

Why is Corruption Less Harmful in Some Countries Than in Others?*

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Abstract

Empirical evidence shows that not all countries with high levels of corruption have suffered poor growth performance. Bad quality governance has clearly been much less damaging (if at all) in some economies than in others. Why this is so is a question that has largely been ignored, and the intention of this paper is to provide an answer. We develop a dynamic general equilibrium model in which growth occurs endogenously through the invention of new goods based on research and development activity. For such activity to be undertaken, firms must acquire complementary licenses from public officials who are able to exploit their monopoly power by demanding bribes in exchange for these (otherwise free) permits. We show that the effects of corruption depend on the extent to which bureaucrats coordinate their rent-seeking behaviour. Specifically, our analysis predicts that countries with organised corruption networks are likely to display lower levels of bribes, higher levels of research activity and higher rates of growth than countries with disorganised corruption arrangements.

Keywords: Organised corruption, disorganised corruption, innovation, growth.

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1 Introduction

There is now a broad consensus amongst development experts that the quality of governance plays a vital role in shaping the fortunes of an economy. Bad quality governance fosters corruption which can lead to inefficiencies and resource costs that impede economic progress.¹ This view is supported by a large empirical literature that has flourished over recent years as a result of new and improved measures of corrupt activity. Armed with such data, a number of authors have undertaken analyses which reveal that corruption has significant adverse effects on growth (e.g., Gyimah-Brempong 2003; Keefer and Knack 1997; Knack and Keefer 1995; Li *et al.* 2000; Mauro 1995; Mo 2001; Sachs and Warner 1997). These, and other, investigations have also indicated various ways in which corruption takes hold, such as lowering rates of investment (e.g., Mauro 1995), creating obstacles to doing business (e.g., World Bank 2002), reducing inflows of foreign investment (e.g., Wei 2000) and causing misallocations of public expenditures (e.g., Mauro 1997; Tanzi and Davoodi 1997). The scale of the offences involved, and the ingenuity of those that perpetrate them, are often quite staggering, as a wealth of anecdotal evidence reveals. Given all of this, it is not surprising that most, if not all, international development agencies have made the fight against corruption a leading, if not the foremost, priority in their agendas for alleviating poverty.²

It is undoubtedly true that many countries of the world have suffered, and continue to suffer, as a result of widespread misgovernance. Yet it is also true that there are some countries for which high levels of corruption have appeared to do little to damage growth prospects. The most prominent examples are to be found in South-East Asia, motivating what Wedeman (2002a) has labelled the “East Asian paradox”. Countries such as China, Indonesia, South Korea and Thailand have all enjoyed considerable growth in their per-capita incomes whilst enduring the reputation of being mired with corruption. There are even some developed countries (most notably, Italy) that share the same notoriety. Such observations suggest that there

¹The most commonly-used definition of corruption is the abuse of public office for personal gain. Governance is defined rather more broadly than this, though the two concepts are intimately connected: just as bad governance fosters corruption, so corruption undermines good governance.

²For numerous accounts of corrupt practices and strategies for combatting them, see the web-sites of the World Bank (www.worldbank.org/publicsector/anticorrupt), the IMF (www.imf.org/external/np/exp/facts/gov.htm), the United Nations (www.unodc.org/unodc/en/corruption.htm/) and the Free Africa Foundation (www.freeafrica.org). For broad surveys of the literature on corruption, see Bardhan (1997), Jain (2001), Rose-Ackerman (1999) and Tanzi (1998). And for an up-to-date review of the empirical evidence on corruption, see Lambsdorff (2005).

is more to the relationship between corruption and development than one is typically led to believe. Indeed, it would appear that, in some instances, this relationship is rather fragile and tenuous.

By way of illustrating the above, we present some summary statistics in Table 1, constructed using cross-country data on growth from the Penn World Table and cross-country data on corruption from Transparency International.³ We report the average growth rates and average corruption ratings over the period 1980-1999 for selected regions of the world - the lesser developed, and reputedly more corrupt, regions. As is seen, these regions share similar corruption ratings, but their growth performances are very different. The sub-Saharan African and Latin American zones provide the classic examples where high corruption is accompanied by low growth.⁴ This is not observed, however, for the South and South-East Asian zone. A closer look at this region reveals some interesting features. In accordance with the findings of others (e.g., Hutchcroft 1994, 2000; Khan 1998, 2000; Lee 1995, 2000; Rock 1999, 2000; Wedeman 2002b), we may divide the region into three distinct groups of countries: the low corruption and high growth economies of Hong Kong, Malaysia and Singapore; the high corruption and low growth economies of the Philippines and South Asia; and the high corruption and high growth economies of China, Indonesia, South Korea and Thailand. Naturally, the question that arises is what is so special about this last group of countries that has enabled them to grow in spite of being saddled with poor quality governance? How might one explain this East Asian paradox? More generally, why might corruption be less harmful in some countries than in others?⁵

³The latter of these datasets is originally given as a “transparency perception index” (TPI) which ranks countries in terms of perceived levels of corruption on a decreasing scale from 10 to 0. This index (which is one of the most widely-used measures of corruption) is constructed as a “poll of polls”, combining the results of questionnaire surveys sent by various organisations to networks of correspondents around the world. As is common practice, we apply a simple transformation to obtain a “corruption perception index” (CPI) which measures the level of corruption on an increasing scale from 0 to 10. The transformation is given by $CPI\ value = 10 - TPI\ value$. Further details about both our corruption and growth data can be found by visiting the appropriate web-sites, www.transparency.org/surveys/index.html and pwt.econ.upenn.edu/php_site/pwt_index.php.

⁴There are some notable outliers in these regions that deserve a mention. Botswana, for example, is often heralded as Africa’s success story, having seemingly been able to control corruption and enjoy high growth. Likewise, Chile has distinguished itself in Latin America by establishing a similar track record.

⁵The same questions are invited from the results of some simple regressions which paint a similar picture to the above. For example, the correlation between growth and corruption is significantly negative for sub-Saharan African and Latin American countries,

One possible answer to the above questions is related to the empirical results of Neeman *et al.* (2004) who re-examine the negative relationship between corruption and development on the basis of the degree of openness of economies. Using a variety of model specifications, it is found that this relationship holds only for countries that are very open, especially in terms of their financial integration with the rest of the world. For countries that are not very well integrated, the relationship more-or-less disappears. An obvious explanation for this is that fewer restrictions on cross-border financial transactions makes it easier for corrupt individuals to hide their illegal income by laundering it abroad. As such, the incentives to engage in corruption, and the effects thereof, are likely to be much greater in this case than in a less liberalised environment where resources cannot be syphoned off so easily. This idea may well have some truth in it, but it does not resolve the puzzle of the East Asian experience. As far back as the 1980s, countries such as Indonesia, Thailand and South Korea were classified as open economies (e.g., Sachs and Warner 1995): yet corruption in these countries has been much less destructive (if at all) than corruption in other nations of the world.

Another possible answer to the questions is given by the so-called “speed money” hypothesis of corruption. According to this, corrupt transactions between private and public agents are a means of circumventing cumbersome and pervasive regulations (red tape) that are detrimental to efficiency (e.g., Huntington 1968; Leff 1964; Leys 1970). This argument - an application of the theory of the second best - views bribery and other forms of kickback, not as any hindrance to the economy, but as convenient devices for overcoming institutional hurdles that distort incentives and opportunities. Whilst plausible at first glance, the argument can be challenged on both conceptual and empirical grounds. Conceptually, there are at least two main problems: first, 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; second, 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. Empirically, the evidence offers very little support to the hypothesis: in Ades and Di Tella (1997), Mauro (1995) and Meon and Sekkat (2005) it is found that the correlation between growth and corruption is consistently negative (and particularly strong) in samples of countries with reputedly high levels of red tape, weak rules of law and widespread government inefficiencies (the type of environment where the

but is only so for South and South-East Asian countries when China, Indonesia, South Korea and Thailand are excluded from the sample.

argument is most relevant); in Kaufman and Wei (2000) it is found that the use of bribes to speed up the bureaucratic process is largely self-defeating as the amount of time negotiating bribes increases.

A final possible answer to the questions is suggested in the discussion of Shleifer and Vishny (1993) on the organisation of corruption. The basic idea has to do with the fact that, in order to conduct business, individuals often need to procure several different types of governmental good (licenses, permits, certificates, etc.) that are complements to each other and that are provided by different governmental agencies or departments. Under such circumstances, the extent to which public officials are organised in their extraction of bribes can have an important influence on the consequences of bribery. If bureaucrats are disorganised and act as independent monopolists, then each of them will seek to maximise his individual bribe income without taking into account the negative effect of this on the bribe-taking capacity of others. This effect arises since the demand for a bribe by one bureaucrat in exchange for his own governmental good imposes a pecuniary externality on other bureaucrats by reducing the demand for their governmental goods and, with this, their ability to profit from corruption. By contrast, if bureaucrats are organised and act as a joint monopoly, then they will strive to maximise their total bribe income and, in doing so, will internalise any externalities. In this way, a centralised network of collusive corruption can lead to a lower level of bribe payment, a greater provision of governmental goods and a smaller scale of distortions than would arise under a decentralised network of non-collusive corruption.⁶ This argument has a good deal of merit and its application to the East Asian experience is particularly relevant. As noted above, this region appears to be divided into three distinct groups of countries: the first - comprising Hong Kong, Malaysia and Singapore - are the low corruption and high growth economies in which corrupt practices have been curbed by strong autonomous states; the second - consisting of the Philippines and South Asia - are the high-corruption and low-growth economies in which disorganised corrupt behaviour has flourished; and the third - consisting of China, Indonesia, South Korea and Thailand - are the high-corruption

⁶As also indicated by Shleifer and Vishny (1993), it is possible to obtain the opposite result if governmental goods are substitutes for each other, or if the same governmental good is provided by more than one bureaucrat. In this case competition between bureaucrats in the absence of collusion could drive down the level of bribes relative to the monopoly outcome in the presence of collusion. As noted by others, however, the conditions for ensuring a competitive equilibrium (such as zero search costs for individuals in their acquisition of information about bribe payments, and zero capacity constraints on bureaucrats in their supply of governmental goods) are fairly stringent and not obviously satisfied in practice (e.g., Bose 2004).

and high-growth economies in which organised corrupt activity has thrived. Some recent evidence lends support to the view that the effects of corruption depend not only on the scale of illegal profiteering, but also on the nature of this profiteering. In particular, it has been found that corruption reduces investment by less when it is more predictable (more organised), and that corruption and investment have displayed a positive correlation in the large newly-industrialised East Asian economies that have centralised (organised) corruption networks (e.g., Campos *et al.* 1999; Rock and Bonnet 2004).⁷

Theoretical research on the organisation of corruption has not progressed much further since the seminal contribution by Shleifer and Vishny (1993). An exception is the recent analysis of Celentani and Ganuza (2002) who develop a game-theoretic model in which one group of agents (a constituency) appoints another group of agents (bureaucrats) to ensure some prescribed level, or quality, of activity (e.g., production) on the part of a third group of agents (providers). The constituency is aware that a bureaucrat and a provider may collude with each other in such a way that the former allows the latter to engage in sub-standard activity in return for a bribe. Higher levels of corruption prompt the constituency to set lower levels of required activity which reduce the gains from corrupt behaviour. Against this background, it is shown how an organised syndicate of corrupt bureaucrats would maximise its illegal income by limiting the number of corrupt transactions, a consideration that does not arise in a disorganised network of rent-seeking officials. As a consequence, the incidence of corruption (quality of activity) is lower (higher) when such a syndicate exists than when it does not.

As far as we know, the present paper is the first to study the above types of issue from an explicitly macroeconomic perspective.⁸ It does so with the view to shedding light on why the effects of corruption on growth and development appear to be so different across countries. Our analysis is based on a dynamic general equilibrium model in which growth occurs endogenously through the design and manufacture of new intermediate goods that are used in the production of final output. Design (or innovation) activity is undertaken by entrepreneurs who require various licenses from public officials in order to embark on this activity. These licenses are complementary in the sense that all of them must be procured - otherwise, an entrepreneur is unable to engage in research and development. All bureaucrats are corrupt and each one of them exploits his monopoly over the issue of a license by

⁷It is worth noting that such networks are also a feature of some developed economies that have a relatively high corruption rating (e.g., Italy).

⁸In their seminal contribution, Ehrlich and Lui (1999) devote part of their analysis to studying the issue, though their model is quite different from ours and is geared towards other (occupational choice) aspects of rent-seeking.

demanding a bribe in exchange for it. We study the implications of this when bureaucrats act either individualistically (disorganised corruption) or collectively (organised corruption). We show that bribe payments are lower, innovation activity is higher and growth is higher in the case of the latter than in the case of the former.

We emphasise that our analysis is not meant as a prescription for the organisation of corruption. Whether organised or not, corruption is always bad for development in our model and the best outcome is achieved when it does not exist at all. The precise effect of corruption is to limit entry into productive activities, an effect that appears prevalent in many countries where opportunities are often restricted by the illicit costs of complying with numerous procedures and regulations.⁹ Corruption is often seen as a form of taxation, though one important difference in the case of entry regulation is that, unlike taxes, bribe payments are made before productive ventures are embarked upon. This can deter such ventures at the outset and may bias entry towards those most able to afford it.

To date, most theoretical research on corruption has been conducted at the microeconomic level, using partial equilibrium models to study specific questions and issues about the nature of corrupt behaviour and the implications for efficiency and welfare (e.g., Andvig and Moene 1990; Banerjee 1997; Cadot 1987; Klitgaard 1988, 1990; Rose-Ackerman 1975, 1978, 1999; Shleifer and Vishny 1993). Much less research has been devoted towards understanding the macroeconomics of misgovernance, particularly from a development perspective.¹⁰ Two of the first contributions in this area are credited to Ehrlich and Lui (1999) and Sarte (2000), the former of whom demonstrate how corruption can lead to a diversion of resources away from growth-promoting activities (investments in human capital) towards power-seeking activities (investments in political capital), whilst the latter of whom shows how corruption may cause resources to be diverted away from the formal (more efficient) sectors of the economy towards the informal (less efficient) sectors. More recently, Blackburn *et al.* (2006) reveal how corruption and development may interact with each other to produce threshold effects and multiple (history-dependent) long-run equilibria, including a poverty trap equilibrium. We establish similar results in Blackburn and Forgues-Puccio (2007), together with demonstrating how corruption can foster inequality by

⁹Various examples from around the world can be found in Bhagwati (1993), De Soto (1990), Djankov *et al.* (2000), Kauffman (1997), Mbaku (2000), Sjaifudian (1997) and the World Bank (2002).

¹⁰In a purely static context, Acemoglu and Verdier (1998, 2000) conduct a general equilibrium analysis of how corruption may form part of an optimal allocation in which market failure is traded off against government failure.

compromising the effectiveness of redistributive policy. Finally, Rivera-Batiz (2001) illustrates the potentially adverse growth implications of financial liberalisation when corruption is left unchecked. With the exception of Ehrlich and Lui (1999), none of these analyses address the issue of how different types of corrupt behaviour may have different consequences for the economy.¹¹

The remainder of the paper is organised as follows. In Section 2 we present a description of the model. In Section 3 we solve for the general equilibrium of the model. In Section 4 we compare and contrast the implications of alternative forms of corruption. In Section 5 we make a few concluding remarks.

2 The Model

We consider a small open economy in which there is a constant population of two-period agents belonging to overlapping generations of dynastic families. Agents of each generation are divided into two groups of citizens - private individuals (or households) and public servants (or bureaucrats). The former are differentiated further into skilled and unskilled workers who supply labour to firms involved in different production activities. The latter are homogeneous and employed by the government in the administration of public policy. To fix ideas, we normalise the size of each group of households to 1 and set the size of the bureaucracy to S .¹² Productive activity takes place in two sectors - a final output sector in which a single consumption good (the numeraire of the economy) is manufactured, and an intermediate input sector in which a variety of differentiated producer goods are created.¹³ At any point in time, t , there is a fixed unit mass of final output firms, an endogenously-determined number, M_t , of existing intermediate input firms and an endogenously-determined number, N_t , of potentially new intermediate input firms. Each type of intermediate input is indexed by $i \in (0, M_t)$,

¹¹To focus on this issue, our analysis abstracts from the potential endogeneity of corruption, as studied by Blackburn *et al.* (2006) and Blackburn and Forgues-Puccio (2007). Rather, we follow the approach of others (e.g., Rivera-Batiz 2001; Sarte 2000) by taking as given the absence or presence of corrupt behaviour, and comparing the implications of these different scenarios.

¹²As in other analyses (e.g., Blackburn *et al.* 2006; Rivera-Batiz 2001; Sarte 2000), we abstract from issues relating to occupational choice by assuming that individuals are separated exogenously at birth according to their skills or through some random selection process. In doing so we are able to simplify the analysis by not having to consider possible changes in the size of the bureaucracy and possible changes in the level of corruption that may result from this.

¹³Implicit in our analysis is the assumption that intermediate goods are non-tradeable.

with M_t representing the most recently invented variety. Invention occurs through research and development by each of the N_t new entrepreneurs, a venture that is risky and that requires licenses from all public officials to be undertaken. Successful research and development leads to an expansion in the number of intermediate goods which raises efficiency in output production and provides the mechanism for endogenous growth. All markets are perfectly competitive, except the market for intermediate inputs which is characterised by monopolistic competition.

2.1 Agents

Each agent (a private or public citizen) works only when young and consumes only when old. An agent is born with one unit of labour endowment which he supplies inelastically to his particular occupation in return for a wage. This, and any other, income is saved at the exogenously given world rate of interest, r . All agents are risk neutral, deriving linear utility from retirement consumption which is financed from savings. This simple set-up of agents' circumstances is chosen largely for convenience and to focus attention on the production side of the economy. Aside from rent-seeking activity on the part of public officials, the behaviour of agents is relatively unimportant and can essentially be ignored in the determination of equilibrium growth in the economy.

2.2 Final Output Firms

The representative firm engaged in final manufacturing combines l_t units of unskilled labour with $x_t(i)$ units of intermediate good i to produce y_t units of consumption good according to

$$y_t = A l_t^{1-\alpha} \int_0^{M_t} x_t(i)^\alpha di, \quad (1)$$

($A > 0, \alpha \in (0, 1)$). The firm hires labour from households at the wage rate w_t and rents each intermediate input from the producer of that input at the price $p_t(i)$. Profit maximisation implies the following factor demands:

$$l_t = \frac{(1-\alpha)y_t}{w_t}, \quad (2)$$

$$x_t(i) = \frac{\alpha y_t}{M_t P_t} \left(\frac{p_t(i)}{P_t} \right)^{\frac{1}{\alpha-1}}. \quad (3)$$

where $P_t = \left[\frac{1}{M(t)} \int_0^{M(t)} p_t(j)^{\frac{\alpha}{\alpha-1}} dj \right]^{\frac{\alpha-1}{\alpha}}$.

2.3 Intermediate Input Firms

An intermediate good is created from a design, or blueprint, that arises out of successful innovation by firms engaged in research and development activity. By way of ensuring the existence of such activity, we assume that any firm which innovates has a perpetual monopoly right over the use of its design (i.e., over the manufacture and sale of its newly-invented product). No other firm can ever exploit the same design to produce the same type of intermediate good.¹⁴ Given this, then any firm that innovates can expect to make positive profits each period so that the incentive to undertake research and development is always preserved.

Research is conducted using skilled labour and previously accumulated, generally available knowledge. We denote by $h_t(j)$ the amount of labour employed by the j th research firm and approximate the currently available stock of disembodied knowledge by the existing stock of designs, M_t . Each firm then has $e_t(j) = h_t(j)M_t$ efficiency units of input with which to undertake its research. The technology for doing this is described by the function $q(e_t(j))$ which gives the probability of successful innovation (i.e., the probability of designing a new product). We assume that this function satisfies the following properties: $q'(\cdot) > 0$ and $q''(\cdot) < 0$ (concavity); $q(0) \geq 0$ and $\lim_{e_t(j) \rightarrow \infty} q(\cdot) \leq 1$ (boundedness); and $e_t(j)q'(\cdot) < q(\cdot)$ (elasticity less than one). The first property implies that there are diminishing returns to research. As in other analyses (e.g., Blackburn and Hung 1998; Blackburn *et al.* 2000; Jones 1995a; Stokey 1995), this feature is intended to capture the notion of ‘crowding’, meaning the duplication of research effort in the presence of a limited stock of ideas: that is, a doubling of research input need not result in a doubling of research output because some of the research may be redundant. The second property is simply a requirement that the probability of successful innovation lies in the unit interval. And the third property ensures the existence of a unique equilibrium with positive innovation activity.¹⁵

For research to be undertaken, a firm must acquire licenses from public

¹⁴For simplicity, we suppose that both the invention and production of an intermediate good are undertaken by the same firm. Equivalently, one could assume separate sectors of innovators and manufacturers, with the former selling their designs to the latter.

¹⁵This last property is necessarily satisfied if, in addition to the other properties, $q'(0)$ is some finite value. It is worth noting that our choice of research technology is based not only on its apparent plausibility, but also on its advantages over more simple (linear) specifications that are often used. Such specifications imply an indeterminate number of research firms, do not accord very well with the notion of a bounded probability of innovating, and inevitably give rise to questionable scale effects (e.g., Blackburn and Hung 1998; Blackburn *et al.* 2000; Jones 1995a,b).

officials. These licenses, or permits, are complementary in the sense that all of them are required, though each one is issued separately by a different bureaucrat. In the absence of any rent-seeking, licenses are issued free of charge. In the presence of rent-seeking, licenses are granted only in exchange for bribes. Let b denote the bribe paid by a firm to a bureaucrat in return for a particular license. The determination of b is an issue to which we turn later.¹⁶ Since each and every bureaucrat demands such a kickback, the total amount of bribe payment that the firm must make is $B = Sb$. Having made this payment, the firm can then engage in research activity by incurring a fixed cost of κ units of output and hiring skilled labour at the wage rate W_t .

Given the above, we may deduce the expected net payoff from innovation. Let $\pi_t(j)$ be the per-period profit that a firm could earn from designing and selling a new intermediate good. With probability $q(\cdot)$, the firm succeeds in its research and is entitled to the entire future stream of these profits. With probability $1 - q(\cdot)$, the firm fails in its research and earns nothing. It follows that the expected net return to the firm is

$$V_t(j) = q(e_t(j)) \sum_{\tau=1}^{\infty} (1+r)^{-\tau} \pi_{t+\tau}(j) - \frac{W_t}{M_t} e_t(j) - \kappa - B. \quad (4)$$

There are two separate problems confronting the firm. The first is to choose a level of labour input, $h_t(j)$, that maximises its expected payoff in (4). The solution to this is

$$M_t q'(e_t(j)) \sum_{\tau=1}^{\infty} (1+r)^{-\tau} \pi_{t+\tau}(j) = W_t. \quad (5)$$

The second problem is to choose a price for its product, $p_t(j)$, that maximises its operating profits, $\pi_t(j)$. It does this by acting as a monopolistic competitor, taking into account the effect of its price on the demand for its product in (3). We assume that, once invented, an intermediate good costs μ units of output to produce. Consequently, $\pi_t(j) = [p_t(j) - \mu]x_t(j)$ and the optimal price is given by the standard constant mark-up rule,

$$p_t(j) = p = \frac{\mu}{\alpha}. \quad (6)$$

3 General Equilibrium

The solution of the model is a symmetric, dynamic general equilibrium in which the economy evolves along a balanced, endogenous growth path. As

¹⁶As we show at that time, the optimal value of bribes chosen by bureaucrats is, indeed, a constant (i.e., $b_t = b$ for all t).

indicated previously, growth occurs through an expansion in the number of intermediate inputs as a result of research and development. The equilibrium is computed by using the results obtained so far in conjunction with certain other relationships, as outlined below.

Symmetry arises by virtue of (6) which shows that the price of each and every intermediate good is the same (and constant). This implies an aggregate price of $P_t = p$ as well. Since equilibrium in the market for unskilled labour requires $l_t = 1$, it follows from (1), (2) and (3) that

$$y_t = Ax^\alpha M_t, \quad (7)$$

$$w_t = (1 - \alpha)y_t, \quad (8)$$

$$x_i(i) = x = \left(\frac{\alpha^2 A}{\mu} \right)^{\frac{1}{1-\alpha}}. \quad (9)$$

The expressions in (7) and (8) imply that both the level of final output and the wages of unskilled labour grow at the same rate as the number of intermediate goods. The expression in (9) shows that the quantity demanded of each intermediate good is identical (and constant).

Given the above, then each intermediate goods firm makes the same fixed amount of operating profits, $\pi_t(j) = \pi = (p - \mu)x$. Consequently, $\sum_{\tau=1}^{\infty} (1 + r)^{-\tau} \pi_{t+\tau}(j) = \frac{\pi}{r}$. In addition, free entry into research and development drives the expected net payoff in (4) to zero. Together with (5), these results imply that each firm engaged in research and development uses the same fixed amount of research input, $e_t(j) = e$, as determined by

$$[q(e) - eq'(e)]\pi = r(\kappa + B). \quad (10)$$

From this we may deduce the following.

Lemma 1 *Given that $\lim_{e \rightarrow 0} [q(\cdot) - eq'(\cdot)]\pi < r(\kappa + B)$, \exists an $e = \varepsilon(B) > 0$ such that $\varepsilon'(\cdot) > 0$.*

Proof. Define $Q(e) = q(\cdot) - eq'(\cdot)$. Since $Q'(\cdot) = -eq''(\cdot) > 0$, then provided that $\lim_{e \rightarrow 0} Q(\cdot)\pi < r(\kappa + B)$, \exists a unique value of $e > 0$ that satisfies $Q(e)\pi = r(\kappa + B)$. Hence $e = \varepsilon(B)$, where $\varepsilon'(\cdot) = \frac{r}{Q'(\cdot)\pi} > 0$. ■

The expression in (10) determines the equilibrium level of research input, e , as an increasing function of the bribe payment, B . We shall return to this shortly. For the moment, we note that (10) may be interpreted equivalently as determining the number of new designers, N_t , for any given number of existing designs, M_t . To be sure, observe that, since $h_t(j) = h_t$, equilibrium

in the market for skilled labour requires $N_t h_t = 1$ so that $e = \frac{M_t}{N_t}$. As noted above, the term $[q(\cdot) - eq'(\cdot)]$ in (10) is an increasing function of e or, equivalently, a decreasing function of N_t .¹⁷ Given this, then neither $[q(\cdot) - eq'(\cdot)]\pi > r(\kappa + B)$ nor $[q(\cdot) - eq'(\cdot)]\pi < r(\kappa + B)$ can be an equilibrium outcome. In the first case the existence of positive profits would lead more firms to enter the research sector, implying that N_t would increase until the condition held with equality. In the second case the prospect of negative profits would cause some firms to leave the research sector so that N_t would decrease until the condition held with equality again. Evidently, the fact that e is a constant means that N_t must grow at the same rate as M_t . The same can be said about the wages of skilled labour since (5) yields

$$M_t q'(e)\pi = rW_t. \quad (11)$$

It remains to determine the equilibrium growth rate, itself. Given that the probability of successful of innovation is independent across designers, then the flow of new designs is $M_{t+1} - M_t = q(\cdot)N_t$. Denoting the growth rate of new designs by $g_t = \frac{M_{t+1} - M_t}{M_t}$, we arrive at the following result.

Lemma 2 *Given Lemma 1, the economy exhibits a constant equilibrium growth rate of $g = \gamma(e) > 0$, where $\gamma'(\cdot) < 0$.*

Proof. Using $e = \frac{M_t}{N_t}$, it follows that $g_t = g = \frac{q(e)}{e} \equiv \gamma(e)$, where e is determined in Lemma 1. Hence $\gamma'(\cdot) = \frac{eq'(\cdot) - q(\cdot)}{e^2} < 0$. ■

As shown already, g is the growth rate for all other (non-stationary) variables as well. In the absence of any transitional dynamics, the economy evolves perpetually over time in a steady state, balanced growth equilibrium characterised by an increasing variety of intermediate goods associated with an increasing number of firms engaged in research and development.

The equilibrium growth rate in (12) depends only on the quantity of research input, e , which is determined according to (10). The constancy of e explains why long-run growth is sustainable in spite of there being diminishing returns in the research technology. As the economy expands, there is an increase in the number of intermediate goods and an increase in the number of firms engaged in innovation. Each of these firms is able to exploit a wider range of ideas (because of the externalities from research), whilst being led to operate at a smaller scale (because of the greater competition for skilled labour). The upshot is that the probability of successful innovation remains constant and that the economy, as a whole, experiences greater

¹⁷Note also that the term, itself, is positively-valued by our earlier assumptions.

research activity which enables it to sustain a constant growth rate of new designs.

4 Corruption and Growth

Corruption in our model takes the form of bribes paid by firms to bureaucrats in exchange for licenses to undertake research and development. One may think of bureaucrats as being able to extract bribes by being able to simply reject license applications outright, or to delay the applications process (which can be crucial for innovation), if firms are not willing to comply with their demands. We assume that bureaucrats can do this without any risk of detection or punishment. This assumption (used in other analyses) is intended primarily as a simplification, though it is probably near the mark for many developing countries where the will and wherewithal to combat corruption are relatively weak.¹⁸ The way that bribe-taking influences growth, and the way that this depends on how bribes are chosen, are the two issues that occupy the remainder of our analysis.

The total bribe payment that a firm has to pay in order to engage in research activity is given by B . This payment acts like an additional fixed cost to the firm and the effect of it on growth is realised straightforwardly as follows.

Proposition 1 *An increase in the level of bribes reduces equilibrium growth.*

Proof. From Lemmas 1 and 2, the equilibrium growth rate can be written as $g = \gamma(\varepsilon(B)) \equiv \Gamma(B)$. Hence $\Gamma'(\cdot) = \gamma'(\cdot)\varepsilon'(\cdot) < 0$. ■

This result arises because an increase in bribe payments increases the costs of research and development, causing a reduction in the number of firms that are willing to embark on such a venture. Whilst each firm, individually, operates at a higher scale, the economy, as a whole, suffers a decline in research activity. In short, corruption impedes growth by limiting entry into

¹⁸Even when governments strive to be vigilant, corruption may thrive for a number of reasons, such as the prohibitive costs of fighting it when resources are scarce, the inherent difficulties in detecting it when monitoring is imprecise and the innate problems in exposing it when monitoring is abused. The last of these possibilities (where those appointed as vigilance officers are themselves open to bribes) bears on the interesting and complex issue of corruption in hierarchies (e.g., Basu *et al.* 1992; Marjit and Shi 1998; Mishra 2002). From a normative perspective, it has been shown by Bose (2004) how imperfect vigilance, combined with direct penalties for bribe-taking, may lead to outcomes that are Pareto-inferior to those that would occur if no sanctions were applied at all.

the business of innovation. There is, of course, an obvious implication of this.

Corollary 1 *The growth rate of a corrupt economy is always lower than the growth rate of a non-corrupt economy.*

Proof. The growth rate is $g = \Gamma(B)$. Since $\Gamma'(\cdot) < 0$, then $\Gamma(B) < \Gamma(0)$ for any $B > 0$. ■

Having established the above, we now consider how bribe payments, themselves, are determined. Recall that $B = Sb$, where S is the number of bureaucrats and b is the bribe that each bureaucrat demands. We study two alternative scenarios: the first - disorganised corruption - is when each bureaucrat acts as an independent monopolist, choosing a level of bribe that maximises his own illegal income without consideration of the aggregate implications of bribe-taking. The second - organised corruption - is when the bureaucracy, as a whole, acts as a joint monopoly, choosing a level of bribe that maximises the illegal income of all (or each) of its members and acknowledging the aggregate effects of its behaviour. In both cases we assume that bureaucrats, whilst never being caught, incur some costs from their corrupt activities. These costs may be thought of in a number of ways. For example, corrupt public officials may need to spend effort and resources on arranging and concealing their illicit transactions, and may also experience some moral shame or social stigma from abusing their privileged positions. It is plausible to imagine that these costs are higher the larger is the scale of the particular offence. We capture this conveniently in terms of a convex cost function that is increasing in the amount of bribe extracted from each firm. This function is given by $\beta(b)$ which is further assumed to satisfy $\beta(\cdot) = b$ at both $b = 0$ and some $b = b^* > 0$. These properties ensure that, at least upto some level of bribe, a bureaucrat's net payoff from bribe-taking is positive (i.e., $b - \beta(\cdot) > 0$ for $b \in [0, b^*]$).¹⁹ The bureaucrat's total net payoff from rent-seeking is given by $I_t = N_t[b - \beta(\cdot)]$, or

$$I_t = M_t \left[\frac{b - \beta(b)}{e} \right] \quad (12)$$

Evidently, for any given M_t , I_t is maximised by maximising the term in $[\cdot]$. Recall from above that corruption has the effect of reducing the number of research firms, N_t , causing an increase in research input, e , but an overall reduction in growth. In other words, a higher demand for bribes implies a

¹⁹This follows from the convexity of $\beta(\cdot)$, implying that $\beta'(\cdot) > 0$ and $\beta''(\cdot) > 0$. In addition, $\beta'(0) < 1$ and $\beta'(b^*) > 1$.

lower bribe base. The difference between disorganised and organised corruption lies in the extent to which bureaucrats take account of this effect when choosing their optimal bribes.

When corruption is disorganised, each bureaucrat chooses his own level of bribes, b , taking as given the bribes demanded by others and hence the total bribe payment, B , that each firm has to make. In doing so, each bureaucrat perceives that his own corrupt behaviour has no influence on N_t and therefore e . The optimal bribe in this case - denoted b^D - is given simply by

$$\beta'(b^D) = 1. \quad (13)$$

It follows from the properties of $\beta(\cdot)$ that $b^D < b^*$ and therefore $b^D - \beta(b^D) > 0$.²⁰

When corruption is organised, the collective bureaucracy recognises that the total bribe payment of a firm depends on the amount of bribe paid to each of its members: that is, it appreciates the fact that $B = Sb$. As such, the bureaucracy is aware that its choice of b will influence N_t and therefore e . One may think of the bureaucracy as making this choice so as to maximise the individual payoff of its representative member, or the aggregate payoff of all of its members. Either way, the optimal bribe in this case - denoted b^O - satisfies

$$\varepsilon(Sb^O)[1 - \beta'(b^O)] - S\varepsilon'(Sb^O)[b^O - \beta(b^O)] = 0. \quad (14)$$

As above, $b^O < b^*$ so that $b^O - \beta(b^O) > 0$.²¹

A comparison of (13) and (14) leads to the following result.

Proposition 2 *The level of bribes under organised corruption is lower than the level of bribes under disorganised corruption.*

Proof. Recall that $\varepsilon'(\cdot) > 0$, together with $b^D - \beta(b^D) > 0$ and $b^O > \beta(b^O)$. Suppose that $b^O \geq b^D$. Then (13) would imply $\beta'(b^O) \geq 1$, in which case (14) would require $S\varepsilon'(Sb^O)[b^O - \beta(b^O)] \leq 0$ which is never satisfied. Hence $b^O \geq b^D$ cannot be true. Suppose, alternatively, that $b^O < b^D$. Then (13) would imply $\beta'(b^O) < 1$, in which case (14) would require $S\varepsilon'(Sb^O)[b^O - \beta(b^O)] > 0$ which is satisfied. Hence $b^O < b^D$ is the only feasible outcome. ■

The intuition for this result is that an organised bureaucracy internalises the negative externalities that arise from individualistic (non-coordinated) rent-seeking behaviour. That is, the bureaucracy takes account of the fact that

²⁰It also follows that the optimal bribe is constant, as claimed earlier.

²¹That $b^O < b^*$ may be seen from (14) which implies that a bureaucrat's payoff is decreasing at b^* (since $\beta'(b^*) > 1$ and $b^* = \beta(b^*)$). It is also evident that the optimal bribe is constant in this case as well.

an increase in the amount of bribe payment to each of its members reduces the number of firms from which bribes can be extracted. The effect of this is to temper the demand for bribes, an effect that is absent when bureaucrats act alone and treat the number of potential bribe payers as given.

Given the above, it is straightforward to deduce the different growth implications of alternative forms of corruption.

Proposition 3 *Growth is higher under organised corruption than under disorganised corruption.*

Proof. The growth rate is $g = \Gamma(B)$, where $\Gamma'(\cdot) < 0$. Since $B^O < B^D$, then $\Gamma(B^O) > \Gamma(B^D)$. ■

The fact that bribe payments are lower when corruption is organised than when it is disorganised means that the fixed cost of research and development is also lower in the case of the former than in the case of the latter. A lower cost of research encourages a greater number of firms to undertake research activity and thereby leads to a higher growth rate.

We emphasise that our analysis is not meant as a prescription for the organisation of corruption to be a policy objective. Whether organised or not, corruption is always bad for growth in our model and the best policy is to eliminate it altogether. What our analysis does show, however, is that the effects of corruption may be very different under different circumstances, which may help to explain why some countries of the world appear more immune than others to equally poor quality levels of governance.

5 Conclusions

Corruption can take many shapes and forms, and it would be surprising if all types of corrupt activity had the same effect on economic performance. Recent empirical evidence indicates that, whilst many countries have suffered significantly as a result of corruption, others have coped well (in some cases, very well) with the phenomenon. The foregoing analysis suggests that one explanation for this is the extent to which perpetrators of corrupt practices - in our case, bureaucrats - coordinate their behaviour. In the absence of an organised corruption network, each bureaucrat demands his own bribe payment whilst ignoring the negative externalities of this on the bribe-taking capacity of others. In the presence of such a network, the collective bureaucracy internalises these externalities and, in doing so, tempers the demand for bribes. The result is that bribe payments are lower, innovation is higher

and growth is higher in the case of the latter than in the case of the former.

Like almost all other analyses, our approach has been to focus on the effects of corruption, taking as given that corruption exists (in one form or another). We have not sought to examine how the incidence of corruption, itself, may change endogenously with other changes in the economic environment. This is not necessarily a major shortcoming: aside from the specific objective of our analysis (which is to draw attention to the difference between organised and disorganised rent-seeking), there is the widely-held view that, for many developing countries, corruption has become so ingrained into the fabric of society that it is unlikely to disappear quickly or easily (if at all). From the perspective of the present paper, the interesting question is not so much why the level of corruption is higher in poor countries than in rich countries, but rather why the nature of corruption appears to vary across countries. The extent to which corruption is organised is one aspect of this, but there are other aspects as well. For example, it is common practice in some countries for arrangements to be made whereby kickbacks from private individuals to public officials are given *ex post* (as a share of profits, for instance), rather than *ex ante* (as an upfront bribe, like in the present analysis); and the presumption is that the effects on the economy will be different in each case. The precise reason why corruption should take one form and not another is an important issue which has been largely neglected and which may well have just as much to do with cultural, social and political considerations as it has with economic circumstances.

The implication of our analysis that corruption is always bad for growth accords with the consensus view among development experts. As we have also shown, however, exactly how bad the effect is can depend on the particular way in which corruption is practised, and there are clearly some types of practice that are less detrimental than others. Given this, then our analysis may be seen as offering a cautionary note against anti-corruption strategies. If fighting corrupt behaviour is costly (i.e., uses up resources that could have been employed more productively elsewhere), and if such behaviour is not that harmful, then one ought to be wary of embarking on a fight merely for the sake of it. Anti-corruption agencies need to analyse and understand the nature of corruption before trying to cure it, just as a medical practitioner needs to examine and identify the symptoms of a sick patient before prescribing the appropriate remedy.

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Table 1
Corruption and Growth in Selected Regions of the World

Region	Corruption Index	% Growth Rate of GDP Per Capita
Sub-Saharan Africa	6.4	0.4
Latin America	6.5	0.1
South and South-East Asia	6.3	4.4
Hong Kong, Malaysia, Singapore	2.8	4.8
Philippines and South Asia	8.1	2.4
China, Indonesia, South Korea and Thailand	7.1	5.9

Note: Figures calculated as averages over 1980-1999 for Sub-Saharan Africa and Latin America and over 1980-1996 for South and South-East Asia.