

Strategic Interaction between Corrupt Governments in a Growth Model

Tom Skladzien *

June 2007

Abstract

This paper investigates the consequences of strategic interaction between corrupt governments on economic growth. I derive a growth model where corruption is the endogenous result of a self-seeking government. The implications of endogenous corruption on economic growth are investigated. The model is then expanded to a two-country setting and solved for both the competitive Nash and cooperative equilibrium. The negative consequences of corruption can be significantly reduced through inter-governmental competition, thus providing a further argument for fiscal decentralization in the context of self-seeking governments. An empirical analysis of the effect of decentralization on corruption is performed which supports the main theoretical result.

*Department of Economics, Washington University in St Louis. Email: trskladz@artsci.wustl.edu. I wish to thank Paul Rothstien, Gaetano Antinolfi, Steven Faz-zari, Raul Barreto and Andrew Leigh for helpful comments and the Center for Research in Economics and Strategy at the Olin School of Business at Washington University in St Louis for financial support. All errors are my own.

Introduction

Corruption has been an object of study for political scientists, sociologists, anthropologists and law scholars for the greater portion of the last forty years. It has only been relatively recently however that corruption has been widely analyzed by the economics profession. As economists have modeled corruption in various settings, it has become clear that there exist many different types of and facets to corruption.

The economics literature has largely focused on the micro causes of corruption as in Shleifer and Vishny (1998). This approach considers corruption in the context of a principal-agent problem, either between a benevolent government and a selfish bureaucrat or a civilian population and a selfish government, and attempts to assess the merits of various policies based on deterrence and punishment designed to limit corruption. Other approaches consider the possibility of efficiency enhancing corruption in the presence of inefficient regulation, as in Shleifer and Vishny (1994).¹ We know that corruption can have severe consequences for the growth experience of economies. It is one of the primary reasons given for the African continent's poor growth record, to give but one example.² A small but growing literature explores the growth effects of corruption. Barreto (2000) develops a growth model that generates endogenous public sector corruption. In his model, public services are performed by self seeking bureaucrats who have an incentive to exploit their monopoly power to some degree thus capturing corruption rents. This behavior decreases welfare and economic growth along the balanced growth path but also has the potential to increase welfare if it provides a way around government red tape. Neeman, Paserman, and Simhon (2003), develop a model in which a small open corrupt economy suffers as a result of capital mobility. Corruption income is transferred overseas to avoid being confiscated domestically, thus lowering the domestic capital stock, with naturally negative consequences for economic growth.

While this literature has come a long way towards increasing our understanding of corruption, its causes and methods for its deterrence, there remain many unanswered questions concerning corruption generally and cor-

¹ For a comprehensive review of the approaches to the economic modeling of corruption see Aidt (2003)

²For a review of the multi-disciplinary literature on the growth of African countries see Ellis (2005)

ruption's effect on economic growth in particular. For example, if we take the global economy as a finite collection of nations or a national economy with a finite set of regional governments, it is apparent that governments are not isolated agents. The interplay between governments in both cases above have long been studied, but not in the context of corrupt governments and economic growth. Specifically, there has been no attempt in the literature to consider the consequences of strategic interaction between corrupt governments that exist in a world of free moving capital. This possibility of strategic interaction beckons several new questions. For example, what are the effects of strategic competition between corrupt governments on the return to capital, both private and public? Perhaps most importantly, what are the welfare consequences of government centralization versus decentralization in the presence of corrupt governments?

The literature on fiscal competition has explored issues of interdependent governments, due to shared tax bases and various other mechanisms. Usually decentralization leads to an inefficiently low provision of public goods as Nash tax rates are too low. Zodrow and Mieszkowski (1986) pioneered this literature and it has flourished along several lines not relevant to our discussion here ³. Another branch of this literature assumes that governments are neither entirely benevolent nor corrupt but Leviathans. In this case, as in Edwards and Keen (1996), tax competition again lowers the provision of public goods, but this serves to improve welfare as a Leviathan government is to some degree concerned with maximizing the size of the public sector at the cost of overall welfare.

In this paper, I present a slightly different approach to the modeling of corruption than that most prevalent in the literature. I consider a government that is self-seeking and constrained not by a principal, such as an electorate, but by the behavior of private agents in the economy and the implied behavior of the private sector as a whole. This is a very basic study of corruption in the sense that I am interested in a type of corruption that exists regardless of institutional frameworks. It requires only the existence of a competitive private sector and a self-seeking government. One could easily argue that this form of corruption exists in all countries, and specific institutional con-

³ For a detailed summary of the tax competition literature see Wilson and Wildasin (2004)

straints serve to limit this corruption to various degrees in different countries.

The question of how to specifically model corruption as a form of behavior is intimately related to the definition of corruption one chooses to employ. For the purposes of this paper, corruption is defined as an action taken by the government for its own benefit as opposed to the benefit of consumers. This is simply the standard definition of public-sector corruption as an abuse of public office for private gain, applied to a self-seeking government in a growth model. If we now consider the government as a monopolist in the provision of some good or service, an exercise of this monopoly power leading to a gain for the government constitutes a corrupt act. This is a natural and powerful definition of public sector corruption which is not new in the literature. It can be found in Shleifer and Vishny (1993) as well as Barreto (2000). The appeal of this approach is largely derived from the undisputable fact that governments do have monopoly power over the provision of certain goods and services. Indeed the very nature of government is closely related to the existence of monopoly power, as is demonstrated through the definition of a state as an entity with monopoly power over the use of force.

The theoretical model presented below suggests that corruption leads to decreased steady state growth and consumer welfare. However inter-governmental competition is found to be welfare improving as it reduces the ability of each government to exploit its monopoly in the provision of the public good. This suggests that decentralization acts as a break on corruption in a growing economy. This conclusion is empirically tested using several different specifications and measures of corruption. Significant evidence is found that decentralization is related to lower levels of corruption as the model would suggest.

The paper is organized as follows. Section 1 gives a brief outline of the model with only one country. The model is solved for both the corrupt government and benevolent government case. Section 2 extends this single country model to a two country setting. In the case of corrupt governments, the model is solved for both Cooperative and Nash equilibria. These two cases are compared to each other, as well as to the benevolent case, through simulations with standard parameter values. Section 3 explores the empirical links between corruption and government decentralization through a cross-country study. Section 4 concludes.

1. Corruption in a Single Country

The model is based on Barreto (2000)'s model of endogenous corruption in a neoclassical growth model. The economy is inhabited by a private producer, a private consumer and a government which produces a single input into private production. This input can be thought of as a general publicly produced input required for private production such as infrastructure. Both the producer and consumer act competitively with respect to each other and the government. The government acts according to its type, either corrupt or benevolent. Regardless of the government's type, at each instant it moves first by setting its policy variable, the amount of capital it wishes to employ as public capital in the production of its input, after which the private agents optimize their respective objective functions.

1.1 Private sector Production

The private sector is represented by a representative consumer and a representative producer. The producer employs a Cobb-Douglas production technology which exhibits decreasing returns in the two factors (private capital and public input) separately but constant returns jointly. This is a standard assumption in the literature on public goods and economic growth. It is assumed that there is no labor input into production (either private or public) for the simple reason that this assumption is entirely innocuous while the inclusion of a labor input complicates the model once we begin to consider the labor shares of the two sectors, private and public. The results are entirely unaffected by the inclusion of a labor input while the model becomes significantly more cumbersome⁴. It is the presence of the public good in private production which generates socially constant returns and thus long run growth⁵. Output is given by the standard production function,

$$y = \hat{f}(k_p, G) = AG^\alpha k_p^{1-\alpha} = k_p A \left(\frac{G}{k_p}\right)^\alpha = k_p f\left(\frac{G}{k_p}\right),$$

where k_p is private capital and G is the public input. The producer maximizes profits and so in equilibrium each factor receives its marginal product and

⁴ See Barreto (2005) for an example of a similar model which includes labor

⁵ See Barro and Sala-I-Martin (1992) for a detailed review of the role of public goods in models of economic growth

profits equal zero. So

$$r = \frac{\partial y}{\partial k_p} = (1 - \alpha)f\left(\frac{G}{k_p}\right)$$

and

$$P = \frac{\partial y}{\partial G} = \frac{\alpha k_p f\left(\frac{G}{k_p}\right)}{G},$$

where r and P are the prices of private capital and the public good respectively. It is worth noting that the producer does have a demand for the public input which gives a price P given the level of G the government provides. In turn, the government is constrained by this demand when choosing G , as is explained below.

1.2 Private sector Consumption

The consumer owns the entire capital stock of the economy and consumes and saves out of the returns to this capital stock. The capital stock can be divided into capital employed by the private sector, and capital employed by the public sector. As capital is interchangeable between these two sectors, in equilibrium it earns the same return. Thus the consumer's budget constraint is given by

$$rk_p + rk_g = c + s$$

where $s = \dot{k} = \dot{k}_p + \dot{k}_g$, k_g is capital employed in the public sector, k_p is capital employed by the private sector, the time subscripts are omitted, and total capital is given by $k = k_p + k_g$. The consumer maximizes inter-temporal utility $U(c) = \int_0^\infty u(c)e^{-\rho t} dt$ taking k_g as given. I assume that

$$u(c) = \frac{c^{1-\sigma} - 1}{1 - \sigma}.$$

The solution to the consumers optimization problem is standard giving a growth rate of consumption of

$$\frac{\dot{c}}{c} = \frac{1}{\sigma}(r - \rho).$$

Using the expression for r above we have;

$$\frac{\dot{c}}{c} = \gamma = \frac{1}{\sigma} \left((1 - \alpha)A \left(\frac{G}{k_p} \right)^\alpha - \rho \right).$$

1.3 Government behavior

In order to better understand the impact on the economy of a corrupt government, I contrast a corrupt to a benevolent government. As we are dealing with public sector corruption, the relevant definition of corruption is an abuse of public office for private gain. In the context of this model, the government has monopoly power over the production of the public input G . The government produces this input with public capital it hires from the private consumer, while it pays for this public capital out of the returns it receives for the supply of the public input. The government charges the private producer a user fee P , for the use of the public input. As private and public capital are interchangeable, the government must pay the capital it hires the private return to capital. Therefore the government does not explicitly tax the private sector but acts as an intermediate goods supplier. An abuse of this monopoly power for its own gain constitutes corruption. Therefore if the government acts as a monopolist with respect to the private sector and consumes its revenues, it is said to be corrupt.

Any government's income is equal to its revenue minus its costs. In the current model, the government's revenue is given by the price received for its public input multiplied by the amount of public input provided at each instant. The government's costs are given by the price paid to public capital hired multiplied by the amount of public capital hired at each instant.

In order to simplify the problem once we allow for two competing governments, I consider a government that does not save. This implies that the private consumer does all of the economy's savings and the government's problem is reduced to a static one. As the private consumer owns all of the economy's capital stock, this does not seem unreasonable. Indeed one could argue that to have an infinitely lived government agent who exploits the government's monopoly power is less reasonable than a continuum of agents that are each able to consecutively exploit the government's monopoly power for an instant of time. In addition, the government employs a linear technology in the production of the public input. Following Barreto (2000), the amount of public input minus the amount of capital required to produce it is a measure of public sector production inefficiency or red tape and is assumed to be exogenous. The single country results outlined below do not greatly differ from those of Barreto (2000), who considers a single corrupt government that

is able to save.

The government produces the public input into private production utilizing a linear production function $G = vk_g$, where $v \in (0, 1]$ represents red tape or government production inefficiency.

The government's monopoly rents or income z , at each instant is given by

$$z = PG - rk_g$$

which reduces to

$$z = [\alpha k_p - (1 - \alpha)k_g]f\left(\frac{G}{k_p}\right)$$

1.3.1 Corrupt Government

The corrupt government chooses the amount of capital to hire as public capital to maximize its income given by z above at each instant. The corresponding first order condition can be expressed as,

$$\frac{k_g}{k_p} = \hat{k}^c = \frac{\alpha^2}{1 - \alpha^2}$$

This implies that in equilibrium, the output of a corrupt economy is given by

$$y^c = Av^\alpha \left(\frac{\alpha^2}{1 - \alpha^2}\right)^\alpha k_p$$

and the return to private capital will be

$$r^c = (1 - \alpha)Av^\alpha \left(\frac{\alpha^2}{1 - \alpha^2}\right)^\alpha$$

which is decreasing in α and so the growth rate of consumption, being linear in r^c , is also decreasing in α . This is not surprising. In the presence of a corrupt government, the more private production relies on the public input, the lower is the growth rate of private consumption.

The economy's equilibrium corruption rate is given by

$$\frac{z}{y^c} = \frac{\alpha(1 - \alpha)}{(1 - \alpha^2)}.$$

It is worth noting that the corruption rate is purely a function of α , the weight of the public input in production. No other aspect of the economy plays any role in determining the corruption rate other than the relative importance of public goods in private production. In addition, it can be shown that the corruption rate is increasing in α , which would be expected. The more important the publicly produced input is in production, the greater is the monopoly power of the government and hence equilibrium corruption.

1.3.2 Benevolent Government

The benevolent government acts as a central planner would, equalizing the marginal product and therefore return of both types of capital. In essence the government chooses k_g to maximize output which implies equalizing the total derivatives of output with respect to k_g and k_p . Therefore we have, $r = \frac{\partial y}{\partial k_g}$, which implies that

$$\frac{k_g}{k_p} = \hat{k}^b = \frac{\alpha}{1 - \alpha}.$$

This implies equilibrium output is equal to

$$y^b = Av^\alpha \left(\frac{\alpha}{1 - \alpha} \right) k_p > y^c.$$

So as we would expect, output in the economy inhabited by a benevolent government is higher than that of the corrupt economy at every instant. It is easy to show that the growth rate of consumption in the benevolent economy is higher than the growth rate of consumption in the corrupt economy as

$$r^b = (1 - \alpha)Av^\alpha \left(\frac{\alpha}{1 - \alpha} \right)^\alpha > r^c.$$

It is also simple to show that government income is zero and hence corruption income is zero in the benevolent case as we would expect. The resulting level of public capital hired by the government is identical to that in Barro (1990) in his analysis of public goods within endogenous growth models, if we assume no red tape. This is evident if we solve for the equilibrium capital shares, $k_p^b = (1 - \alpha)k^b$ and $k_g^b = \alpha k^b$. If red tape is not assumed to be zero, the effective marginal product of public capital deviates from its realized return by a factor proportional to the amount of red tape present. Comparing the

capital shares in the benevolent case with those of the corrupt case, which are given by $k_p^c = (1 - \alpha^2)k^c$ and $k_g^c = \alpha^2 k^c$, it is evident that the share of public capital in the presence of a corrupt government is below the welfare maximizing level which prevails in the benevolent case. This is due to the government restricting its hiring of public capital in order to increase its real price and earn monopoly rents. Effectively, the corrupt government creates a wedge between the real return to public and private capital in order to earn corrupt income. This wedge is responsible for lowering the return to private capital and therefore consumption growth and welfare.

1.4 Balanced Growth Equilibrium

A balanced growth path is defined as usual by;

$$\frac{\dot{c}}{c} = \frac{\dot{y}}{y} = \frac{\dot{k}}{k} = \frac{\dot{k}_p}{k_p} = \frac{\dot{k}_g}{k_g} = \gamma.$$

A balanced growth equilibrium occurs on a balanced growth path when consumers, firms and the government are maximizing their respective objective functions. Hence we know that the growth rate of the economy is lower in the corrupt case than in the benevolent case along the balanced growth path, which implies consumer welfare is lower as a result⁶.

2. Two Country Model of Corrupt Governments

In this model, a private consumer owns the entire capital stock of each country as before, but is now allowed to invest in the capital market of both countries. For simplicity, and without a loss of generality, the consumer can only consume the output of the economy from which her income is generated. As the two countries' consumer goods are assumed to be perfect substitutes, this assumption only serves to simplify the analysis. In equilibrium the consumer allocates her capital such that the private rate of return between both countries is equal. The private producer acts as before but now is able to hire the foreign country's capital stock. The governments of each country act as before, but now know the global capital constraint in order to allow for strategic interaction. In addition governments know the return to private capital is equal between the two countries. This significantly complicates

⁶ As this is a modified Ak model, growth can be treated as a measure of welfare.

the corrupt government's optimality condition and no closed form solution is possible. However, with the aid of simulations, significant results can still be derived.

2.1 Private sector consumption

For simplicity I assume that the global capital stock k is owned by a single consumer who lives in either one or neither of the economies. She derives income from rents paid on his capital stock, both by the private producers and the public sectors in each economy. The consumer can either save or consume out of this income. Again labor is assumed to be zero and not required for production for simplicity. Thus her budget constraint at any given instant is given by

$$c + s = r_i k_p^i + r_j k_p^j + r_i k_g^i + r_j k_g^j \quad (1)$$

where r_i and r_j are the returns to private capital in economy i and j respectively, the superscripts on capital indicate the region in which the capital is invested, the subscripts indicate whether the capital is private or public and total capital is given by

$$k = k_p^i + k_p^j + k_g^i + k_g^j. \quad (2)$$

For simplicity, the consumer is restricted to consuming the output of the economy from which her income is generated. Therefore we can write

$$c_i = r_i k_p^i + r_i k_g^i - s_i$$

where s_i is savings done in economy i . Likewise

$$c_j = r_j k_p^j + r_j k_g^j - s_j.$$

It follows that $c = c_i + c_j$ and $s = s_i + s_j$. In addition we require $c_i \geq 0$ and $c_j \geq 0$. This holds trivially in equilibrium. The consumer derives utility from consumption and maximizes an inter-temporal utility function

$$U(c) = \int_0^{\infty} u(c) e^{-\rho t} dt \quad (3)$$

where

$$u(c) = \frac{c^{1-\sigma} - 1}{1-\sigma}.$$

Taking public capital as given, the consumer maximizes (3) subject to (1) and (2). As all savings are done by the private consumer, it follows that $s = \dot{k}$ and rearranging (1) we can write the Hamiltonian as

$$H = u(c) + \psi(r_i k_p^i + r_j k_p^j + r_i k_g^i + r_j k_g^j - c)$$

and the Lagrangian as

$$L = H + \lambda(k - k_p^i - k_p^j - k_g^i - k_g^j).$$

The First Order Conditions are

$$\frac{\partial L}{\partial c} = 0$$

which implies the standard result

$$\dot{\psi} = u'' \dot{c} \tag{4}$$

in addition,

$$\frac{\partial L}{\partial k_p^i} = \psi r_i - \lambda = 0 \tag{5}$$

$$\frac{\partial L}{\partial k_p^j} = \psi r_j - \lambda = 0 \tag{6}$$

and

$$\frac{\partial L}{\partial k} = \frac{\partial H}{\partial k} + \lambda = 0 \tag{7}$$

$$\frac{\partial H}{\partial k} = \rho \psi - \dot{\psi} \tag{8}.$$

Combining (5) and (6) we have

$$r_i = r_j = r \tag{9}$$

and combining (7), (8) and (4) we have the standard growth rate of consumption

$$\frac{\dot{c}}{c} = \frac{1}{\sigma}(r - \rho) \tag{10}.$$

2.2 Private Production

Each country is inhabited by a private producer who acts competitively. Producers have access to an identical Cobb-Douglas technology

$$y_i = \hat{f}_i(k_p^i, G_i) = AG_i^\alpha k_p^{i,(1-\alpha)}, i = 1, 2 \quad (11).$$

Producers seek to maximize profits given by

$$\pi_i = y_i - r_i k_p^i - P_i G_i, i = 1, 2 \quad (12)$$

where G_i is the public input produced in economy i and P_i is its price. Maximizing (12) subject to (11), we have the standard Cobb-Douglas factor prices

$$\frac{\partial y_i}{\partial k_p^i} = r_i = (1 - \alpha) f\left(\frac{G_i}{k_p^i}\right) \quad (13)$$

$$\frac{\partial y_i}{\partial G_i} = P_i = \frac{\alpha k_p^i f\left(\frac{G_i}{k_p^i}\right)}{G_i} \quad (14)$$

where

$$f\left(\frac{G_i}{k_p^i}\right) = A\left(\frac{G_i}{k_p^i}\right)^\alpha, i = 1, 2.$$

Thus profits are zero and each factor is paid its marginal product as before.

2.3 Government behavior

As before, the Government in each region produces an input into private production using the linear technology

$$G_i = v_i k_g^i \quad (15)$$

where $v_i \in (0, 1], i = 1, 2$ represents public sector inefficiency or 'red tape' as before.

A benevolent government chooses the amount of public capital to hire, and thus the amount of public input to produce, by equating the marginal product of private and public capital,

$$\frac{\partial y_i}{\partial k_p^i} = \frac{\partial y_i}{\partial k_g^i}, i = 1, 2$$

subject to (9), which reduces to

$$\alpha k_p^i f\left(\frac{G_i}{k_p^i}\right) = (1 - \alpha) k_g^i f\left(\frac{G_j}{k_p^j}\right). \quad (16)$$

In the case of two benevolent governments, the model reduces to a standard two-country growth model with public inputs. The two countries are symmetrical and the resulting equilibrium is identical to the single country case. This is not surprising as a benevolent government acts mechanically by setting the marginal return to its public capital equal to the marginal return of private foreign capital. If both governments are benevolent, this condition is equivalent to that of a single country as above.

2.3.1 Nash corrupt equilibrium

A corrupt government's income is equal to

$$z_i = P_i G_i - r_i k_g^i \quad (17)$$

A corrupt government maximizes (17) subject to (2),(13),(14),(15) and (9) and taking k_g^j as given. The first-order condition is

$$\alpha f^i + \alpha k_p^i \left[\frac{\alpha}{k_g^i} f^i + \frac{\alpha}{k_p^i} f^i \right] - (1 - \alpha) f^j - \alpha(1 - \alpha) \frac{k_g^i}{k_p^i} f^j = 0 \quad (18)$$

where $f^i = f\left(\frac{G_i}{k_p^i}\right)$.

The equilibrium is symmetric given symmetric economies, which is assumed to be the case. In this case the first order condition reduces to

$$\frac{k_p}{k_g} + \frac{k_g}{k_p} = \frac{1 - \alpha - \alpha^2}{\alpha}$$

This first order condition does not allow for a closed-form solution to be derived, but a Nash equilibrium does exist as long as the two economies are symmetrical.

2.3.2 Cooperative equilibrium

A cooperative equilibrium can be calculated through the maximization of total government income $z = z_i + z_j$ through the choice of both country's public capital at each instant. The corresponding first-order conditions are identical to that of a corrupt government in a single country for each country.

This implies that a coordinating authority acts as a single corrupt government, as would be expected.

2.4 Balanced Growth Equilibrium

A balanced growth path is reached when

$$\frac{\dot{c}}{c} = \frac{\dot{k}_p^i}{k_p^i} = \frac{\dot{k}_g^i}{k_g^i} = \frac{\dot{y}^i}{y^i} = \gamma, i = 1, 2.$$

If in addition private producers, consumers and governments are maximizing their respective objective functions, the economies have reached a balanced growth equilibrium.

2.5 Simulation results

In order to better compare the results of each case, simulations of the three cases were performed and are presented in table 1 and 2 below. Initial capital is set to 1 and parameter values are set to $\alpha = 0.3, \rho = 0.02, \sigma = 10$ and $A = 1$. It should be noted that as both the cooperative, competitive and benevolent equilibrium yield symmetrical results, only the results for one country are presented.

Table 1: **Cooperative, Nash and Benevolent simulations**

	v=1		
	Benevolent1	Nash	Cooperative
Growth rate	0.052	0.044	0.031
Government size	0.300	0.199	0.073
Savings rate	0.067	0.067	0.066
Consumption rate	0.933	0.807	0.690
Corruption rate	0.000	0.126	0.245

Perhaps the most striking result evident in Table 1 is the comparison between the corruption rates of a cooperative corrupt economy that is centralized compared with a Nash corrupt economy that is decentralized. The corruption rate is almost halved simply due to the competition between two corrupt governments. This remains true regardless of the degree of red tape

(the value of v). This is a strong indication that in the presence of corrupt governments, centralization of government activity to a single government entails a high price in terms of growth and welfare.

While striking, this result is not surprising. A Nash equilibrium between two corrupt governments implies a lower payoff to each government than cooperation. This is what we would expect. However, in the present context, this lower payoff to the governments' implies higher welfare to the private consumer, and thus is a socially beneficial outcome. One can easily imagine a corrupt government wanting to maximize its role in the economy in order to maximize its potential to gain corruption rents. This indicates that decentralization decreases corruption and it may partially explain why states that are considered to be highly corrupt are often also highly centralized. This result is explored in greater detail below. It also provides a reason why corrupt governments might restrict the movement of goods and factors across borders.

As would be expected, the government, as measured as the size of total inputs into production, is larger in the decentralized Nash case. This is a new result when compared to the tax competition literature. In that literature, inter-governmental competition always decreases public good provision, regardless whether the government is benevolent or a Leviathan. If the government is benevolent, competition is welfare reducing while if it is a Leviathan competition is welfare improving. In the present case, inter-governmental competition increases government good provision to the benefit of consumer welfare. This result may seem counter intuitive. It seems intuitive to think of a corrupt government as a large government. However, government size is measured here as the proportion of publicly provided goods into private production, which can be termed effective government and is analogous to public good provision. If we measure government size as the proportion of output consumed by the government or government revenue, the intuitive result of a large corrupt government stands.

Table 2: **Growth comparison**

v	Growth Rate	
	Cooperative	Nash
1	0.031	0.044
0.9	0.030	0.043
0.8	0.029	0.041
0.7	0.027	0.039
0.6	0.026	0.038
0.5	0.025	0.035
0.4	0.023	0.033
0.3	0.021	0.030
0.2	0.018	0.026
0.1	0.014	0.021

Table 2 analyzes the effect of the degree of red tape on growth rates in both the Nash and Cooperative corrupt cases. It is clear that the benefits of competition between corrupt governments in terms of growth are quite high, although they decrease as the degree of red tape increases. With no red tape, a decentralized economy grows a full 1.3 percentage points faster than its centralized counterpart, while with an extremely high degree of red tape $v = 0.1$, this difference is reduced to 0.7 of a percent. It should also be noted that the degree of red tape that must prevail in a decentralized economy in order for a consumer to be indifferent between such an economy and one that is centralized but experiences no red tape is very high, $v = 0.3$. This is quite a striking result as $v = 0.3$ implies that 70% of public capital hired is wasted. So a consumer is indifferent between living in a centralized economy that wastes 10% of its public capital and a decentralized economy that wastes 70% of its public capital. We can say at this point of indifference, competition between corrupt governments is worth 60% of public capital hired at each instant from the consumers point of view. This is a further indication of the large effect of competition in terms of constraining government behavior, reducing the corruption rate and increasing growth. Indeed, it indicates that the benefits of decentralization can be expected to be significantly greater than the benefits of decreased red tape or government waste in a centralized corrupt economy.

3. Empirical analysis

There has been little attention in the literature given to the question of how decentralization may effect corruption, either in terms of possible mechanisms through which decentralization may limit corruption or in terms of evidence that such affects exist. However there do exist some exceptions to this. Arikan (2004) analyzes the effect of decentralization on corruption in a modified tax competition model and concludes that decentralization does lead to lower levels of corruption through the effect of increased inter-governmental competition. The mechanism for this affect is basically the same as the familiar mechanism which decreases tax rates and public service provision in tax competition models. As a government is forced to set lower tax rates with an increase in inter-governmental competition, it is restricted in the amount of tax revenue and therefore corruption earnings it can generate. Arikan (2004) goes on to empirically test the relationship between decentralization and corruption in a cross-country framework. While this analysis does not produce strong results, it does provide some evidence that the hypothesized link exists. The author attributes the lack of strong empirical results to a small sample size of 40 observations.

More robust evidence of the link between decentralization and corruption is presented in Fisman and Gatti (2002) who also use a cross-country framework. While both studies use similar measures of decentralization, Arikan (2004) use the Corruption Perception Index (CPI) developed by Transparency International as their main measure of corruption and a country's land area as an instrument for decentralization. In contrast, Fisman and Gatti (2002) use the International Country Risk Guide's corruption index as their main measure of corruption as well a legal origin as their instrument for decentralization. This difference provides a slightly larger data set as well as a better performing instrument. As a result of these factors, Fisman and Gatti (2002)'s results are stronger and more robust than Arikan (2004)'s. In summary, Fisman and Gatti (2002) find a strong and consistent positive relationship between decentralization and low levels of corruption. These results are persistent when controlling for erogeneity bias as well as possible omitted variable bias.

In order to further investigate the empirical links between corruption and decentralization, I perform a cross-country analysis similar to those of Fisman and Gatti (2002) and Arikan (2004). However, I expand the analysis by

considering both measures of corruption used in the articles cited above, as well as a previously unused measure of decentralization.

3.1 Estimation methodology and data

The basic equation to be estimated using ordinary least squares is

$$Corruption_i = \alpha + \beta Decentralization_i + \gamma X_i + \varepsilon_i, \quad (18)$$

where X_i is a vector of other explanatory variables and ε_i is a white noise error term. This estimation equation captures the basic principle that decentralization has a direct effect on the level of corruption in an economy while allowing other factors to also play a role. In what I term the basic model X_i comprises; log of GDP per capita, a measure of democracy and the log of population. The inclusion of the log of GDP aims to capture the level of economic development of a country. The inclusion of the level of development is standard in the literature and is based on the idea that poor countries might be expected to experience higher levels of corruption, which the theoretical model presented above also suggests. The log of population measures a country's absolute size. This is an important inclusion as a larger country could be expected to adopt a more decentralized fiscal system in order to better cater to a diverse range of public preferences. However, larger countries might also exploit economies of scale in the provision of public services (Alesina and Wacziarg (1997)) and be more likely to have few public service outlets per capita. In this case a higher degree of corruption might be expected as individuals who are able to might seek to bribe public officials in order to receive prompt service. Therefore, not including a measure of country size could lead to spurious results. Both the population and the GDP data were taken from Heston, Summers, and Aten (2002) for the period 1995-2000.

The inclusion of an index of democracy is intended to control for the idea that public involvement in the political process might act as a restraint on government corruption. This affect is controlled for by an index of civil liberties in Fisman and Gatti (2002) and an index of press freedom in Arikan (2004). I choose to use the index of democracy as it is democracy that ultimately determines the public's ability to punish and thus deter corrupt governments. While the results are not presented, specifications which included both civil liberties and press freedom were run but did not produce

starkly different results. The democracy index takes a value between 0 and 100 (where a higher number indicates a greater degree of democracy) for the period 1970 to 1994 and is taken from La Porta, Lopez-de Silanes, and Shleifer (2002).

The base model is expanded to include one other variable that is thought to play a significant role in determining a country's level of corruption. Openness, as measured by imports plus exports as a share of GDP, is included for several reasons and is also taken from Heston, Summers, and Aten (2002) for the same period. Ades and di Tella (1997), Neeman, Paserman, and Simhon (2003), Fisman and Gatti (2002) and Arikan (2004) all find evidence for a negative effect of openness on corruption. As outlined by Leite and Weidmann (1999), this affect is thought to be due to the fact that restrictions to trade create rents which in turn provide opportunities for corrupt earnings by public officials.

In order to obtain robust results on the effect of decentralization on corruption, I use two measures of corruption as well as two measures of decentralization. The two corruption measures are the most commonly used measures in the literature, the first being the International Country Risk Guide's corruption index (CORRUPT) taken from La Porta, Lopez-de Silanes, and Shleifer (2002) for the period 1982-1995 and the second being Transparency International's Corruption Perception Index (CPI) for the year 2005 ⁷. The CPI and CORRUPT were used by Arikan (2004) and Fisman and Gatti (2002) respectively. In addition, it is worth noting that both measures of corruption are inverse measures, where a higher value indicates a lower level of corruption.

The two measures of decentralization I use are the share of sub-national (local and state) expenditure and revenue in total government expenditure and revenue. While the sub-national expenditure share is a common measure of decentralization used in the literature, used in both Fisman and Gatti (2002) and Arikan (2004), the share of sub-national revenue is not. However, a strong case can be made that a sub-national government's degree of independence is directly linked to its ability to raise revenue. For this reason I

⁷Transparency International's CPI is freely available at <http://www.transparency.org/policy.research/surveys.indices/cpi> for the years 1998-2006

deem the sub-national share of revenue an important measure of decentralization and include it in my analysis. Both these measures are taken from the World Bank's Country Database on Fiscal Decentralization which in turn is taken from the IMF's Government Financial Statistics Yearbook (2003) and are for the year 1997.

As is alluded to above, the first stage of the analysis is an ordinary least squares estimation of equation 18 above with the various measures of corruption, decentralization and X_i vectors. The second stage of the analysis is a two stage least squares estimation in order to control for the possible endogeneity of decentralization. I follow Fisman and Gatti (2002) and use the legal origin of the country in question as the instrument for the degree of decentralization. Fisman and Gatti (2002) find that legal origin performs very well as an instrument and provide some institutional arguments as to why this might be the case. While I will not go into the argument here ⁸, it centers around the observation that a centralized government system is better supported by a civil legal code as opposed to a common legal code. The legal origin dummy is taken from La Porta, Lopez-de Silanes, and Shleifer (2002).

3.2 Empirical results

The results of the ordinary least squares estimation are presented in the table below. The first thing that strikes the reader upon looking at Table 3 is the lack of significance in any decentralization variable when CPI is the dependent variable, even though the sample size is larger than when CORRUPT is the dependant variable. This result is consistent with the strength of Fisman and Gatti (2002)'s results when compared to those of Arikan (2004) if one recalls that the dependant variable was CPI in the case of Arikan (2004) and CORRUPT in the case of Fisman and Gatti (2002). When Corrupt is the dependent variable the expenditure measure of decentralization is highly significant and of the right sign (recall that as corruption is an inverse variable, a positive sign indicates more decentralization is associated with lower corruption), both in the case of the base model and when Openness is included in the estimation.

⁸For a detailed discussion of the links between legal origin and decentralization see Glos (1978)

Table 3: **Ordinary Least Squares Results**

Explanatory variables	Dependent variables							
	CPI				CORRUPT			
Exp share	0.02 (1.62)	0.02 (1.20)			0.04* (2.93)	0.05* (3.45)		
Rev share			0.02 (1.02)	0.01 (0.66)			0.03 (1.59)	0.03** (1.77)
Log of Pop	-0.60* (-2.76)	-0.76* (-3.42)	-0.49* (-2.18)	-0.68* (-2.79)	-0.90* (-3.43)	-0.72* (-2.39)	-0.88* (-3.08)	-0.78* (-2.50)
Log of GDP	4.17* (5.41)	4.12* (5.38)	3.96* (5.38)	3.97* (5.34)	2.63* (2.87)	2.72* (2.98)	2.33* (2.48)	2.32* (2.51)
Democracy	0.15** (1.72)	0.16** (1.84)	0.18* (2.22)	0.19* (2.27)	0.14 (1.65)	0.11 (1.33)	0.18* (2.19)	0.18* (2.06)
Openness		-0.01 (-1.33)		-0.01 (-1.36)		0.01** (1.70)		0.00 (0.82)
Number of obs	53	53	52	52	41	41	40	40
R-squared	0.78	0.79	0.78	0.79	0.75	0.77	0.74	0.74

t-statistics are in parentheses. * and ** represent significance at the 5% and 10% levels respectively. Standard errors are corrected for heteroscedasticity.

While the revenue measure of decentralization does not produce as strong results, it is significant at the 10% level in the expanded model that includes Openness. It is worth noting that regardless of the measure of corruption used, both economic development (as measured by log GDP) and country size (as measured by log population) have a strongly significant effect on corruption. Both of these affects are in the direction that we would hypothesize, with more development leading associated with lower corruption and a larger country size associated with greater corruption. Democracy also plays an important role in determining the level of corruption, as we would expect from theory. In all but 2 specifications it is significant (4 times at the 5% level) and of the right sign, indicating that more democracy does indeed limit a government's ability to engage in corrupt activity. Openness is insignificant in all but one of the specifications, and then only at the 10% level when Corrupt is the dependent variable, expenditure is the measure of corruption and Openness is excluded from the equation. This suggests that the degree of openness to trade does not play the large role we might think in determining a country's level of corruption.

While the results presented above provide some evidence that decentralization leads to lower levels of corruption, there is a possibility that the least squares estimates are biased as a result of the endogeneity of decentralization. If it is the case that decentralization does limit a government's ability to extract corrupt rents, then one would expect corrupt central government officials to fight against the decentralization of government services thus making decentralization endogenous to corruption. As mentioned above, in order to control for this affect, I instrument decentralization with the legal origin of the country and perform a two stage least squares analysis, the results of which are presented in Table 4 below.

Table 4: **Two Stage Least Squares Results**

Explanatory variables	Dependent variables							
	CPI				CORRUPT			
Exp share	0.08*	0.07			0.08*	0.13		
	(2.17)	(1.42)			(2.19)	(1.61)		
Rev share			0.07*	0.07			0.06*	0.09
			(2.44)	(1.53)			(2.22)	(1.60)
Log of Pop	-0.99*	-1.02*	-0.76*	-0.80*	-1.14*	-0.95*	-1.04*	-0.88*
	(-2.79)	(-3.33)	(-2.61)	(-3.03)	(-3.78)	(-2.55)	(-3.57)	(-2.63)
Log of GDP	4.47*	4.45*	3.89*	3.90*	3.06*	3.61*	2.30*	2.26*
	(4.91)	(4.79)	(4.61)	(4.60)	(2.59)	(2.19)	(2.36)	(2.23)
Democracy	0.05	0.06	0.14	0.14	0.03	-0.11	0.14	0.01
	(0.52)	(0.50)	(1.53)	(1.54)	(0.23)	(-0.42)	(1.32)	(0.70)
Openness		-0.00		-0.00		0.02		0.00
		(-0.18)		(-0.20)		(1.52)		(1.06)
Number of obs	53	53	52	52	41	41	40	40
R-squared	0.70	0.72	0.71	0.72	0.70	0.55	0.70	0.64

t-statistics are in parentheses. * and ** represent significance at the 5% and 10% levels respectively.

Once I instrument for possible endogeneity bias both measures of decentralization are highly significant (at 5%) in the base model, regardless of the measure of corruption used. This is a strong indication that corruption can indeed be mitigated through decentralization as the theoretical model predicts. However, once I expand the model to include a measure of openness this significance vanishes, even though openness itself is not signif-

icant in these specifications. One possible explanation for this result is that openness measures a degree of inter-governmental competition from overseas governments. If openness captures factor mobility between borders as well as product mobility, which we might expect it too, the theoretical results suggest that this mobility leads to greater inter-governmental competition with foreign governments that is not captured in the decentralization variable. In this case the affect I am trying to measure would be split between openness and fiscal decentralization, leaving both insignificant when both are included in the same specification.

In addition, it is interesting to note that while both country size and the level of development retain their strongly significant effects on corruption, the degree of democracy does not. Indeed in none of the specifications is democracy significant and in some the sign is reversed. This result is the exact opposite of Arikan (2004) who finds press freedom to be insignificant in least squares regressions but significant in two stage least squares regressions. While this result is intriguing, it does not have direct implication for our main thesis.

4. Conclusion

I have presented a two country model of economic growth where governments which play a crucial part in their respective economies are driven by self interest. With the presence of a public input into private production which generates constant returns and therefore long run growth, the ability of a government to exert monopoly power over the supply of this public input has significant negative consequences for the growth rate and private welfare of the economy. I have shown the affects of this self interested or corrupt behavior on the economy in isolation, as well as how it is alleviated to a large degree by competition between governments. These results indicate that government centralization or cooperation in the presence of corruption may lead to a significant loss of private welfare, far greater than can be accounted for by pure public sector inefficiency alone. In addition, the result suggests that free factor mobility may also mitigate corruption through an increase in inter-governmental competition. This implies that decentralization, as well as free trade policies, may be an effective policy in the fight against corruption. In addition, in the presence of corrupt governments, it has been shown that inter-governmental competition can increase government good provision. This is in sharp contrast to the tax competition

literature where competition always leads to a decrease in government good provision. Further work is needed to investigate the effect of increasing the number of governments which compete. It is hypothesized that the marginal benefits of inter-governmental competition will be decreasing in the number of governments, as each government's degree of market power is decreasing in the number of governments.

The results of the theoretical model are empirically tested using a cross-country framework. The results suggest that decentralization does indeed play a role in mitigating corruption. This result is not only persistent when correcting for possible endogeneity but strengthened by it. The robustness of this affect is tested by the use of two different measures of both decentralization and corruption. In addition, some indirect evidence is found that openness may also induce a degree of inter-governmental competition. The results offer further evidence that the benefits of fiscal decentralization go beyond those currently well understood.

References

- ADES, A., AND R. DI TELLA (1997): “National Champions and Corruption: Some Unpleasant Interventionist Arithmetic,” *The Economic Journal*, 107, 1023–1042.
- AIDT, T. S. (2003): “Economic Analysis of Corruption: A survey,” *The Economic Journal*, 113, 632–652.
- ALESINA, A., AND R. WACZIARG (1997): “Openness, Country Size and Government,” *Journal of Public Economics*, 3(69), 305–321.
- ARIKAN, G. G. (2004): “Fiscal Decentralization: A Remedy for Corruption,” *International Tax and Public Finance*, 11, 175–195.
- BARRETO, R. (2005): *Economic Growth Issues*. Nova Science Publishers, Inc, New York, New York, USA.
- BARRETO, R. A. (2000): “Endogenous corruption in a neoclassical growth model,” *European Economic Review*, 44, 35–60.
- BARRO, ROBERT, J., AND X. SALA-I-MARTIN (1992): “Public Finance in Models of Economic Growth,” *Review of Economic Studies*, 59, 645–661.
- BARRO, R. J. (1990): “Government Spending in a Simple Model of Endogenous Growth,” *Journal of Political Economy*, 98(5), 103–125.
- EDWARDS, J., AND . KEEN, M (1996): “Tax competition and Leviathan,” *European Economic Review*, 40, 113–134.
- ELLIS, S. (2005): “How to Rebuild Africa,” *Foreign Affairs*, 84(5), 135–148.
- FISMAN, R., AND R. GATTI (2002): “Decentralization and Corruption: Evidence Across Countries,” *Journal of Public Economics*, 83(3), 325–345.
- GLOS, G. (1978): *Comparative Law*. Fred, B Rothman and Co.
- HESTON, A., R. SUMMERS, AND B. ATEN (2002): “Penn World Table Version 6.1,” Center for International Comparisons at the University of Pennsylvania (CICUP).
- LA PORTA, R., F. LOPEZ-DE SILANES, AND A. SHLEIFER (2002): “Government Ownership of Banks,” *The Journal of Finance*, 57, 265–301.

- LEITE, C., AND J. WEIDMANN (1999): “Does Mother Nature Corrupt? Natural Resources, Corruption and Economic Growth,” IMF Working Paper 99/85.
- NEEMAN, Z., D. PASERMAN, AND A. SIMHON (2003): “Corruption and Openness,” C.E.P.R. Discussion Papers, 4057.
- SHLEIFER, A., AND R. W. VISHNY (1994): “Politicians and Firms,” *Quarterly Journal of Economics*, 109, 995–1026.
- (1998): *The Grabbing Hand, Government Pathologies and their Cures*. Harvard University Press, Cambridge, MA.
- SHLEIFER, A., AND W. VISHNY, R (1993): “Corruption,” *Quarterly Journal of Economics*, 108(3), 599–617.
- WILSON, JOHN, D., AND E. WILDASIN, DAVID (2004): “Capital tax competition: bane or boon,” *Journal of Public Economics*, 88, 1065–1091.
- ZODROW, G. R., AND P. MIESZKOWSKI (1986): “Pigou, Tiebout, Property Taxation, and the Underprovision of Local Public Goods,” *Journal of Urban Economics*, 19(3), 356–370.