In the event that corruption is detected, the bureaucrat is fined the full amount of his legal and illegal income, while the household is forced to pay its full tax liability.[14]

2.2 Households

Each young household is endowed with $\lambda > 1$ units of labour which it supplies inelastically to a firm in return for a wage of w_t. Depending on whether or not this is the only source of income, a household is either a low-tax payer or a high-tax payer. Whatever its status, the household saves its entire net income at the market rate of interest, r_{t+1}, in order to finance old-age consumption.

For some households, w_t is the only source of income and τ_t is the only tax liability. These are relatively low-income households that have no incentive to engage in tax evasion. Each of these households saves the amount $\lambda w_t - \tau_t$.

For other households, w_t is not the only source of income and τ_t is not the only tax liability. These are relatively high-income households that may conspire with a corruptible bureaucrat in bribery and tax evasion. The additional amount of income earned by each of these households may be motivated in various ways and the precise origins of it are inessential to our analysis.

[14] The model could be extended straightforwardly to allow the costs of monitoring to depend on the level of corruption and to allow the probability of detection to depend on the amount of monitoring expenditures. As will become evident, doing this would not alter the main implications of the model.

Thus, rather than being specific and adding unnecessary detail to the model, we prefer to leave matters general and establish our results within a broader, more inclusive context. Given this, it is convenient to assume that the extra income is simply a fixed quantity, q, and that the extra tax is simply a fixed amount, σ.[15] A household may seek to avoid paying its extra tax liability by bribing a bureaucrat in return for having its extra income unreported. If a household abstains from such practice, then its net income is $\lambda w_t - \tau_t + q - \sigma$. If it engages in such practice, then its net income depends on the amount of bribe paid and the probability of being caught. Let x_t denote the bribe. With probability p, the household and bureaucrat succeed in their conspiracy and the household's net income is $\lambda w_t - \tau_t + q - x_t$. With probability $1 - p$, their collusion is exposed and the household is forced to pay its full tax liability, implying a net income of $\lambda w_t - \tau_t + q - \sigma - x_t$. Given these outcome, we may write the expected savings of a high-income household as

$$E(s_t^h) = \begin{cases} \lambda w_t - \tau_t + q - \sigma & \text{if } x_t = 0, \\ \lambda w_t - \tau_t + q - (1-p)\sigma - x_t & \text{if } x_t > 0. \end{cases} \tag{1}$$

2.3 Bureaucrats

Each young bureaucrat is endowed with one unit of labour which he supplies inelastically to the government in return for a salary of w_t.[16] Each bureaucrat has jurisdiction over $\frac{(1-\mu)m}{n}$ low-income households and $\frac{\mu m}{n}$ high-income households. Depending on his personal characteristics, a bureaucrat may or may not be 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 total income, or savings, of such a bureaucrat is always w_t.

In contrast, a corruptible bureaucrat may or not be corrupt. If the latter, then his total income is w_t, as above. If the former, then his income is uncertain and depends on the bribes that he receives, the chances that he is caught, the resources that he spends on trying to avoid detection and the penalties that he incurs if he is exposed. In general, corrupt individuals,

[15] Consider, for example, the following scenario. In addition to their own consumption, some individuals derive utility from the bequests they leave to their offspring. If the marginal rate of substitution between consumption and bequests is independent of the level of consumption, then the optimal size of bequest will be constant so that each generation will inherit the same fixed amount of wealth. This inheritance would be equivalent to q and the additional tax, σ, paid by these individuals may be interpreted as an inheritance (or wealth) tax.

[16] The fact that bureaucrats have lower labour endowments than households may be used to justify the assumption that bureaucrats do not pay any tax (i.e., their labour incomes lie below the tax threshold).

in order to remain inconspicuous, may hide their illegal income, may invest this income differently from legal income and may alter their patterns of expenditure.[17] These activities typically entail costs in one form or another. For the purposes of the present analysis, we make the simple assumption that a bureaucrat who is corrupt must spend a fixed amount of resources, e, on trying to conceal his behaviour if he is to stand any chance of not being caught.[18] As indicated previously, the bureaucrat is fined the full remaining amount of his legal and illegal income should he fail in this endeavour. It follows that the bureaucrat's net income is $w_t + (\frac{\mu m}{n})x_t - e$ with probability p, and zero with probability $1 - p$. Accordingly, we may write the expected savings of each corruptible bureaucrat as

$$E(s_t^b) = \begin{cases} w_t & \text{if } x_t = 0, \\ p[w_t + (\frac{\mu m}{n})x_t - e] & \text{if } x_t > 0. \end{cases} \tag{2}$$

2.4 Firms

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

$$y_t = Al_t^\alpha k_t^{1-\alpha} g_t^\alpha, \tag{3}$$

($A > 0$, $\alpha \in (0, 1)$) where l_t denotes labour and k_t denotes capital.[19] 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 $w_t = \alpha Al_t^{\alpha-1} k_t^{1-\alpha} g_t^\alpha$ and $r_t = (1-\alpha)Al_t^\alpha k_t^{-\alpha} g_t^\alpha$. Since $l_t = \lambda m$ in equilibrium, and since $g_t = \theta y_t$ by assumption, we may write these conditions as

$$w_t = \left(\frac{a\alpha}{\lambda m}\right) k_t, \tag{4}$$

$$r_t = a(1 - \alpha), \tag{5}$$

where $a = [A(\lambda m\theta)^\alpha]^{1/(1-\alpha)}$. Thus the equilibrium wage is proportional to the capital stock, while the equilibrium interest rate is constant.

[17] 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.

[18] This expenditure may well depend on the amount of illegal income that a bureaucrat is trying to hide. As will become clear, allowing for this would not alter our results.

[19] This is essentially the production technology used by Barro (1990), where public services, g_t, enter as labour-augmenting inputs which create externality effects and produce constant returns to the accumulable factors of production.

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 what follows we study the individual incentives of private and public agents to behave in this way.

From the preceding analysis, the expected lifetime income (or utility) of an agent may be written generically as $E[(1+r_{t+1})s_t] = [1+a(1-\alpha)]E(s_t)$. This implies that a high-income household (corruptible bureaucrat) is willing to pay (accept) a bribe if doing so yields an expected value of savings at least equal to the value of savings obtained in the absence of bribery. From (1), the maximum bribe that a household is willing to concede is determined as

$$x_t = p\sigma \equiv \widehat{x}. \tag{6}$$

From (2), a bribe that is acceptable to a bureaucrat is one that satisfies

$$x_t \geq \frac{(1-p)nw_t + pne}{p\mu m}. \tag{7}$$

Intuitively, a household is prepared to bribe a bureaucrat by no more than what it expects to save in taxes, while a bureaucrat demands a larger size of bribe the more he expects to lose in legal income if he is caught and the more he needs to spend on trying not to be caught.

For corruption to take place, both (6) and (7) must be satisfied simultaneously. By virtue of (4), this joint condition may be stated as

$$k_t \leq \frac{\lambda mp(\mu m\widehat{x} - ne)}{(1-p)na\alpha} \equiv k^c, \tag{8}$$

where we assume that $\mu m\widehat{x} > ne$ to make our analysis non-trivial. Accordingly, there is a critical level of capital, k^c, below which corruption exists and above which corruption is absent. This reflects the fact that higher levels of capital, associated with higher wages of all agents, imply higher costs to bureaucrats if they are caught being corrupt. At sufficently large values of k_t, these costs are prohibitive and the incentive to be corrupt disappears.

4 The Development Process

The foregoing analysis reveals the extent to which corruption is influenced by economic development. We now turn to study the process of development, itself. As we shall see, this process is not immune to the incidence of corrupt activity which has important effects on capital accumulation and growth. In this way, our model predicts a relationship between corruption and development that is fundamentally two-way causal. We examine this relationship under two scenarios: the first - which we refer to as the homogeneous case and which is the simplest - is based on the model as it presently stands with all corruptible bureaucrats (and all agents of each other group) being identical in every respect; the second - which we refer to as the heterogeneous case and which admits a richer set of outcomes - entails an extension of the model to allow for differences among corruptible bureaucrats. In conducting our analysis, we make use of some of our earlier results and assumptions. In particular, we recall the expression for wages in (4) and the expression for bribes in (3), together with deducing that the government spends $g_t = a\theta k_t$ on public services. In addition, we note that equilibrium in the capital market requires k_{t+1} to be equal to the total savings of all agents.

4.1 The Homogeneous Case

Suppose, first, that $k_t > k^c$, implying that no corruptible bureaucrat is corrupt. The government obtains the maximum tax revenue of $m\tau_t + \mu m\sigma$ which it uses to finance its expenditures on public services, g_t, and bureaucrats' salaries, nw_t. The value of τ_t is determined from the government's budget constraint as

$$\begin{aligned} m\tau_t &= g_t + nw_t - \mu m\sigma \\ &= \frac{a(\theta\lambda m + \alpha n)}{\lambda m} k_t - \mu m\sigma. \end{aligned} \tag{9}$$

Total savings in the economy comprise the total savings of low-income households, $(1-\mu)m(\lambda w_t - \tau_t)$, of high-income households, $\mu m(\lambda w_t - \tau_t + q - \sigma)$, and of bureaucrats, nw_t.[20] Collecting these terms together, and exploiting (9), we may derive the following expression for capital accumulation:

$$\begin{aligned} k_{t+1} &= \lambda m w_t - g_t + \mu m q \\ &= a(\alpha - \theta)k_t + \mu m q \equiv f_H(k_t). \end{aligned} \tag{10}$$

Under the assumption that $a(\alpha - \theta) \in (0, 1)$, this capital accumulation path exhibits a stationary point at $k_H^* = \frac{\mu m q}{1 - a(\alpha - \theta)}$.[21]

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

[21] A necessary condition for such a point to exists is that $\alpha > \theta$. Since α (θ) is the share of labour (government expenditure) in national income, this condition is satisfied empirically.

Now suppose that $k_t \leq k^c$, implying that all corruptible bureaucrats are corrupt. There is a total population of ηn such bureaucrats, of whom a fraction, p, evade detection by the government, while the remaining fraction, $1-p$, are caught. The government's tax receipts are $\left(\frac{m}{n}\right)\tau_t$ from each of the former, and $\left(\frac{m}{n}\right)\tau_t + \left(\frac{\mu m}{n}\right)\sigma$ from each of the latter who is also fined the amount $w_t + \left(\frac{\mu m}{n}\right)\widehat{x} - e$. From each non-corruptible bureaucrat, of whom there are $(1-\eta)n$, the government receives $\left(\frac{m}{n}\right)\tau_t + \left(\frac{\mu m}{n}\right)\sigma$ in tax revenue. In addition to its expenditures on public services and bureaucrats' salaries, the government devotes d units of expenditure to monitoring. As above, the value of τ_t may be inferred from the government's budget constraint,

$$\begin{aligned} m\tau_t &= g_t + [1-(1-p)\eta]nw_t + d - (1-p)\eta\mu m\widehat{x} \\ &\quad + (1-p)\eta ne - (1-p\eta)\mu m\sigma \\ &= \frac{a\{\theta\lambda m + [1-(1-p)\eta]\alpha n\}}{\lambda m}k_t + d \\ &\quad + (1-p)\eta ne - (1-p^2\eta)\mu m\sigma. \end{aligned} \tag{11}$$

The population of households comprises a mass of $(1-\mu)m$ low-income households, a mass of $(1-\eta)\mu m$ high-income households that do not bribe and a mass of $\eta\mu m$ high-income households that do bribe.[22] Total savings of each of these groups are, respectively, $(1-\mu)m(\lambda w_t - \tau_t)$, $(1-\eta)\mu m(\lambda w_t - \tau_t + q - \sigma)$ and $\eta\mu m[\lambda w_t - \tau_t + q - (1-p)\sigma - x_t]$.[23] Total savings of bureaucrats consist of the savings of all non-corruptible bureaucrats, $(1-\eta)nw_t$, and of all corruptible bureaucrats, $\eta np[w_t + \left(\frac{\mu m}{n}\right)\widehat{x} - e]$. Together with (11), these expressions yield the following process governing capital accumulation:

$$\begin{aligned} k_{t+1} &= \lambda m w_t - g_t + \mu m q - d - \eta n e \\ &= a(\alpha-\theta)k_t + \mu m q - d - \eta n e \equiv f_L(k_t). \end{aligned} \tag{12}$$

Under our previous assumption, together with the restriction that $\mu m q > d + \eta n e$, this process displays a stationary point at the positive level of capital $k_L^* = \frac{\mu m q - d - \eta n e}{1-a(\alpha-\theta)}$.

A comparison of (9) and (11) reveals that the tax levied on all households, τ_t, is higher under corruption than under non-corruption.[24] This follows from

[22] These expressions are based on the observation that the fraction of high-income households that pay bribes - call it ϕ - is equal to the fraction of corruptible bureaucrats (all of whom are corrupt). To be sure, recall that the total population of corruptible bureaucrats is ηn and that each of these bureaucrats is assigned to $\frac{\mu m}{n}$ high-income households, of whom $\phi\mu m$ are bribe-payers. It follows straightforwardly that $\phi = \eta$.

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

[24] This result is established by observing from (6) and (7) that, in the case of corruption, $p\mu m\widehat{x} > (1-p)nw_t$.

the fact that corruption entails both a loss of revenue to the government from the evasion of the surcharge tax, σ, by high-income households and an additional outlay for the government from the costly monitoring of bureaucratic behaviour. Conversely, a comparison of (10) and (12) reveals that capital accumulation is lower under corruption than under non-corruption: that is, $f_L(\cdot) < f_H(\cdot)$ for any given k_t. Naturally, this implies that the steady state level of capital is also lower under corruption than under non-corruption: that is, $k_L^* < k_H^*$. The extent to which corruption depresses capital accumulation is determined by the amount of resources that the government spends on monitoring and the amount of resources that corruptible bureaucrats spend on trying to avoid detection.

Based on the above results, we are led to distinguish between two types of development regime for the economy: the first - associated with $k_t < k^c$ - is a low development regime in which the incidence of corruption is high; the second - associated with $k_t > k^c$ - is a high development regime in which the incidence of corruption is low. The overall evolution of the economy depends crucially on the initial stock of capital, k_0, together with the relationship between k_L^* and k^c. This is illustrated in Figure 1. Suppose that $k_0 < k^c < k_L^*$. In this case the economy starts off in a situation where all corruptible bureacrats are corrupt and development takes place along the low capital accumulation path, $f_L(\cdot)$. At some point in time, k_t reaches k^c and the incentive for each corruptible bureaucrat to continue being corrupt disappears. This propels the economy onto the high capital accumulation path, $f_H(\cdot)$, by causing it to jump from $f_L(k^c)$ to $f_H(k^c)$, after which it converges to the high steady state equilibrium, k_H^*. This chain of events describes a process of transition from the low development regime to the high development regime. But there is nothing in the model to guarantee such an outcome. To be sure, suppose that $k_0 < k_L^* < k^c$. Under such circumstances, the economy is destined for the low steady state equilibrium, k_L^*, being locked forever on the low capital accumulation path, $f_L(\cdot)$, and being mired forever with rampant corruption. To the extent that the high steady state equilibrium, k_H^*, would be attained if $k_0 > k^c$, the model now presents a situation in which limiting outcomes depend fundamentally on initial conditions.

4.2 The Heterogeneous Case

As it stands at present, the model is able to explain both why corruption is higher in poor countries than in rich countries, and why corruption and poverty may co-exist as persistent (rather than transitory) phenomena. Naturally, the model's description of events is stylised in a number of respects, not least of which is the feature that the incidence of corruption is essentially a binary variable which takes on either a high value or a low value, depending on whether all corruptible bureaucrats are either corrupt or non-corrupt. An implication of this is that, if transition between development regimes takes place, then it does so abruptly (discontinuously) as soon as the threshold level, k^c, is reached. In what follows we present a simple extension of the model which allows for smooth variations in the incidence of corruption along a continuous capital accumulation path. This extension produces a third (intermediate) development regime and expands the set of possible outcomes for the economy.

We relax the assumption that all corruptible bureaucrats are identical. Specifically, and with the minimum complication, we introduce heterogeneity in terms of e, the cost to a bureaucrat of trying to conceal his illegal income should he engage in corruption. Since the return to being bribed is now different across bureaucrats, the incentive to accept bribes is also different across these agents. To fix ideas, we assume that e is uniformly distributed on $[0, 1]$ with probability density function $\chi(e) = \eta n$. Let ϵ_t $(1 - \epsilon_t)$ denote the fraction of corruptible bureaucrats who are corrupt (non-corrupt). From (8), we have

$$\epsilon_t = \begin{cases} 1 \quad \text{if } k_t \leq \frac{p\mu\lambda m^2\widehat{x} - p\lambda mn}{(1-p)na\alpha} \equiv k_L^c, \\ 0 \quad \text{if } k_t \geq \frac{p\mu\lambda m^2\widehat{x}}{(1-p)na\alpha} \equiv k_H^c, \\ \frac{p\mu\lambda m^2\widehat{x} - (1-p)na\alpha k_t}{p\lambda mn} \quad \text{if } k_t \in (k_L^c, k_H^c). \end{cases} \tag{13}$$

There are now two critical levels of capital, k_L^c and k_H^c, such that the incidence of corruption may be high, low or somewhere in between. At any point in time, the total population of corruptible public agents is divided into a population of $\int_0^{\epsilon_t} \chi(e)de = \epsilon_t \eta n$ corrupt agents (for whom $e < \epsilon_t$), and a population of $\int_{\epsilon_t}^1 \chi(e)de = (1 - \epsilon_t)\eta n$ non-corrupt agents (for whom $e \geq \epsilon_t$).

Given the above, we may proceed as before to compute the income tax imposed on each household and the capital accumulation path for the economy as a whole. The principal difference from our previous analysis is the aggregation of individual behaviour within certain cohorts of agents. As regards the cohort of corruptible bureaucrats, we integrate over $(0, \epsilon_t)$ for those who are corrupt, and over $(\epsilon_t, 1)$ for those who are non-corrupt. As regards the cohort of high-income households, we note that $\epsilon_t \eta$ is the fraction that pay bribes, while $(1 - \epsilon_t \eta)$ is the fraction that do not pay bribes. The government continues to use its tax revenues to finance its expenditures on public services, bureaucrats' salaries and bribery detection. The last of these is now specified as $\delta(\epsilon_t)$, where $\delta(0) = 0$ and $\delta(\cdot) = d$ for $\epsilon_t > 0$.[25] It is

[25] Our results would be unchanged if one were to assume monitoring costs to be a

straightforward to show that the budget constraint of the government is

$$\begin{aligned} m\tau_t &= g_t + [1-(1-p)\eta\epsilon_t]nw_t + \delta(\epsilon_t) - (1-p)\eta\epsilon_t\mu m\widehat{x} \\ &\quad + \tfrac{1}{2}(1-p)\eta n\epsilon_t^2 - (1-p\eta\epsilon_t)\mu m\sigma \\ &= \frac{a\{\theta\lambda m + [1-(1-p)\eta\epsilon_t]\alpha n\}}{\lambda m}k_t + \delta(\epsilon_t) \\ &\quad + \tfrac{1}{2}(1-p)\eta n\epsilon_t^2 - (1-p^2\eta\epsilon_t)\mu m\sigma. \end{aligned} \tag{14}$$

The process governing capital accumulation is determined from total savings, equal to the savings of all bureaucrats plus the savings of all households. This process is deduced as

$$\begin{aligned} k_{t+1} &= \lambda m w_t - g_t + \mu m q - \delta(\epsilon_t) - \tfrac{1}{2}\eta n\epsilon_t^2 \\ &= a(\alpha-\theta)k_t + \mu m q - \delta(\epsilon_t) - \tfrac{1}{2}\eta n\epsilon_t^2 \equiv F(k_t). \end{aligned} \tag{15}$$

Expressions (14) and (15) imply that, for any given k_t, the value of τ_t (k_{t+1}) is highest (lowest) when $\epsilon_t = 1$ and lowest (highest) when $\epsilon_t = 0$. Between these extremes, when $\epsilon_t \in (0,1)$, τ_t and k_{t+1} take on more moderate, intermediate values.

Since there are now two critical levels of capital, we may distinguish between three types of development regime for the economy: the first, like before, is a low development regime ($k_t < k_L^c$) in which the incidence of corruption is at its maximum value ($\epsilon_t = 1$); the second, also like before, is a high development regime ($k_t > k_H^c$) in which the incidence of corruption is at its minimum value ($\epsilon_t = 0$); and the third, unlike before, is an intermediate development regime ($k_t \in (k_L^c, k_H^c)$) in which the incidence of corruption lies somewhere between its maximum and minimum values ($\epsilon_t \in (0,1)$). These regimes are shown in Figure 2 which depicts the typical shape of the transition path, $F(\cdot)$, defined in (15) (with ϵ_t determined according to (13)).[26] A stationary point on this path satisfies $k^* = F(k^*)$ and is stable (unstable) if $F'(k^*) < 1$ ($F'(k^*) > 1$). In principle, the model can generate upto three steady state equilibria that are stable. One of these - associated with the case of $\epsilon_t = 1$ - is a low equilibrium in which the steady state level of capital is $k_L^* = \frac{\mu mq - d - \frac{1}{2}\eta n}{1-a(\alpha-\theta)} < k_L^c$. Another - associated with the case of $\epsilon_t = 0$ - is a high equilibrium in which the steady state level of capital is $k_H^* = \frac{\mu mq}{1-a(\alpha-\theta)} > k_H^c$. And the third - associated with the case of $\epsilon_t \in (0,1)$ - is an intermediate equilibrium in which the steady state level of capital satisfies $k_M^* \in (k_L^c, k_H^c)$.

continuously increasing function of the incidence of corruption.

[26] The discontinuity in $F(\cdot)$ at k_H^c reflects the discontinuity in $\delta(\cdot)$ at $\epsilon_t = 0$. These features would remain under any specification of $\delta(\cdot)$ that involve some fixed cost of monitoring.

If an unstable equlibrium exists, then it does so for the case of $\epsilon_t \in (0,1)$ and occurs at the point $k_U^* \in (k_L^c, k_H^c)$.

As in our previous analysis, transition between development regimes may or may or not take place. Of course, it is now true that there are three (rather than just two) regimes and that transition is generally associated with gradual (rather than abrupt) changes in the incidence of corruption. The complete process of transition may be divided into two distinct stages - from the low development regime to the intermediate development regime, and from the intermediate development regime to the high development regime. Depending on circumstances, either of these stages may or may not be completed so that the economy may end up in any one of the regimes, including the regime where it started. For example, if the economy is poor and corrupt to begin with, then its final destination may be a steady state in which it is still poor and corrupt, or a steady state in which poverty and corruption have been partially alleviated, or a steady state in which there is prosperity without any corruption. The first and third of these possibilities are illustrated in Figure 3. Panel A depicts the latter, where there is a single stable steady state equilibrium at k_H^*. Starting from an initial capital stock of k_0, the economy undergoes complete transition towards this steady state with the incidence of corruption declining continuously as it does so. Panel B depicts the former scenario, where there are three stable steady state equilibria at k_L^*, k_M^* and k_H^*, together with an unstable steady state at k_U^*. In this case an economy that starts off at any $k_0 < k_U^*$ is irrevocably desitined to end up at k_L^* with the incidence of corruption at its maximum value.

The existence of mutliple equlilbria means that countries with essentially the same structural characteristics, but different initial conditions, may face very different prospects in terms of their economic development and quality of governance. In terms of the above, these prospects would look decidedly bleak for countries located below the threshold point k_U^*, unless there was the possibility of a fundamental adjustment that could produce a sudden turn of events. One such possibility is a windfall increase in the stock of capital that might allow the threshold to be breached. Another is a change in the value of some key structural parameter that may cause a favourable shift in the transition function and the threshold, itself. Yet even allowing for these events, it may still be difficult for some countries to escape from their predicament: switching from a state of low development to a state of intermediate development is a prospect that is more within the reach of those economies located relatively close to the threshold than those that lie relatively far away from it. The same can be said when considering transition from the intermediate to the high development regime, which requires the breach of another threshold (i.e., k_H^c). In addition, if countries do not share the same structural characteristics, then there would be a distribution of transition paths and a distribution of limiting outcomes that would reflect similar divisions between poor and rich countries. These observations suggest that cross-country differences in development and corruption may be persistent, rather than transitory, fixtures of the global economy.

5 Conclusions

Corruption can occur on various scales, in many shapes and forms, and at all levels within public office. Corruption can affect the allocation of resources, the process of growth and the distribution of income in an economy. These observations are not new, but they have only recently become the subject of systematic, formal investigation using modern techniques of theoretical and empirical analysis. As a result of this, economists are gaining a much better understanding of the causes and consequences, incidence and importance, of corrupt behaviour within society's public institutions.

This paper has focused on corruption among public bureaucrats and the implications of this for economic development. Our analysis 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. These features reflect the three main conditions for any type of corruption to occur - namely, that there is a delegation of authority from a principal to an agent, that this authority can be exploited to capture economic rents, and that these rents are large enough to motivate pursuit of them. Of course, to the extent that bribes are merely transfer payments from some individuals to others, corruption need not impose any net social costs. As with any illegal activity, however, at least some resources will be spent on trying to conceal and detect rent-seeking behaviour. To the extent that these resources could have been devoted to more productive activities, then such behaviour will result in lower investment and lower capital accumulation. This is the mechanism by which corruption affects development in our model. At the same time, the incentives to be corrupt are likely to change with changes in economic circumstances. As growth takes place and incomes rise, agents will stand to lose more if they are caught engaging in corrupt practices which therefore become less attractive to them. This is the mechanism by which development affects corruption in the model. The upshot is that both corruption and development are determined endogenously through a relationship that is negative and two-way causal.

In spite of its simplicity, the model produces a rich variety of outcomes as a result of the mutual interaction between bureaucratic decision making and aggregate economic activity. This interaction gives rise to threshold effects and the possibility of multiple long-run equilibria. In this way, the model is able to explain not only why the incidence of corruption is so diverse among countries, but also why this diversity appears to be so persistent. Indeed, many countries of the world seem to have become trapped in a vicious circle of widespread corruption and widespread poverty, concern over which has been growing visibly among international organisations. That our analysis treats corruption as being bad for growth is consistent with the majority view among development experts and with almost all recent empirical evidence.

To date, relatively few attempts have been made to analyse corruption within a (dynamic) general equilibrium context. Only by doing this, however, is one likely to gain a clearer understanding of both the mechanism by which corruption affects the forces of development and the mechanism by which these forces, in turn, affect the incidence of corruption. Our intention in this paper has been to make a step forward in this direction.

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Figure 1

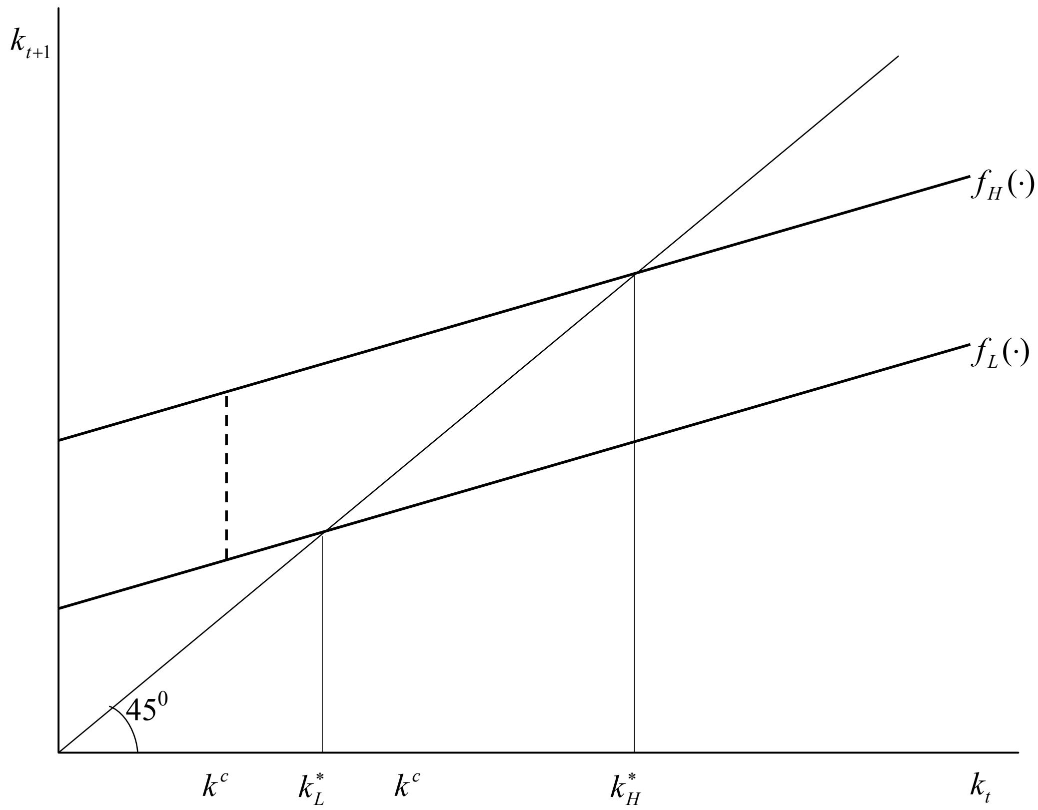


Figure 2

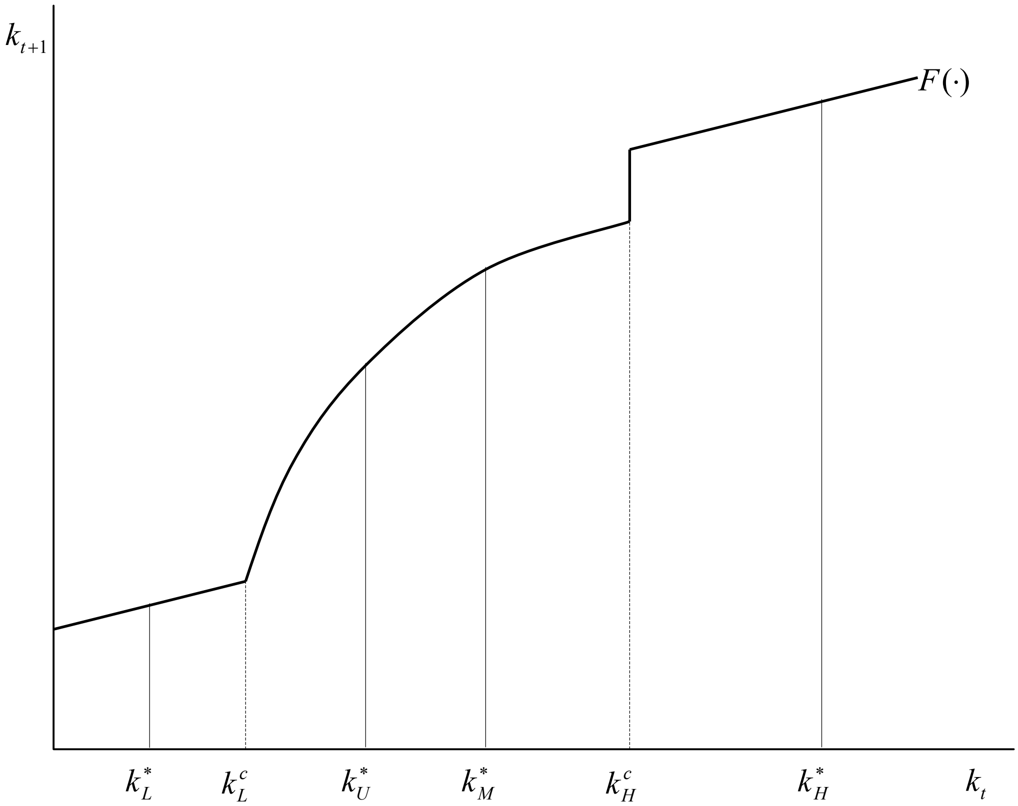
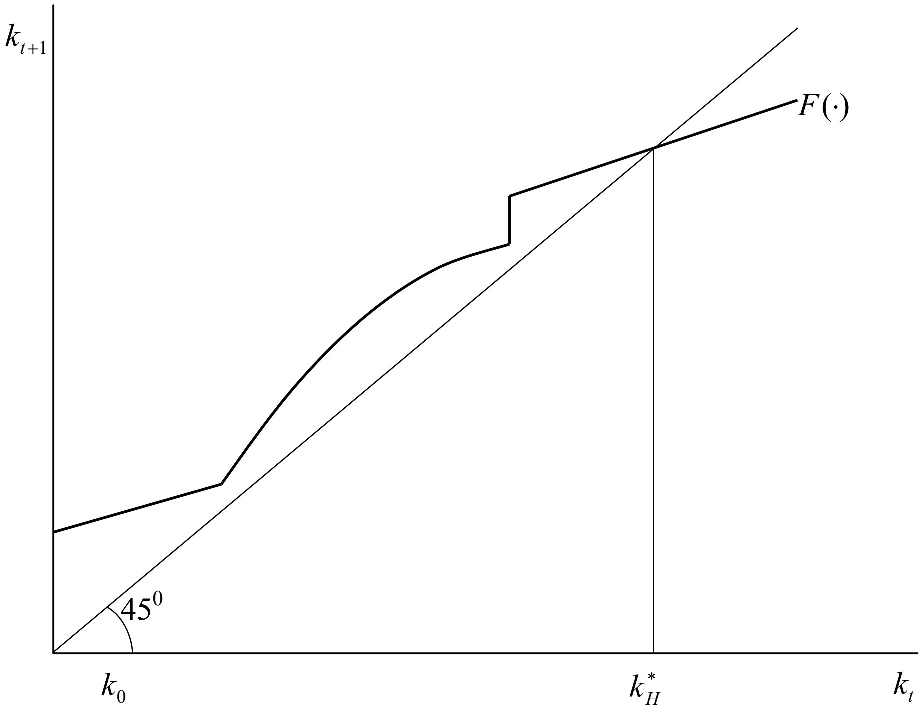
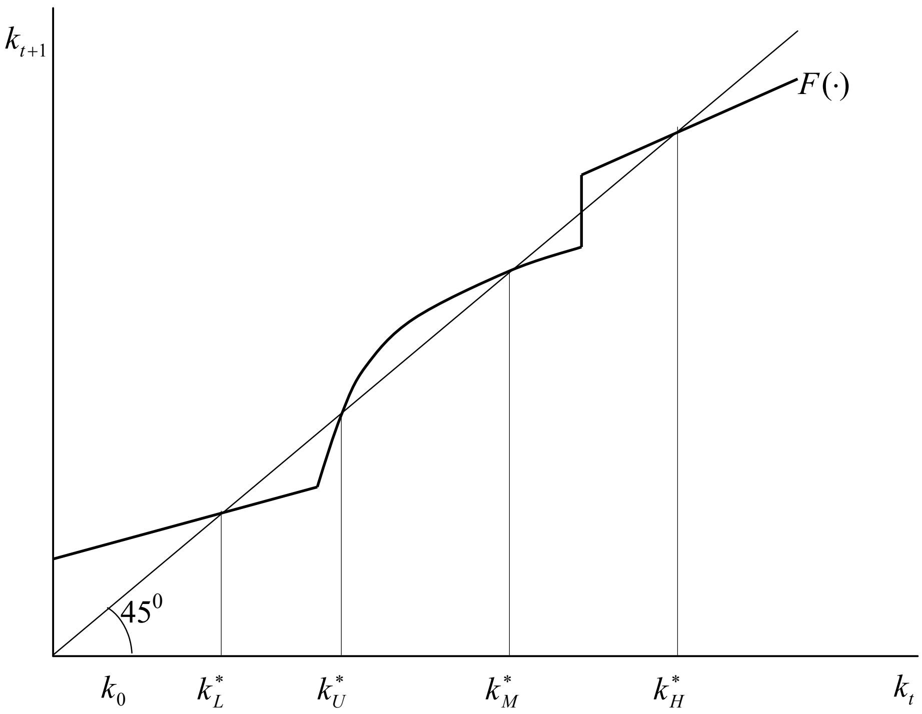


Figure 3



A. Unique Equilibrium



B. Multiple Equilibria