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Corruption, Development and Demography

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Abstract

This paper presents an analysis of the joint, endogenous determination of bureaucratic corruption, economic development and demographic transition. The analysis is based on an overlapping generations model in which reproductive agents mature safely through two periods of life and face a probability of surviving for a third period. This survival probability depends on the provision of public goods and services which may be compromised by corrupt activities on the part of public officials. The dynamic general equilibrium of the economy is characterised by multiple development regimes, transition between which may or may not be feasible. In accordance with empirical evidence, the model predicts that low (high) levels of development are associated with high (low) levels of corruption and low (high) rates of life expectancy.

Keywords: Bureaucratic corruption, economic development, demographic transition.

JEL classification: D73, J10, J18, O11.

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1 Introduction

Corruption is an issue that is dominating the international development arena. To most, if not all, development experts, many of the problems that beset the poorest countries of the world can be traced to the widespread abuse of authority by public officials whose self-seeking actions undermine the quality of governance and, with this, the prospects for growth.[1] Amongst all that has been written on the subject, Sen (1999, p.275) declares that corruption is "one of the major stumbling blocks in the path to successful economic progress", while the World Bank (on its web-site) states that corruption is "the single greatest obstacle to economic and social development".[2] In spite of such claims, and the wealth of evidence to support them, there exists relatively little theoretical work on the macroeconomics of misgovernance with the view to providing the analytical rigour and precision that would strengthen one's understanding of why corruption and development are so inextricably linked. The purpose of the present paper is to go some way towards filling this gap.[3]

Empirical work on corruption has flourished over recent years. This has been due to the publication of several cross-country data sets that are widely regarded as providing reliable measures of corrupt activity.[4] The evidence obtained from this research has established without doubt that corruption and development are strongly connected in a relationship that is both negative and two-way causal. In one set of analyses it is estimated that relatively small increases in the incidence of corruption can have substantial adverse

[1] The abuse of public office for personal gain is the most common definition of public sector corruption. The concept of governance is broader than that of corruption, though the two are intimately connected: just as bad governance fosters corruption, so corruption undermines good governance.

[2] The World Bank web-site, www.worldbank.org/publicsector/anticorrupt, is one of the richest sources of information about corruption. Another is the IMF web-site, www.imf.org/external/np/exp/facts/gov.

[3] Various surveys of corruption can be found in Bardhan (1997), Jain (2001), Rose-Ackerman (1999) and Tanzi (1998). As is clear from these, the vast majority of the literature is microeconomic in nature, using partial equilibrium models to study specific aspects and issues arising from the principal-agent type relationship between superiors and subordinates in public office.

[4] These data sets, or corruption indices, have been compiled by various international organisations using questionnaire surveys sent to networks of correspondents around the world. The surveys are designed to provide a ranking of countries in terms of the extent to which corruption is perceived to exist (e.g., the extent to which public officials are believed to accept bribes, to make fraudulent demands and to embezzle public funds). Nowadays, the most commonly used index is that of Transparency International, details of which can be found on the web-site www.transparency.org/surveys/index.html♯cpi.

effects on investment and growth (e.g., Gyimah-Brempong 2002; Keefer and Knack 1997; Li *et al.* 2000; Mauro 1995). According to Mauro (1995), for instance, an improvement in the corruption index by one standard deviation would increase investment by as much as 3 percent of output. In another set of analyses it is found that the incidence of corruption depends significantly on economic prosperity (e.g., Ades and Di Tella 1999; Fisman and Gatti 2002; Paldam 2002; Treisman 2000). According to Treisman (2000), for instance, as much as 50 to 73 percent of the variations in corruption indices can be explained by variations in per capita income levels. Casual observation suggests also that corruption and poverty may establish themselves as almost permanent fixtures of society. Indeed, many of the most poor and corrupt countries of the past are among the most poor and corrupt countries of today, having seemingly become trapped in a vicious circle of widespread deprivation and wholesale misgovernance (e.g., Bardhan 1997; Sah 1988). Whichever way one looks at it, the picture to emerge shows that, in general, higher levels of corruption are associated with lower levels of development.[5]

Corruption can take many shapes and forms and can impact on growth in many different ways. In the analysis that follows we focus specifically on corruption in public procurement and the effect of this on human development - in particular, health human capital. Generally speaking, corruption can affect both the volume and composition of public expenditures in ways that compromise the effectiveness of social policies. Public funds earmarked for vital areas of spending may simply go missing and never be reclaimed. Purchases of goods and services may be based on who offers the best kickbacks, rather than who offers the best price-quality combination. Entire public programmes may be chosen more for their capacity to generate illegal income than for their potential to improve standards of living. Empirical investigations suggest that corruption is, indeed, associated with a misallocation and misappropriation of public resources. Gupta *et al.* (2000) find that corruption has the effect of reducing the provision of education and health care, and of increasing infant mortality. Mauro (1997) presents evidence that corruption distorts public expenditures away from growth-promoting areas (like education and health) towards other types of project (e.g., infrastructure investment) that are less productivity-enhancing. In a similar vein, Tanzi and Davoodi (1997) find that corruption leads to a diversion of public funds to where bribes are easiest to collect, implying a bias in the composition of public spending towards low-productivity projects at the expense of

[5]In contrast to this, there is very little evidence to support the view that corruption might actually be good for growth by helping to circumvent cumbersome regulations (red tape) in the bureacratic process. This is true even for countries that are reportedly mired with such regulations (e.g., Mauro 1995).

value-enhancing investments. Other authors make similar observations, as do several national and international agencies engaged in the monitoring of public expenditure programmes in various countries.[6] The general conclusion is that corruption tends to reduce the provision and quality, whilst raising the cost, of public goods and services that enhance individuals' human capital in terms of both educational ability and health status. That such services are important for growth is evidenced clearly in a number of studies (e.g., Bidani and Ravallion 1997; Diamond 1989; Otani and Villaueva 1990).

Economic development is typically accompanied by a process of demographic transition, and one of the most striking demographic trends over the past 100 years has been the dramatic rise in longevity among the populations of almost all countries of the world. In the US, for example, life expectancy at birth has risen by almost 50 percent since 1920: in that era the average lifetime of a person was only 54 years; by 1950 this figure had increased to 68 years, by 1965 to 70 years, and by 1980 to 74 years. Nowadays, the average US citizen can expect to live upto 80 years of age, which is twice as long as the average US citizen born in 1850 (e.g., Fogel 1994; Lichtenberg 1998). There are numerous other examples of this radical turn of events, both for developed and developing economies (e.g., Fogel 1997; Livi-Bacci 1997; Preston 1980; Pritchett and Summers 1996). Thus it has been reported that life expectancy among developing countries increased by as much as 50 percent during the period 1950-1990, while average lifetimes in nearly all countries were extended by 9 years or more between 1960 and 1990.[7]

Changes in life expectancy are more than just a statistical feature of demographic transition: on the contrary, it is often argued that such changes are the driving force of this process, a process that interacts with economic development.[8] Significantly, a number of authors have shown theoretically

[6]Examples include the Public Affairs Centre in India, the World Bank, the Free Africa Foundation, Transparency International, and Community Information, Empowerment and Transparency. Details are contained on their respective web-sites.

[7]Different ways of looking at the data give the same impression. For example, it has been estimated that a US citizen born in 1960 had a 71 percent chance of surviving to age 65, while the same person born in 1990 had a 90 percent chance of reaching that age. Similarly, it has also been estimated that half of the US population aged 85 or over in 1990 would not have been alive if mortality rates had been the same as those in 1960. On a more global level, recent evidence suggests that the number of countries (with more than 1 million inhabitants) where life expectancy is less than 50 years has fallen from 70 in 1960 to around 18 today.

[8]For surveys of the demographic transition literature, see Ehrlich and Lui (1997) and Kirk (1996). The importance of mortality for explaining transition derives from the fact that mortality is a key determinant of fertility. Only by allowing for changes in mortality does it seem possible to account for the observed hump-shaped behaviour in population growth - that is, the tendency for population growth to be low at early stages of develop-

how exogenous improvements in expected lifetimes can foster higher growth by increasing savings, increasing investment in education and decreasing fertility (e.g., de la Croix and Licandro 1999; Ehrlich and Lui 1991; Kalemli-Ozcan *et al.* 2000; Zhang and Zhang 2001; Zhang *et al.* 2001). The implied positive correlation between longevity and development is well-supported by the data (e.g., Bloom *et al.* 2001; Knowles and Owen 1995; Preston 1978; Pritchett and Summers 1996). For example, cross-section evidence suggests that, in 1996, average life expectancy in the poorest countries was 50 years of age, while average life expectancy in the richest countries was 76 years of age. More recently, several other authors have taken the important step of constructing models in which life expectancy is endogenous, acknowledging that health status can change with changes in individual circumstances, government policies and various other aspects of the socio-economic environment (e.g., Blackburn and Cipriani 1998, 2002; Jones 2001; Kalemli-Ozcan 2002; Tamura 2003). This has usually been accomplished by specifying life expectancy to be a function of some measure of development (such as the level of output, consumption or capital). The presumption, of course, is that development is conducive to longer lifetimes as technological progress, increased education and rising per capita incomes manifest themselves in the forms of higher levels of nutrition, better standards of sanitation, greater provision of health care, improved awareness of health risks, advances in medical knowledge and so on and so forth. The implication is that the relationship between longevity and development (like that between corruption and development) is two-way causal, with effects running in both directions. Empirical evidence suggests that these effects can be significant: according to some estimates, as much as half of the increase in life expectancy among developing countries can be attributed to income gains, while each extra year of life expectancy would raise annual output by as much as 4 percent in some countries (e.g., Bloom *et al.* 2001; Preston 1980). Naturally, greater life expectancy is associated with all-round improvements in health and it is often claimed that the historical gains in life expectancy have been due mainly to increases in income and advances in health technology (e.g., Easterlin 1996; Fogel 1994). There is also a good deal of evidence that testifies to a strong positive correlation between income and various measures of health, with the poor having a significantly worse health status than the rich (e.g., Bidani and Ravallion 1997; Gupta *et al.* 2001; Gyimah-Brempong and Wilson 2004).[9]

ment, to subsequently rise as development proceeds and to eventually decline with further increases in per capita incomes.

[9] Improvements in health can have important economic effects beyond those engendered by greater life expectancy. This follows from the fact that health, like education, is a form of human capital and so is likely to be related to labour market outcomes. Thus lower

The purpose of the present paper is to investigate theoretically the link between corruption, development and demography, taking into account various aspects of the foregoing discussion. Our analysis is based on a dynamic general equilibrium model in which public officials (whom we call bureaucrats) are designated the task of providing public goods and services that enhance human development in terms of health status and life expectancy. In general, changes in life expectancy reflect changes in mortality at different stages in the life-cycle, especially early childhood and later adulthood. As in other analyses, we focus on the latter, partly because of the need to exercise some discretion, and partly because of the fact that most gains in longevity now tend to occur through improvements in survival at older ages, rather than reductions in deaths during infancy (e.g., Kannisto *et al.* 1994; Lee and Tuljarpurkar 1997).[10] Unlike other analyses, we endogenise life expectancy, not through some arbitrary connection to economic activity, but by linking it to the provision of public goods and services. This provision may be undermined by bureaucrats as they exploit the opportunity to embezzle public funds which are used to procure public goods.[11] The upshot is a weakening of individuals' incentives to save and thereby a reduction in aggregate capital accumulation. At the same time, the net gains from corruption decrease as capital accumulation takes place, and there is a critical (threshold) level of capital beyond which corruption disappears. Accordingly, the model generates multi-causal linkages between economic, demographic and governance outcomes: on the one hand, low (high) levels of development are conducive to high (low) levels of corruption and low (high) rates of life expectancy; on the other hand, high (low) levels of corruption and low (high) rates of life expectancy are conducive to low (high) levels of development. The existence of

morbidity and better functionality can raise the productivity and wages of individuals. For a review of the literature in this area, see Strauss and Thomas (1998).

[10] We do not mean to trivialise the considerable reductions in infant and child mortality that have played such a vital role in increasing life expectancy. At least in industrialised countries, however, mortality rates of the young-age population are now very low (infant mortality is less than 1 percent) and any further reductions are likely to be small by historical standards. The general trend over recent decades has been a deceleration in the rate of mortality decline at young ages, but an acceleration in the rate of mortality decline at adult ages.

[11] Embezzlement - the theft by an individual of resources that he is supposed to administer - is an especially difficult offence to deal with when it entails the misappropriation of public funds. While everyone in society may be affected, the fact that no private property is stolen or exchanged means that individuals have no legal rights by which to protest and seek compensation. This type of non-collusive corruption may pose just as many problems as more collusive forms, where benefits accrue to all parties involved. Indeed, in many of the most corrupt countries, embezzlement is a major aspect of public sector misconduct, often more important than bribery.

threshold effects gives rise to multiple development regimes associated with different incidence of corruption and different rates of life expectancy. Transition between these regimes may or may not be feasible, and there is the possibility of a poverty trap equilibrium in which development is repressed, corruption is widespread and life expectancy is short. These results provide answers to such questions as to why corruption may arise in the first place, why corruption may persist or decline over time and why corruption may vary across otherwise similar economies.

As indicated earlier, there are very few other analyses that address the issue of corruption from a development macroeconomic perspective.[12] In two of the first to do so, Ehrlich and Lui (1999) demonstrated 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), while Sarte (2000) showed 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.* (2005) have established results similar to those above, revealing how corruption and development may interact with each other to produce threshold effects and multiple (history-dependent) long-run equilibria. None of these analyses address the types of issue relating to public policy, demographic change and savings behaviour that feature in the present line of inquiry.

The remainder of the paper is organised as follows. In Section 2 we describe the economic environment. In Section 3 we identify the conditions under which corruption occurs. In Section 4 we study the implications for economic development and demographic transition. In Section 5 we make a few concluding remarks.

2 The Model

Time is discrete and indexed by $t = 0, .., \infty$. The economy is populated by finitely-lived agents who belong to overlapping generations of single-parent and single-child families.[13] At any point in time, there is a population of

[12] In 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.

[13] We abstract from fertility choice for simplicity, referring the reader to other analyses that deal with this issue (e.g. Blackburn and Cipriani 2002; Ehrlich and Lui 1991; Zhang and Zhang 2001; Zhang *et al.* 2001). Allowing for endogenous fertility would tend to strengthen our results since changes in life expectancy would then cause changes in savings by causing changes in both the return on savings and the demand for children. As usual,

young agents, a population of middle-aged agents and a population of old agents. Young agents are economically inactive, being simply raised and cared for by their parents. Middle-aged agents are child-bearers and workers, earning income which is allocated between consumption and savings. Old agents are retired, consuming all of the proceeds from their savings. Each generation of agents is divided into two groups of citizens - private individuals (or households) and public servants (or bureaucrats).[14] To save on notation, we fix the size of each group to be a measure of unit mass. Households work for firms in the production of output, while bureaucrats work for the government in the administration of public policy. For simplicity, we assume that only households face uncertainty about their lifetimes: specifically, we suppose that each household matures safely through two periods of life and has a probability of surviving for a third period; bureaucrats, by contrast, live for three periods with certainty. Public policy consists of a programme of taxes and expenditures designed to make available public goods and services which contribute to the health human capital of individuals. Corruption may arise because of the opportunity for bureaucrats to appropriate public funds for themselves. We assume that a fraction, $\nu \in (0,1)$, of bureaucrats are corruptible in this way, while the remaining fraction, $1-\nu$, are non-corruptible, with the identity of a bureaucrat being unobservable by the government.[15] Firms, of which there is a unit mass, hire labour from households and rent capital from all agents in perfectly competitive markets.

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we also abstract from complications of marriage by assuming that an agent is able to bear children on her own.

[14] We assume that agents are differentiated at birth according to their abilities and skills. Households are individuals who lack the skills necessary to become bureaucrats. Bureaucrats are individuals who possess these skills and who are induced to take up public office by an allocation of talent condition established below. Thus, as in other analyses (e.g., Blackburn *et al.* 2005; Ehrlich and Lui 1999; Sarte 2000), we abstract from issues relating to occupational choice. 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.

[15] 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., Acemoglu and Verdier 2000; Blackburn *et al.* 2005). The main purpose of the assumption is to allow us to determine the wages of bureaucrats in a relatively straightforward way that does not demand additional assumptions about how public sector pay is determined. In fact, all we need for this purpose is that there be at least one bureaucrat who is non-corruptible - all other bureaucrats may well be potential transgressors.

2.1 The Private Sector

2.1.1 Firms

Each firm combines l_t units of labour with k_t units of capital to produce y_t units of output according to

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

($A > 0$, $\alpha \in (0, 1)$) where K_t denotes the aggregate stock of capital.[16] The output of a firm is subject to a constant proportional tax, $\tau \in (0, 1)$.[17] 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 requires $w_t = (1-\tau)\alpha Al_t^{\alpha-1} k_t^{1-\alpha} K_t^{\alpha}$ and $r_t = (1-\tau)(1-\alpha)Al_t^{\alpha} k_t^{-\alpha} K_t^{\alpha}$. In equilibrium, where $l_t = 1$ (the fixed supply of labour, as given below) and $k_t = K_t$, we may write these conditions as

$$w_t = (1-\tau)\alpha Ak_t = (1-\tau)\alpha y_t, \tag{2}$$

$$r_t = (1-\tau)(1-\alpha)A \equiv r \tag{3}$$

Thus the equilibrium wage is proportional to the capital stock, while the equilibrium interest rate is constant.

2.1.2 Households

Each household lives for two periods with certainty and faces a probability of surviving for a third period. The expected lifetime utility of a household of generation $t-1$ is given by

$$u_{t-1}^h = \log[c_{t-1,t}^h + v(q_t)] + \theta p_t \log(c_{t-1,t+1}^h), \tag{4}$$

($\theta \in (0, 1)$) where $c_{t-1,t}^h$ denotes consumption in middle-age, $c_{t-1,t+1}^h$ denotes consumption in old-age, q_t denotes bequests to offspring and p_t is the probability of surviving to old-age. We model altruism according to the simple 'warm-glow', or 'joy-of-giving', motive for making bequests, as reflected in the function $v(\cdot)$ which is assumed to be strictly concave and to satisfy the usual Inada conditions. Bequests are made by parents during middle-age, being invested in the capital market and becoming available to children when

[16] This aggregate externality - a common feature of endogenous growth models - allows us to work with a simple AK technology, where the social returns to capital are constant. Our results would be unchanged were we to assume diminishing returns to capital instead.

[17] Alternatively, taxes could be imposed on households, in which case our results would be the same.

they, themselves, reach maturity. Our particular specification of middle-age felicity implies that the marginal rate of substitution between consumption and bequests is independent of the level of consumption. As we shall see, this leads to the convenient result that bequests are constant across generations.[18] The possibility of dying before reaching old-age is reflected in the fact that the discount factor applied to old-age consumption includes p_t, the probability of surviving into retirement. This probability is assumed to be the same for all households of the same generation and is discussed further below.

A middle-aged household is endowed with one unit of labour (hence $l = 1$, as claimed above) which it supplies inelastically to firms in return for a wage of w_t. The household is also entitled to its inheritance, equal to the wealth bequeathed by its parent when it was young, plus the interest earned on this bequest: that is, $(1+r)q_{t-1}$. Given these resources, the household consumes, saves and makes bequests to its own offspring. Denoting savings by s_t^h, the budget constraint for a middle-aged household is

$$c_{t-1,t}^h + s_t^h + q_t = w_t + (1+r)q_{t-1}. \tag{5}$$

If a household survives to old-age, then it no longer works but finances its consumption entirely from savings. As in other models of uncertain lifetimes, we need to deal with the subtle issue of how to treat the retirement savings that are left by individuals who do not survive to old-age. As far as the present analysis is concerned, it makes no essential difference as to whether one assumes that these savings are merely wasted (e.g., Ehrlich and Lui 1991), or that they are distributed among the surviving population of savers through actuarially fair annuity markets (e.g., Zhang and Zhang 2001).[19] For simplicity, we follow the former approach, in which case the budget constraint of an old-age household is

$$c_{t-1,t+1}^h = (1+r)s_t^h. \tag{6}$$

[18]This property is true for any specification of middle-aged utility of the form $u[c_{t-1,t}^h + v(b_t)]$. We choose a logarithmic formulation merely for simplicity and to save on notation. The precise role of bequests in the model is to serve as a technical device for ensuring the existence of non-degenerate steady state equilibria. For this reason, we appeal to the simplest of bequest motives.

[19]In the first scenario the rate of return on savings is simply the market rate of interest, $1+r$. In the second scenario the return on savings is the market interest rate divided by the average survival rate, $\frac{1+r}{p_t}$. It is straightforward to verify that the conditions for utility maximisation are the same in both instances. A third approach to the issue (one that we do not consider) is to view the savings of the deceased as being left to the next generation in the form of unintended bequests from parents to children (e.g., Abel 1985).

Our description of households is completed by considering the determinants of the survival probability, p_t. In general, one may think of life expectancy as being determined by factors that are both internal and external to an individual's decisions. Examples of the former are personal expenditures on food, hygiene, exercise and medical care, while examples of the latter include parental influence and family background, environmental conditions and social infrastructure, and public expenditures on education and health. To many observers, most changes in life expectancy are due to changes in the external inputs to individual health, and the positive correlation between longevity and income is a reflection of the fact that income acts more as a proxy for these inputs, rather than as a key variable, itself, in determining survival. For example, there is considerable evidence that the education and health levels of parents, correlated positively with family income, have a significant influence on the life expectancy of offspring (e.g., Mirowski and Ross 1998).[20] A similarly large body of evidence suggests that it is public (rather than private) spending on health care, correlated positively with aggregate income, which is the major determinant of health status and longevity among all members of society, whether rich or poor (e.g., Anand and Ravallion 1993; Gupta *et al.* 2001).[21] Historically, improvements in life expectancy can be allied to fundamental changes in the socio-economic environment, such as the establishment of public order, the introduction of revolutionary medicines and the development of an infrastructure in transport and commerce, which reduced fatalities from violence, famines, malnutrition, epidemics and contagious diseases (e.g., Lichtenberg 1998; McKeown *et al.* 1972; Schofield *et al.* 1992). We return to some of these issues - public policy in particular - later. For the moment, we note that, if life expectancy is determined primarily by factors that are external to individuals, then it will be rational for an individual to treat her probability of survival as essentially given and beyond her own control. This is the approach followed in most other analyses and is the approach that we take here. For this reason, we find it convenient to postpone further discussion of p_t until after we have solved for the decisions that a household is able to make for itself.

[20] Specific instances of this are revealed by numerous case studies which indicate that healthier and better educated parents tend to have healthier children who are less likely to take up smoking, to become overweight, to be sexually promsicuous, to suffer long-term illnesses and so on and so forth. For further discussion, see Mirowski and Ross (1998) and the references therein.

[21] In relative terms, it is the poor who appear to benefit the most. For example, some estimates suggests that, for the same percentage increase in public health spending, twice as many deaths are prevented among the poor than the non-poor (e.g., Bidani and Ravallion 1997; Gupta *et al.* 2001).

Our representative household of generation $t-1$ chooses $c^h_{t-1,t}$, $c^h_{t-1,t+1}$, s^h_t and q_t so as to maximise (4) subject to (5) and (6). Solving this problem yields

$$s^h_t = \frac{\theta p_t}{1+\theta p_t}[w_t + Q], \tag{7}$$

where $Q = rq + v(\cdot)$. This expression shows that savings is an increasing function of wages and an increasing function of the probability of survival. The latter property arises because the more that an individual expects to surivive to old-age, the more that the individual will save during middle-age in order to finance retirement consumption. Observe that $q_t = q$ for all t by virtue of the condition $v_q(\cdot) = 1$, which confirms our earlier assertion that the optimal size of bequest is constant across generations.

2.2 The Public Sector

2.2.1 Government

The primary role of the government is to provide public goods and services which contribute to the well-being of individuals. Such provision may cover a wide range of categories, including education, health, social infrastructure and the environment. To simplify matters, we consolidate these items into a composite measure of public goods, denoted G_t. For further simplicity, we assume that the government needs to incur one unit of expenditure to acquire one unit of public goods provision. Finally, we suppose that the benefit to individuals from accessing public goods is subject to a congestion externality which we model in terms of aggregate output, Y_t. The relevant measure of public goods provision is then given by the ratio $g_t = \frac{G_t}{Y_t}$ (e.g., Barro and Sala-i-Martin 1992).

The way in which g_t enters our model is through individuals' probability of survival, p_t. Specifically, we assume that $p_t = \pi(g_t)$, where $\pi_g(\cdot) > 0$: *ceteris paribus*, a greater provision of public goods means a higher life expectancy of individuals. As mentioned earlier, there is a large body of evidence which indicates that state-provided health care (which accounts for a significant fraction of the public purse in most countries) is a major determinant of health status, in general, and life expectancy, in particular (e.g., Anand and Ravallion 1993; Bidani and Ravallion 1997; Gupta *et al.* 2001). This holds for all classes of citizen, though it is especially true for the poor who tend to benefit more than the rich from an expansion in public health programmes, the impact of which on the poor's health status tends to be much greater than the impact of an increase in private spending on health care. Both directly and indirectly, the evidence suggests that the positive correlation between income and life expectancy is due, in large part, to the fact that wealthier nations are more able to fund a better provision of essential health-improving public services, such as sanitation, medical care, epidemiological protection, environmental safeguards and education. In other words, it is not income growth *per se* that matters for longevity, but rather the extent to which higher incomes are used to support public health and welfare programmes, the benefits of which are distributed among the whole population.

Responsibility for public goods provision lies with bureaucrats, some of whom may be tempted to exploit their positions of authority by engaging in corrupt practices. Given this, the government sets the salaries of bureaucrats in accordance with the following considerations. Any bureaucrat (whether corruptible or non-corruptible) can work for a firm to receive an 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 some form of malpractice and is therefore immediately identified as being corrupt. As in other analyses (e.g., Acemoglu and Verdier 1998; Blackburn *et al.* 2005), 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). Consequently, 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.[22]

The government runs a continuously balanced budget, using whatever public funds it has available to finance its expenditures on public goods. Its total revenue is simply the total proceeds from taxes on firms, τY_t, out of which it pays bureaucrats salaries, w_t. Let F_t denote the amount of public funds that is allocated among bureaucrats for the procurement of public goods. It follows that $F_t = \tau Y_t - w_t$. Using (2), together with the fact that $Y_t = y_t$, we may write this expression as

$$\begin{aligned} F_t &= [\tau - (1-\tau)\alpha]Y_t \equiv \Phi Y_t \\ &= \left[\frac{\tau - (1-\tau)\alpha}{(1-\tau)\alpha}\right] w_t \equiv \phi w_t \end{aligned} \tag{8}$$

where we assume that $\tau > (1-\tau)\alpha$.

[22]This has the usual interpretation of an allocation of talent condition. The government cannot force any of the 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.

2.2.2 Bureaucrats

As indicated earlier, we assume, for simplicity, that bureaucrats survive through the maximum three periods of life with certainty. For further convenience, we also assume that they are non-altruistic.[23] The role of each bureaucrat is to act as an agent for the government in the administration of public policy. Specifically, each bureaucrat is given charge over f_t amount of public funds with which to procure public goods. It is because of this delegation of authority that corruption might arise as a bureaucrat may be tempted to appropriate these funds for himself.

Naturally, only a corruptible bureaucrat would ever abuse his powers of public office, whereas a non-corruptible bureaucrat would always behave honestly. If the former does transgress, then he must undertake certain actions in order to escape detection by the authorities. In general, corrupt individuals may try to remain inconspicuous in a number of ways, such as hiding their illegal income, investing this income differently from legal income and altering their patterns of expenditure. Such activities typically entail costs in one form or another. For the purposes of the present analysis, we consider the following simple scenario. A bureaucrat who is corrupt can avoid immediate detection by storing his illegal income in hiding (rather than investing it in capital) and by mimicing the behaviour of a non-corrupt bureaucrat (rather than risking conspicuous consumption). The bureaucrat can then evade subsequent arrest by taking flight with his wealth and consuming in secrecy elsewhere. The implications of these actions are captured formally as follows.[24]

As before, let $c^b_{t-1,t}$ and $c^b_{t-1,t+1}$ denote, respectively, the middle-age and old-age consumption of a bureaucrat of generation $t-1$. The lifetime utility of this bureaucrat is given by

$$u^b_{t-1} = \begin{cases} \log(c^b_{t-1,t}) + \theta \log(c^b_{t-1,t+1}) & \text{if non-corrupt} \\ \log(c^b_{t-1,t}) + \delta\theta \log(c^b_{t-1,t+1}) & \text{if corrupt.} \end{cases} \tag{9}$$

The parameter $\delta \in (0,1)$ is meant to capture the idea that, for reasons given

[23] Neither of these assumptions are crucial for our main results. The fact that households have uncertain lifetimes (which may be influenced by public policy) and make bequests to their offspring (which ensures non-degenerate equilibria) is sufficient for the purposes of our analysis.

[24] By undertaking such actions, a bureaucrat is able to avoid any risk of being caught. As argued by others (e.g., Shleifer and Vishny 1993), this risk is likely to be negligible when the political will, public pressure and institutional framework for combatting corruption are relatively weak, which is generally the case in developing countries. Our results would not be changed if one was to assume that a bureaucrat who is corrupt faces some probability of being apprehended.

above, corruption is not entirely costless for an individual, but entails some disutility.[25] For example, a bureaucrat may need to spend effort on secretly absconding with his income, may derive less satisfaction from consuming in hiding than consuming at home, and may feel some moral shame, or social stigma, from abusing his privelaged position. In all of these cases it is plausible to imagine that the cost incurred is greater the larger is the scale of the subterfuge, as measured by the total amount of income that the bureaucrat takes flight with and consumes elsewhere. In each case, as well, it is the utility from old-age consumption that is affected since it is during old-age when the bureaucrat makes off with his ill-gotten gains.[26]

Each middle-aged bureaucrat supplies inelastically one unit of labour to the government in return for the salary of w_t. For a non-corrupt bureaucrat, this is the only source of income. For a corrupt bureaucrat, there is also f_t, the amount of public funds that he steals. As indicated above, these funds must be stored away in hiding and are therefore unavailable for consumption and (productive) savings. Denoting the latter by s_t^b, it follows that each middle-aged bureaucrat (whether non-corrupt or corrupt) faces the budget constraint

$$c_{t-1,t}^b + s_t^b = w_t. \tag{10}$$

On reaching old-age, a bureaucrat retires and consumes all of his remaining wealth. This wealth is different for corrupt and non-corrupt bureaucrats since the former, unlike the latter, have access to illegally obtained income that was previously concealed. The final period budget constraint for each type of bureaucrat is

$$c_{t-1,t+1}^b = \begin{cases} (1+r)s_t^b & \text{if non-corrupt} \\ (1+r)s_t^b + f_t & \text{if corrupt.} \end{cases} \tag{11}$$

According to our description of events, a bureaucrat who is corrupt can avoid immediate detection if he not only hides his illegal income, but also imitates the consumption and savings behaviour of a non-corrupt bureaucrat

[25]Following footnote 15, one may think of non-corruptible bureaucrats as incurring prohibitively high levels of disutility from corruption.

[26]As a precise example, suppose that a corrupt bureaucrat's utility function is $\log(c_{t-1,t}^b) + \theta[\log(c_{t-1,t+1}^b) - \gamma\log(e_{t+1})]$, where e_{t+1} denotes effort spent on avoiding detection. Suppose also that this effort is proportional to the amount of income with which the bureaucrat absconds. Since this income is equal to (old-age) consumption, then $e_{t+1} = \epsilon c_{t-1,t+1}^b$ ($\epsilon \in (0,1)$). It follows that the bureaucrat's utility may be written as in (9), where $\delta = 1-\gamma$. One could think of other resource costs (expenditures of income) associated with concealing corruption (e.g., Blackburn *et al.* 2005). The disutility cost specified in (9) is sufficient for our purposes.

during middle-age.[27] The latter type of individual chooses $c^b_{t-1,t}$, $c^b_{t-1,t+1}$ and s^b_t so as to maximise his utility in (9) subject to his budget constraints in (10) and (11). Solving this problem yields

$$s^b_t = \frac{\theta}{1+\theta} w_t. \tag{12}$$

The consumption profiles of corrupt and non-corrupt bureaucrats are determined by substituting (12) into (10) and (11), and by using the fact that $f_t = F_t$ in (8). In turn, the utility of each type of bureaucrat is computed by appropriate substitution in (9). This payoff is

$$u^b_{t-1} = \begin{cases} \log(V_0) + (1+\theta)\log(w_t) & \text{if non-corrupt} \\ \log(V_1) + (1+\theta\delta)\log(w_t) & \text{if corrupt,} \end{cases} \tag{13}$$

where $V_0 = \left(\frac{1}{1+\theta}\right)\left[\frac{\theta(1+r)}{1+\theta}\right]^{\theta}$ and $V_1 = \left(\frac{1}{1+\theta}\right)\left[\frac{\theta(1+r)+(1+\theta)\phi}{1+\theta}\right]^{\theta\delta}$.

3 The Incentive to be Corrupt

A corruptible bureaucrat will embezzle public funds if his utility from doing so is no less than his utility from not doing so. From (13), we may write this condition as $\log(V_1) - \log(V_0) \geq \theta(1-\delta)\log(w_t)$, or $\frac{V_1}{V_0} \geq w_t^{\theta(1-\delta)}$. This expression shows that a bureaucrat is more likely to be corrupt when wages are low than when they are high. At low levels of wages, the extra income from corruption yields additional utility that more than compensates the costs of concealing corruption. An increase in wages implies an increase in both the legal and illegal incomes of a bureaucrat, but the gain in utility is less when the bureaucrat is corrupt than when he is not corrupt because of his costly subterfuge. This means that, as wages rise, the net gains from corruption are reduced until, at some point, they vanish altogether and turn to net costs.

Wages in our model are determined according to (2). Given this, we may re-state the condition for a bureaucrat to be corrupt as

$$k_t \leq \frac{1}{(1-\tau)\alpha A}\left(\frac{V_1}{V_0}\right)^{\frac{1}{\theta(1-\delta)}} \equiv \overline{k}. \tag{14}$$

[27] If a corrupt bureaucrat was free to make optimal decisions, then his behaviour would be different from this. The fact that he has an extra amount of (illegal) income during old-age means that, compared to a non-corrupt bureaucrat, he would optimally consume more and save less during middle-age.

This expression defines a critical (threshold) level of capital, below which corruption occurs and above which corruption does not occur. In other words, corruption is more (less) likely to exist at lower (higher) stages of economic development. Evidently, since capital accumulation is endogenous in our model, then so too is corruption.

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. As we shall also see, the way in which corruption takes hold is through changes in savings induced by endogenous changes in the life expectancy of agents. This implies a relationship between longevity and development that is also two-way causal.

Equilibrium in the economy requires that the total demand for capital by firms is equal to the total supply of capital by agents. The latter comprises the savings and bequests of households (s_t^h in (7) and q), plus the savings of bureaucrats (s_t^b in (12)). Using (2), it follows that the dynamic equation governing capital accumulation is

$$k_{t+1} = \left(\frac{\theta p_t}{1+\theta p_t} + \frac{\theta}{1+\theta}\right)(1-\tau)\alpha A k_t + \frac{\theta p_t}{1+\theta p_t} Q + q \equiv \kappa(k_t, p_t). \quad (15)$$

This equation shows how economic development is influenced by life expectancy. Suppose, as in most other models, that the probability of survival is exogenously given such that $p_t = p$ for all t. Suppose also that $\kappa_k(\cdot, p) \in (0, 1)$, implying the existence of a unique steady state equilibrium at $k^* = \kappa(k^*, p)$.[28] Then (15) describes a simple linear transition path along which the economy converges towards k^*. An increase in p has the effect of shifting up the transition path ($\kappa_p(\cdot, p) > 0$) and raising the steady state level of capital. In other words, exogenous improvements in life expectancy lead to improvements in the prospective fortunes of the economy. The reason for this follows from our earlier observation that a higher probability of survival induces a higher level of savings on the part of households. Our result is consistent with that obtained in other models and accords with the empirical finding of a positive correlation between life expectancy and economic development.

[28] For the case in which $\kappa_k(\cdot, p) > 1$, the economy displays perpetual growth.

With the foregoing in mind, we now turn to consider how life expectancy is determined endogenously in our economy and how this might affect the economy's growth prospects. Recall that the survival probability is deemed to be an increasing function of public goods provision (subject to a congestion externality): that is, $p_t = \pi(g_t)$, where $g_t = \frac{G_t}{Y_t}$. Public goods provision depends crucially on the integrity of bureaucrats, each of whom is instructed to procure f_t ($= F_t$ in (8)) units of goods using the f_t amount of public funds allocated to him. In the absence of corruption, each and every bureaucrat does this so that total public goods provision is $\widehat{G}_t = F_t$. In the presence of corruption, only non-corruptible bureaucrats (of whom there are $1 - \nu$) do this, while all corruptible bureaucrats (of whom there are ν) appropriate public funds for themselves, implying a total public goods provision of $\widetilde{G}_t = (1 - \nu)F_t$. These outcomes are associated with $\widehat{g} = \Phi$ and $\widetilde{g} = (1 - \nu)\Phi$, respectively. Correspondingly, we have $\widehat{p} = \pi(\widehat{g})$ and $\widetilde{p} = \pi(\widetilde{g})$. Evidently, $\widetilde{p} < \widehat{p}$ since $\widetilde{g} < \widehat{g}$: life expectancy is lower under corruption than under non-corruption because corruption reduces the provision of life-enhancing public services. Now recall that corruption exists (does not exist) at levels of capital, k_t, below (above) the critical level, $\overline{k}$. Given this, then life expectancy is seen to be determined endogenously in a similar way: individuals face a relatively low probability of survival ($\widetilde{p}$) at relatively low levels of development ($k_t \leq \overline{k}$), and a relatively high probability of survival ($\widehat{p}$) at relatively high levels of development ($k_t > \overline{k}$).

Based on the above, we deduce from (15) that capital accumulation takes place according to

$$k_{t+1} = \begin{cases} \kappa(k_t, \widetilde{p}) & \text{if } k_t \leq \overline{k}, \\ \kappa(k_t, \widehat{p}) & \text{if } k_t > \overline{k}, \end{cases} \tag{16}$$

where $\kappa(0, \widetilde{p}) < \kappa(0, \widehat{p})$ and $\kappa_k(\cdot, \widetilde{p}) < \kappa_k(\cdot, \widehat{p})$. This expression leads us to distinguish between two types of development regime: the first - for which $k_t \leq \overline{k}$ - is a low development regime in which corruption is pervasive, life expectancy is short and steady state capital is $\widetilde{k}^* = \kappa(\widetilde{k}^*, \widetilde{p})$; and the second - for which $k_t > \overline{k}$ - is a high development regime in which corruption is absent, life expectancy is long and steady state capital is $\widehat{k}^* = \kappa(\widehat{k}^*, \widehat{p})$. The presence of threshold effects means that the evolution of the economy and its final destination can be radically different under different circumstances. Precisely which steady state equilibrium the economy converges to depends critically on the relationship between $\overline{k}$ and $\widetilde{k}^*$. We show this diagrammatically in Figure 1, where k_0 denotes the initial stock of capital.

Suppose that $\overline{k} < \widetilde{k}^*$. Starting from k_0, the economy evolves along the low capital accumulation path, $\kappa(\cdot, \widetilde{p})$, displaying a high incidence of corruption and a low rate of life expectancy. On reaching $\overline{k}$, there is a jump to the high capital accumulation path, $\kappa(\cdot, \widehat{p})$, as corruption disappears and life expectancy increases such that the economy converges to the high steady state equilibrium, $\widehat{k}^*$. This chain of events describes a process of transition from the low development regime to the high development. Yet there is nothing in the model to guarantee that this will happen. Suppose, conversely, that $\overline{k} > \widetilde{k}^*$. Starting again from k_0, the economy is now destined to remain on the low growth path, $\kappa(\cdot, \widetilde{p})$, and to converge to the low steady state equilibrium, $\widetilde{k}^*$, without any attenuation of corrupt activity or any improvement in life expectancy. To the extent that the high steady state equilibrium, $\widehat{k}^*$, would be attained if $k_0 > \overline{k}$, the model now describes a situation where limiting outcomes depend fundamentally on initial conditions: that is, there are multiple, history-dependent long-run equilibria, including a poverty trap equilibrium in which corruption remains high and life expectancy remains low.

The existence of multiple equilibria means that countries with essentially the same structural characteristics, but different initial conditions, may face very different prospects in terms of their economic development, quality of governance and demographic transition. For countries located below the threshold level, $\overline{k}$, these prospects would look decidedly bleak, unless there was the possibility of a fundamental adjustment that could produce a 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 the low development regime to the high development regime 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. 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 corruption, development and demography may be persistent, rather than transitory, fixtures of the global economy.

5 Conclusions

Economic development and demographic transition have been studied from many different angles, and economists are now furnished with a much a better understanding of the mechanisms involved and the interactions between them. The analysis in this paper offers a further perspective that is particularly relevant in the current climate of debate about the role of governance and the effects of corruption. Such issues have become an overriding concern among all major international development agencies and are likely to remain so for the foreseeable future. For the most part, however, they have yet to be incorporated systematically into macroeconomic models and have yet to be analysed with the methodological rigour of modern macroeconomic theory. This is no doubt due to the complex, multi-dimensional nature of the relationships involved, the aggregation of which may be difficult to conceptualise. Nevertheless, economists are much better equipped now than they were in the past for rising to the challenge and for making in-roads to the macroeconomics of misgovernance.

Our specific interest in this paper has been the way in which corruption can affect economic performance by undermining the effectiveness of public policy in enhancing human development. Corruption takes the form of the embezzlement of public funds, the consequence of which is to reduce the provision of public goods and services that contribute to the health and longevity of individuals. Lower life expectancy weakens the incentives to save and thereby slows down capital accumulation and growth. At the same time, the payoff from corruption decreases as growth takes place, and there is a critical level of capital beyond which corruption disappears. Accordingly, the model generates both a negative, two-way causal relationship between corruption and development, and a positive, two-way causal relationship between development and longevity. These features are reflected in the existence of multiple development regimes, transition between which may or may not be feasible. In the event of the former, the economy converges to a unique limiting outcome associated with a high level of development, a low incidence of corruption and a high rate of life expectancy. In the event of the latter, initial conditions dictate whether the economy converges to the same steady state or to a poverty trap equilibrium in which development is repressed, corruption is widespread and life expectancy is short. These implications are a result of the dynamic general equilibrium nature of our analysis, which allows us to provide an account of the joint, endogenous determination of economic, demographic and governance outcomes.

Corruption may well be a problem in all countries of the world, but it is particularly acute among less developed economies, where the incentives that drive corrupt practices are often strong and resistant, whilst the forces that oppose them are typically weak and fragmented. Perpetrators of such practices may have privilaged in-roads to the legal infrastructure, offering them the opportunity to avoid prosecution. Dishonest behaviour at one level in public office is often contagious and often supported by dishonest behaviour at other levels. The abuse of power can create its own stubborn, self-sustaining momentum by strengthening the very incentives that motivate it in the first place. And the level of corruption at any moment in time may have more to do with what has happened in the past than what is currently being done to counter it. For these and other reasons, the fight against corruption is fraught with difficulties - difficulties that are confronting many countries of the world which appear to have become ensnared in the type of poverty trap equilibrium described by our analysis.

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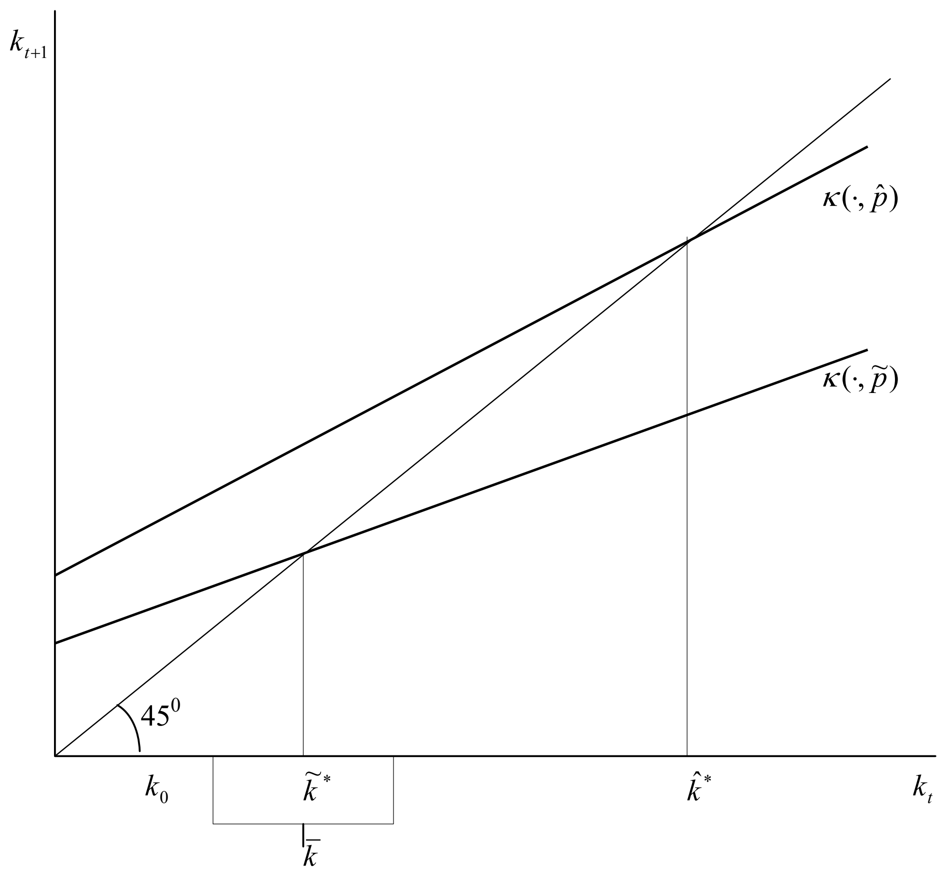
Figure 1



k_{t+1}
$\kappa(\cdot, \hat{p})$
$\kappa(\cdot, \tilde{p})$
45^0
k_0
$\tilde{k}^*$
$\hat{k}^*$
k_t
$\bar{k}$