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Institutions and Growth: A Simplified Theory of Decentralization and Corruption*

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Abstract

This paper aims at giving a theoretical background to the, sometimes observed, puzzling inverse correlation between the degree of decentralization and economic growth. We provide evidence that there is some interaction between decentralization and corruption in explaining growth. Within an endogenous growth model, we analyze the problem of a benevolent central government trying to determine the optimal degree of fiscal decentralization. Specifically, it can produce a public good directly, but inefficiently, or it can delegate some (or all) of the production to more efficient local bureaucrats. In the latter case, however, some resources will be wasted because of corruption and the costs linked to monitoring expenditures. With respect to the benchmark case, then, the possibility of corruption yields both a distorted allocation of resources (insufficient decentralization) and an overall under provision of the public good.

Keywords: Fiscal federalism, Corruption, Endogenous growth, Public capital, Fiscal policy

JEL Codes: H1, H2, H4, H7, D73

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1 Introduction

The financial crisis that has been propagating through the world economy since the summer of 2007, and the apparent limitations of monetary policy, brought fiscal policy to the forefront of the economic policy debate. Virtually all the countries of the G20 group designed, in the winter of 2008-09, important stimulus packages aimed at sustaining aggregate demand. Most countries, like the US, China, and the largest eurozone economies, gave priority to investment in infrastructures or in human capital, so as to reduce debt sustainability issues and to enhance complementarity with private capital. In some cases, the mobilization of such a large amount of resources has revived the fear of rent seeking and resource misuse, especially from local government officials. The Chinese stimulus plan (see Wong 2011 for details), for example, raised the issue of coordination between the central government input and the implementation by provinces and town leaders. During the discussion on the implementation of the plan party officials have been quoted as saying: "What people hate most is that local governments usually sing a different tune from central policies during implementation. Central government policies could sometimes be used by some at grassroots to seek personal gains. We've learnt grave lessons from and paid dearly for similar cases." (China Daily 2009). While not limited to them (see e.g. The Economist 2009), this problem is particularly felt in large emerging countries, where size makes it necessary to pass through local governments to efficiently provide public goods. From private conversations we gathered the information that the already impressive Chinese stimulus plan ($585bn, accounting for 7% of Chinese GDP, over the two years 2009-2010) could have been even larger in size, were it not for the doubts of the central government about its capacity to limit rent seeking and corruption during the program implementation at the local level.

Yet, a casual look at the literature is sufficient to realize that the relationship between corruption, decentralization and growth is more controversial than one would expect, and that the debate is still unsettled (remaining within the previous discussion, see for example Zhang and Zou 1998 and Jin, Qian, and Weingast 2005 for contrasting results referring to Chinese provinces). While the generally poor quality of data on decentralization and corruption may be one source of inconclusiveness, we will argue that taking into account the interaction between the efficiency gains of decentralization and rent seeking may go a long way in explaining the apparent lack of robustness of the relationship. To look into this issue we start from our own, somewhat puzzling, empirical evidence. First, we find the robust result that more corrupt countries tend to be more centralized. Then, we observe that,

contrary to most of the empirical literature, corruption is not significant once it enters into a growth regression together with decentralization. This seems to suggest that one channel through which corruption affects growth is its effect on the decision to delegate power to subnational governments. In other words, as the fear of Chinese government officials demonstrates, the existence of corruption may lead to suboptimal allocation of public spending between central and local governments.

This paper is an attempt to make sense of the empirical puzzle. We try to do this in the simplest possible framework, developing an endogenous growth model with the services of public capital, as in Barro (1990) in which a benevolent central government is confronted with the choice of providing a public good directly, but somewhat inefficiently, or delegating its provision to a local government that is more efficient while potentially corrupt. In such a simple setting, the possibility of corruption generates a distorted allocation of expenditure between levels of government, as well as an overall provision of the public good that is lower than the benchmark optimal level, as yielded by the model of Barro.

Furthermore, the model may shed light on the role of political centralization in determining the effectiveness of fiscal decentralization. It's generally accepted that the Chinese experience of fiscal decentralization in seventies and eighties was an overall success, while that of Russia in the early nineties a failure. Among the many explanations advanced, Blanchard and Shleifer (2001) emphasize differences in the degree of political centralization between these two countries. The single-party system in China implied that local bureaucrats were often appointed by the central authorities and generally lacked a strong local powerbase. In Russia, on the other hand, the wave of economic and political reforms of the early nineties produced a number of territorial cleavages with regional governors being elected and often having political affiliations drastically different from that of the central government.[1] Thus, it may be argued that fiscal decentralizations in China and Russia happened against very different political backgrounds with Chinese local bureaucrats not necessarily being less corruptible, but much more accountable to the center than their Russian counterparts. Our model can capture this phenomenon via the parameter that measures the costliness of monitoring of local bureaucrats by the central government.

The outline of the paper is as follows: the next section reviews the related literature on federalism, corruption and growth. Section 3 presents the

[1] An extreme example of this phenomenon was the emergence of the so-called "red belt" of (mostly Central-European) regions where local political elites openly supported (and often belonged to) the Communist Party. Note that this argument is not unchallenged, see Bardhan and Mookherjee (2006b), p. 184.

empirical results that motivate the paper, and highlights the link between corruption and decentralization in explaining growth. Section 4 introduces a simple and standard endogenous growth model, and derives the results on public good provision in the presence of bureaucratic corruption. We show that even within this simple setting, once we consider the choice to decentralize in conjunction with rent seeking, it is possible explain the somewhat puzzling results of section 3. Section 5 concludes and gives suggestions for future research.

2 Related literature

The foundations of fiscal federalism theory have been laid in seminal work by Musgrave (1959) and Oates (1972)[2]. The main result of the early strands of literature states that the central government should provide all public goods for which there is no heterogeneity of preferences across jurisdictions, and those for which it is impossible for local governments to properly target the users (due for example to the mobility of the tax base and/or of the beneficiaries). On the other hand, decentralization is optimal when heterogeneity of preferences (or production costs) over public goods exists across regions, together with the capacity of local governments to provide them. In that case, the provision of public goods by local governments can be tailored to the demand of their constituencies, thus improving welfare over uniform provision by the central government. This is in essence the "Decentralization Theorem" (Oates 1972), whose validity relies nevertheless on a number of conditions, the most important being the absence of externalities. If the effects of local public good provision spill over the boundaries of the jurisdiction, a trade-off emerges between the uniform provision of the public good by the central government, that internalizes the externality but loses the capacity to equate marginal costs and revenues for citizens in different jurisdictions, and the provision by the local government, tailored to the needs of local citizens but unable to take into account the externality. The trade-off between heterogeneity and externalities remains central in the more recent work on the subject, based on asymmetric information and incomplete contracts (Seabright 1996). The second assumption of the Decentralization Theorem is that the central government can only provide a uniform level of the public good across jurisdictions, i.e. that it is unable to tailor the

[2]A second important branch of the literature on fiscal federalism, initiated by Tiebout (1956), focuses on the competition between different jurisdictions, and on the effects on the overall efficiency of government action. As we focus on the relationship between the central government and a unique local government, we do not discuss this literature.

provision of the public good to local preferences. This assumption is usually justified on theoretical grounds by an informational advantage of local governments, who are closer to their constituencies, and as a consequence have a knowledge of local preferences. Following Oates' seminal contribution, a wide literature, theoretical and empirical alike, has investigated the links between decentralization, efficiency, and growth, with empirical results being rather inconclusive overall (see Martinez-Vazquez and McNab 2003, who also provide an overview of the different channels through which growth and decentralization can affect each other). Reviewing this literature goes beyond the scope of our paper.

Our work departs from Oates' framework in that the level of public good provided by the central and the local governments need not differ, which allows us to focus on a single region, and to neglect heterogeneities. Nevertheless, we retain the classic idea that the local government has a knowledge of local conditions that the central government lacks. As a consequence, while part of the central government effort is wasted (implicitly assuming that it bears the cost of monitoring the needs of local constituencies), the local bureaucrats are perfectly efficient in providing the public good. An alternative interpretation of our framework (in the spirit of Breton and Scott 1978) could be that the signaling costs associated with centralization are larger than the administrative costs associated with decentralization, so that local governments are *ceteris paribus* more efficient.

As most of the literature on growth and public expenditure, we build on the seminal endogenous growth model by Barro (1990) which uses a constant returns to scale production function incorporating public sector services as an input to private production. Under the assumption of tax-financed public services (i.e. of a balanced government budget), a trade-off appears: the increase in taxes reduces investment and growth, whereas the increase in public services raises it through capital productivity increases. The second effect dominates when government size is small, but the negative effect of taxes on investment and growth eventually becomes more important as the size of government increases. We introduce a specific production function for the public good, which takes inputs from the local and from the central government. This production function is specified so as to yield Barro's baseline result as a special case.

While more efficient, the local government may be corrupt, i.e. it may engage in rent seeking activities. A very large body of economic research has been undertaken with the aim of understanding the sources and consequences of corruption, which can be broadly defined as illegal profit-seeking activity of bureaucrats trying to exploit their public-sector positions. Early theoretical models typically focused on establishing the microfoundations of

the relationship between governments and bureaucrats (e.g. Rose-Ackerman 1978, Shleifer and Vishny 1993, Banerjee 1997, Carrillo 2000) focusing on the role of government structure, information and incentives in creating and preventing corrupt activities. A common feature of many of these models is the presence of a cost of monitoring the public officials/bureaucrats, whose actions cannot be perfectly observed; this results in the government and the bureaucrats being involved in a principal-agent type relationship.[3] Here we do not develop this aspect of the relationship between the different levels of governments, but take as given rent seeking (attenuated by monitoring) by the local government.

Barreto (2000) embeds the rent seeking formalization of Shleifer and Vishny (1993) into a neoclassical growth model, where corruption is an endogenous result of competition between public and private agents. In his model corruption may be growth enhancing if it allows for the elimination of red-tape. Interestingly enough, even in highly developed countries such as the U.S. the negative correlation between (regional) growth and corruption is significant as the recent study by Johnson, LaFountain, and Yamarik (2011) demonstrates. Yet, the evidence is less conclusive than one would expect (see the recent surveys of Svensson 2005 and Aidt 2009). In most of the literature the growth rate is reduced by corruption, either because it affects private investment (Mauro 1995), or because it leads to over-investment in public capital (Tanzi and Davoodi 1997; Keefer and Knack 2007). A small body of literature finds nevertheless evidence in favour of the so-called "greasing the wheel" hypothesis, by which in systems with dysfunctional institutions corruption may actually *increase* efficiency and growth, by helping overcome red tape and public sector inefficiencies.[4]

In this paper, we focus on the effects on public capital and growth of the interaction between a rent-seeking local government and a benevolent central government. This interaction may actually yield under-investment in public capital, similar to the suboptimal provision of insurance in standard textbook examples. In a work related to our own, but more focused on the principal-agent relationship, Besfamille (2004) shows that when local governments collude with contractors to extract rent from the central government, that may result either in excessive costs of project, or in un-

[3]This basic principle-agent framework was later incorporated in several papers (see for instance Ehrlich and Lui 1999, Sarte 2000 and Blackburn, Bose, and Haque 2006) that studied corruption and growth in a dynamic general equilibrium context.

[4]The greasing-the-wheel hypothesis is used to explain the so-called Asian paradox, by which in a number of fast growing East-Asian countries we observe positive correlation between corruption and growth, even once institutions are taken into account (see e.g. Rock and Bonnett 2004; Li and Wu 2007; Vial and Hanoteau 2010).

der(over)provision of valuable(useless) projects. Bardhan and Mookherjee (2005) study how political capture on both levels of government, coupled with corruption at the central level, may lead to different optimal levels of decentralization, depending on the level of poverty of regions. Another study related to our work, by Brueckner (2000), identifies a possible trade-off between fiscal decentralization, associated with better satisfaction of heterogeneous public-good demands, and regional (subnational) corruption which increases the cost of public-good provision. Fiscal decentralization becomes welfare-improving only when corruption-related loss is small enough not to offset the benefit of better tailoring the supply to local needs. His work focuses on the allocation of spending between the different layers of government, neglecting the total amount of public goods provision and its effects on the growth rate of the economy.

3 Evidence

This section presents empirical evidence on the relationship between decentralization, corruption and growth. Our results show a negative impact of corruption on the degree of fiscal decentralization and, through this, on economic growth. Yet, we must warn the reader that this evidence can only be taken as suggestive due to the quality of data on decentralization and, especially, corruption. We will ask two questions. The first is whether there is a link between corruption and the degree of decentralization. And the answer will be that it exists and it is negative. The second is whether decentralization and corruption play a role in an otherwise standard growth equation. The answer will be that they do but only when included separately.

3.1 Data and Variables Description

Most of our macroeconomic and financial data were taken from the World Bank Global Development Finance (GDF) and World Development Indicators (WDI) datasets[5]. We augmented these with data on corruption and political institutions taken from the dataset assembled by Enikolopov and Zhuravskaya (2007). Given the severe lack of data on corruption and fiscal decentralization for many countries, most of our variables are measured as averages over the 1997-2001 period. Table 1 gives the exact definition and sources of all the variables used in our econometric analysis. The *Transparency International*'s Corruption Perceptions Index (CPI) is a widely utilized index of corruption that uses the scale from 1 (highly corrupt) to 10

[5]Accessed on line: http://databank.worldbank.org

(least corrupt). As stated by its creators, the CPI ranks almost 200 countries "by their perceived levels of corruption, as determined by expert assessments and opinion surveys". As such, it suffers from the common drawbacks of indexes constructed using surveys, namely arbitrariness and difficulties in interpreting year-to-year changes. This is why, consistently with the developers' original intention, we took it as a simple cross-sectional snapshot over the 1997-2001 time period.

3.2 Corruption and the Degree of Decentralization

Table 2 presents the results for the effect of corruption on decentralization. Our first specification used as controls a set of standard factors affecting decentralization, such as country size (proxied by the population size) and openness. The second specification expands the set of controls to account for the role of political institutions that could potentially affect the degree of decentralization. Finally, in specification (3), we added a set of dummy variables denoting countries' legal origin. These are all standard controls used in regressions on decentralization. Each specification includes the corruption variable, constructed as 10 minus the CPI discussed above.

The estimations show that countries with higher corruption levels tend to be less decentralized. This is already apparent in the basic regression and is robust to the introduction of additional controls in specifications (2) and (3).

A further check of robustness of our results consisted in restricting the sample to the OECD countries, more homogeneous in terms of development and corruption. The results are reported in table 3 where we ran the same regressions as in table 2.[6] The results confirm our findings of the effect of corruption on decentralization obtained using the full sample. The estimated coefficient of corruption is negative and significant in all specifications. Country size and openness, having a greater in absolute value coefficent of correlation in the OECD subsample than in the full sample (-0.48 vs. -0.18), are jointly insignificant (we kept them for comparison with Table 2).

To summarize, conditional to the quality of our dataset, we are able to document a robust relationship between the degree of corruption and the share of subnational government expenditure.

[6] In specification (3') we drop the dummy variable for the socialist legal origin as it does not concern any of the OECD countries.

3.3 The Effect of Corruption and Decentralization on Growth

Next we investigated the effect of corruption and decentralization in an otherwise standard growth equation. We restricted our sample to include all countries (43) for which we had comparable data on controls (specifically, the public debt variable) and the two exogenous variables of interest (corruption and subnational expenditure).

We chose to regress average growth from 2001 to 2007 (i.e. before the onset of the crisis), on corruption and subnational expenditure, together with a number of standard controls, at the beginning of the period. More specifically, we averaged the control variables over the four years period 1997-2001. In other words, we investigated the overall performance of the economy over the early years 2000, using as explanatory variables a snapshot of relevant factors at the beginning of the period. This approach has the disadvantage of not capturing short term co-movement between the variables, and does not necessarily rule out the problem of endogeneity; but, in our opinion, when investigating the role of slow-moving institutional variables, it better captures intrinsically long-term relationships. We furthermore opted for a simple cross sectional analysis, rather than using a panel, because data limitations would not allow going sufficiently back in time.

Table 4 reports the regression results. In specification (1) average growth of GDP per capita is regressed on a set of standard control variables (initial GDP, openness, public debt over GDP) and on subnational expenditure. All the controls yield the expected signs (openness positively affects growth, while initial GDP and public debt have a negative impact), and are significant. Taken alone, decentralization also has the expected impact: delegating spending to local governments increases efficiency and growth.

In the second specification we replace the decentralization variable with corruption. Following Swaleheen (2011), we added a square term to capture possibly non-linear effects of corruption on growth. The control variables keep the expected signs, and corruption, also as expected, has a statistically significant negative impact on growth (with a $p - value$ of 0.061). The non linear-term, while it substantially improves the goodness of fit, has a small coefficient value, and in the relevant range for corruption ($Corrupt \in [0,\ 10]$) it is dominated by the linear term.

Finally, in specification (3), we tested the joint impact of the two variables on growth. The estimated coefficient on subnational expenditure is positive, while both corruption terms become insignificant. This, taken together with the results of Table 2, provides support for our theoretical result that corruption affects growth through changes in the optimal degree of fiscal

decentralization.

It is interesting to observe that, as could be expected, these results are driven primarily by non-OECD countries. If we restrict the sample to OECD countries, the results become inconclusive (The regression results are available upon request).

Our empirical results show first, that corrupt countries should be more fiscally centralized, i.e. ceteris paribus, corruption and the share of subnational government expenditure should be negatively correlated. Then, our regressions suggest that decentralization and growth are positively correlated, while corruption seems to impact growth mostly through its impact on the degree of decentralization.

We then need to specify our theoretical model in order to obtain the normative prediction that decentralization positively impact growth, and the positive implication that higher corruption leads to lower decentralization which in turn leads to lower growth. Our objective is to obtain these results in the simplest possible model.

4 The Model

In this paper, the interaction between the central government and local bureaucrats, more efficient but potentially capable of extracting rent from the provision of public goods, happens against the background of an endogenous growth model in which the services of public capital enter together with private capital as an input to production. We ask two questions: the first is whether the trade-off between rent seeking of local bureaucrats and inefficiency of the central government alters the *composition* of the public good production, i.e., the shares of local and central government. The second question is whether this trade-off alters the *level* of total public good provision, with respect to the benchmark represented by the original Barro (1990) model. Our model is based on the interaction of the three types of agents:

1. The central government, whose objective is to provide a public good that is necessary for production, and which is financed through taxation.

2. Local bureaucrats, prone to corruption but more efficient than the government in the production of the public good.

3. A private sector that produces and accumulates capital subject to the constraints imposed by taxation, and to the positive externalities resulting from the provision of the public good.

The private sector in this model remains in the background. We consider a simplified version of Barro's (1990) endogenous growth model with capital and the services of public capital (the 'public good' hereafter) being the only productive factors:

$$y = Ak^{1-\alpha}g^{\alpha} \tag{1}$$

As in Barro, we assume the budget of the government to be always balanced, so that the production of the public good is financed exclusively by tax receipts. Let τ and $\theta = \tau y$ denote the proportional tax rate and the total of tax receipts respectively. As the production function is standard, the growth maximizing level of taxation will be equal to the share of government services in output. Assume that a representative household has standard CRRA preferences

$$\max \int_0^{\infty} \frac{c_t^{1-\sigma}}{1-\sigma} e^{-\rho t} dt \quad s.t.$$
$$\dot{k}_t = (1-\tau)y_t - c_t$$

where ρ is the rate of time preference, and σ is the intertemporal rate of substitution (we assume no depreciation). Standard maximization yields the textbook decentralized solution:

$$\gamma \equiv \frac{\dot{c}}{c} = \frac{1}{\sigma}(MPK - \rho)$$

where the marginal product of capital is

$$MPK = (1-\tau)(1-\alpha)Ak^{-\alpha}g^{\alpha} \tag{2}$$

As in Barro, this model exhibits no transitional dynamics, and welfare/utility maximization is obtained when the growth rate is maximized. Maximization of the growth rate by the central government is equivalent to finding an overall level of public good provision g, and the corresponding tax rate τ, such that MPK is maximized.

4.1 The Production Function for the Public Good

We structure our model in a sort of a principal-agent setting. The central government, the principal, has the choice of providing the good directly (g_c), which creates inefficiencies, or transferring some funds to the potentially corrupt local bureaucrats, who produce the good (g_l) more efficiently but may, at the same time, appropriate some of the transferred resources. The production function of the public good is assumed to be non-homothetic, so

that g can be produced by the local government, or by both levels jointly. The function can be written in implicit form as

$$g = \sqrt{\left(\frac{g_c}{\psi} + g\right) g_l} \tag{3}$$

where $\psi \geq 1$. The explicit form of this function has a linear term in g_l and a concave term

$$g = \frac{1}{2} g_l + \frac{1}{2} \sqrt{g_l^2 + \frac{4 g_c g_l}{\psi}}$$

This *ad hoc* formulation serves our main objective of having standard isoquants, while simultaneously allowing for corner solutions with only one factor (g_l) used in production. Furthermore, we design it to yield (as a special case with no corruption) the standard optimal-provision-of-public-goods result of the Barro model. Our results nevertheless do not depend on this particular form; in appendix B we show that any sufficiently well-behaved version of equation (3) produces the same qualitative conclusions on the effect of corruption on the composition and the size of government spending.

The parameter ψ can be interpreted as a measure of efficiency of g_c in the production of g. This is better understood by computing the marginal rate of substitution between g_c and g_l.

$$MRTS(g_c \text{ for } g_l) = \frac{\partial g / \partial g_c}{\partial g / \partial g_l} = \frac{2 g_l}{\sqrt{\psi^2 g_l^2 + 4 \psi g_c g_l} + \psi g_l + 2 g_c}$$

which is decreasing in ψ indicating that, for a given level of g, a smaller amount of g_l can be given up if one additional unit of g_c becomes available. Thus, higher values of ψ are associated with smaller relative efficiency of g_c. In other words, ψ can be interpreted as the "efficiency loss" associated with using g_c in the production of the public good g. Figure 1 shows the isoquants corresponding to different values of ψ. It can be observed that as ψ increases the isoquants become flatter. Notice further that all the isoquants intersect the g_l axis which implies that the production of g can take place with g_l alone; in that case, as equation (3) shows, production becomes linear: $g = g_l$.

We now turn to the characterization of each agent's problem.

4.2 Local Government

Given the amount of transfers t received from the central government, local bureaucrats decide on the amount $g_l \leq t$ that they will actually spend on the provision of public goods. We assume that local bureaucrats are fundamentally corrupt, and that they try to divert funds from public spending.

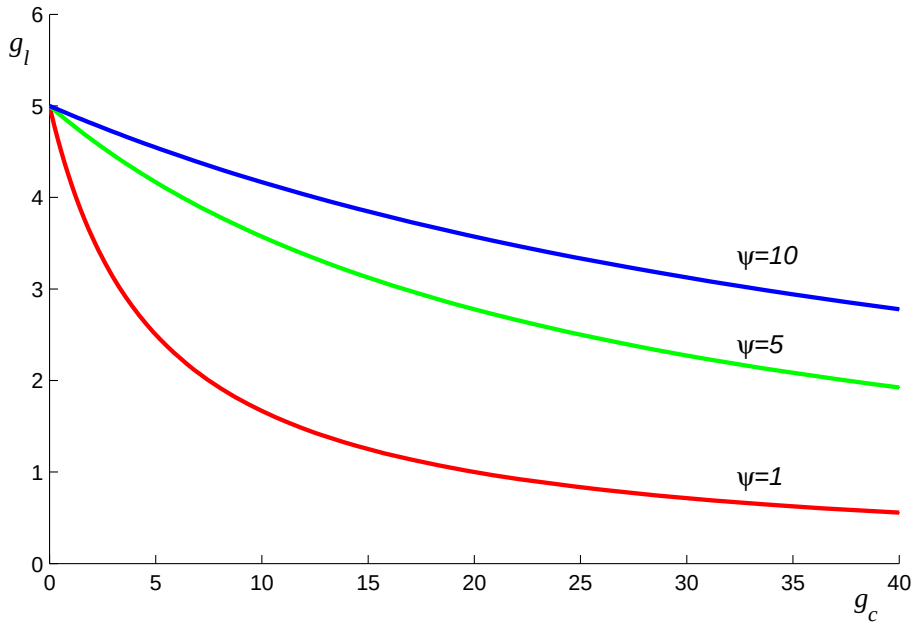

Figure 1: Isoquants for the production of $g = 5$ ($\psi = 1, 5, 10$)

The relationship between different levels of government and corruption has been extensively studied (see for instance, Tanzi 1998; Martinez-Vazquez and McNab 2003; and Gurgur and Shah 2005). Theoretically, decentralization may be seen to increase the level of corruption (through the proliferation of spending decisions and the blurring of administration and political roles), or to decrease it (through increased transparency and proximity to constituencies and hence accountability). In this paper we assume that the former effect dominates (as in Dalgic and Long 2006), and that the utility function of local bureaucrats is linear in the amount of transfers *diverted* from local spending. Thus, for a given transfer t the net rent of local bureaucrats $(t - g_l)$ is maximized subject to the constraint that an excessive amount of stealing increases the probability p of being caught. We assume that p monotonically decreases in the ratio of g_l to t, and that when caught, the payoff of local bureaucrats becomes zero, therefore, their problem can be written as

$$\max_{g_l} \left(p \cdot 0 + (1-p)(t - g_l)\right) \quad s.t.$$
$$p(g_l, t) = \beta \left(1 - \frac{g_l}{t}\right)$$

where p is the probability of being caught, and β is a function of the efficiency of monitoring the local provision of public goods. The value of the parameter β is taken as given by local officials, but as will be clear below, it is determined by the expenditure on monitoring and transfers of the central government.

The solution to the problem is given by

$$g_l = t - \frac{t}{2\beta} \tag{4}$$

The larger is the value of β, the lower will be the rent extraction by local bureaucrats, i.e. for a given amount of transfers, g_l will be higher. In equation (4), $g_l \geq 0$ requires β to be bounded from below: $\beta \in [\frac{1}{2}, \infty)$.

4.3 The Central Government

The central government maximizes the growth rate of the economy, γ, subject to the technological constraints (for the production of y and of g), an incentive compatibility constraint that avoids excessive stealing by the local government, and the standard balanced budget constraint. Central to our model, we assume that while corrupt, local bureaucrats are more efficient in the provision of public goods. We share this assumption with the early literature on decentralization while being aware of the existence of much more nuanced theoretical models (see for instance Bardhan and Mookherjee 2006a). It is also useful to keep in mind that some recent applied work provided empirical support for this argument. For example, Alderman (2002), using data from the poverty alleviation program in Albania, finds that local authorities often possess (for example through surveys) information that is not readily available to the central government and which can be used to better allocate program funds in their jurisdictions. Using the natural experiment provided by the Bolivian decentralization reform of 1994, Faguet (2004) shows that the substantial transfer of power to municipalities significantly altered the sectoral composition of public investment because local authorities were able to tailor public funds to the different needs of their constituencies.

Within this framework, the central government has to make three interrelated choices:

1. Choose the overall tax rate τ, and consequently, given all the constraints, the amount of public good produced g.

2. Determine the portion of its tax receipts θ, to be allocated to the direct production of g *via* g_c, with the remaining resources being transferred to local bureaucrats:

   $$\theta = \theta_c + \theta_l,$$

   with θ_c and θ_l denoting the portions of tax receipts allocated to centralized and decentralized production respectively. Since we assume that

there is no corruption among the central government officials, all of the resources allocated to central government spending translate into the central government input to the production of the public good. On the other hand, some leakage due to corruption appears when delegating to local bureaucrats the provision of the good:

$$g_l < \theta_l$$
$$g_c = \theta_c$$

Choosing the allocation of resources between central and local levels of government is equivalent to deciding the degree of decentralization, i.e. g_c/g and g_l/g.

3. Finally, the central government has to minimize rent seeking and appropriation by local bureaucrats; this is done through allocation of the resources devoted to local production between monitoring, m and transfers to the local government, t :

$$\theta_l = m + t,$$

We assume that β, and hence the probability of catching the local bureaucrats who steal from the transfers, depend linearly on the ratio m/t :

$$\beta = \delta \frac{m}{t} \tag{5}$$

The efficiency of the monitoring technology is captured by the parameter δ, that will be central in our subsequent analysis. This parameter can also be interpreted as the extent of political centralization thereby indicating that, ceteris paribus, more politically centralized government structures will be better at detecting corruption at the subnational level.

To summarize, the central government's problem can be represented as:

$$\max_{\tau,m,t,g_c} \gamma \quad s.t.$$
$$\gamma = \frac{1}{\sigma}\left((1-\tau)(1-\alpha)Ak^{-\alpha}g^{\alpha} - \rho\right)$$
$$g = \sqrt{(\frac{g_c}{\psi} + g)g_l}$$
$$\theta = m + t + g_c$$
$$g_l = t - \frac{t}{2\beta}$$
$$\beta = \delta\frac{m}{t}$$

To solve the problem we proceed backwards:

- First, the central government has to decide how much to spend on monitoring (m) and on transfers to the local government (t), in order to maximize spending by the local bureaucrats g_l for a *given* total amount of resources allotted to decentralized production, θ_l.
- Next, for a given total amount of the public good g, the government has to determine the optimal (cost minimizing) allocation between g_l and g_c.
- Finally, the government has to decide the total amount of the public good g that maximizes the growth rate of the economy.

4.3.1 The choice of m and t

We start by finding the optimal allocation of *given* funds allotted to decentralized production, between transfers and monitoring. From the monitoring technology equation (5), and the local government optimal choice (equation 4), we can write

$$g_l = t - \frac{1}{2}\frac{t^2}{m\delta}$$

The allocation of resources between transfers and monitoring can then be determined through the solution to the following problem:

$$\max_{m,t}\left(t - \frac{1}{2}\frac{t^2}{m\delta}\right) \quad s.t. \tag{6}$$
$$m + t = \theta_l$$

Problem (6) yields the following solution for t and m :

$$t = \theta_l \frac{\sqrt{2\delta+1}-1}{\sqrt{2\delta+1}}$$
$$m = \frac{\theta_l}{\sqrt{2\delta+1}}$$

Notice that since $\beta = \delta m/t$, any value of $\delta > 0$ is compatible with our prior constraint that $\beta \geq 1/2$ which we had to assume in order to ensure the non-negativity of g_l (see equation 4). Notice also that we do not explicitly model the incentives faced by the central government in dealing with the the local government agency problem. We simply assume that it faces a tradeoff between excessive rent-seeking and waste of resources for monitoring[7].

Computing the amount of local government spending is then straightforward:

$$g_l = \frac{(1+\delta)\sqrt{2\delta+1}-2\delta-1}{\delta\sqrt{2\delta+1}}\theta_l$$

We can actually define the amount of wasted resources induced by corruption (whether directly through rent seeking, or indirectly through the cost of monitoring): define ϕ as the ratio of actual spending to the local government's contribution to public good production:

$$\phi \equiv \frac{\theta_l}{g_l} = \frac{\delta\sqrt{2\delta+1}}{(1+\delta)\sqrt{2\delta+1}-2\delta-1}$$

A value of ϕ in excess of 1 can be interpreted as the "corruption loss", and it only depends (negatively) on the efficiency of monitoring δ. Furthermore, as δ increases, ϕ tends to 1 (figure 2). In other words, as the efficiency of monitoring increases, the ratio of actual spending to the local government's contribution to public good production, $\frac{\theta_l}{g_l}$, converges to 1 (and the corresponding corruption loss converges to zero).

In what follows, it will be convenient to think of ϕ as the determinant of the amount of resources necessary to obtain g_l, i.e., $\theta_l = \phi g_l$. Remember on the other hand that no leakage appears in the case of centralized production ($\theta_c = g_c$).

[7]For example, as g_l and t are observable, we should have punishment of the local government each time $g_l < t$ is observed. To make the model into a fully fledged principal-agent relationship we could introduce a non observable leakage in the transfer. The qualitative results would not be different.

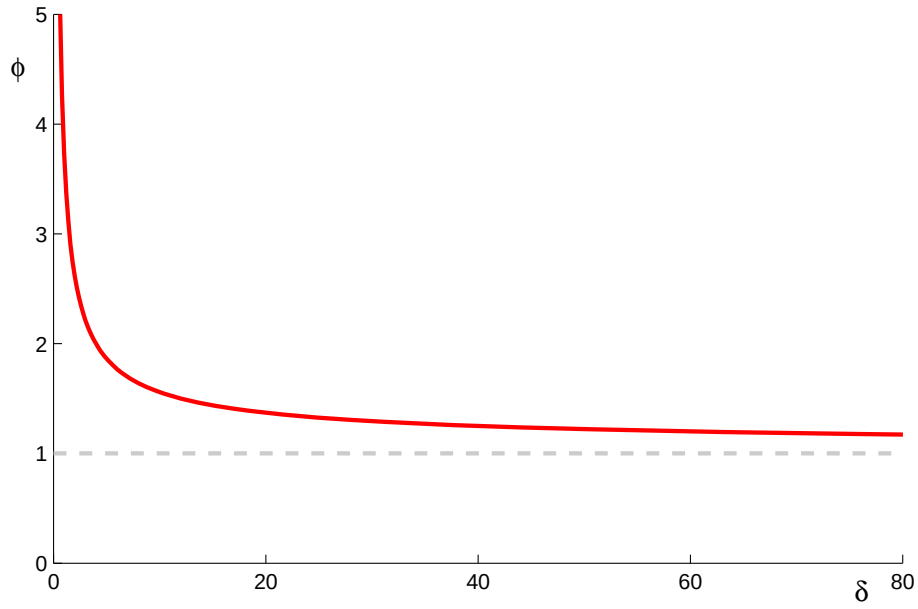

Figure 2: Corruption loss, ϕ, as a function of monitoring efficiency δ.

4.3.2 Choice of g_l and g_c for a given g

Let's now turn to the problem of determining the local and central inputs g_l and g_c necessary to obtain a *given amount* of the public good g, given the concave "technology" defined in equation (3) that allows for possible corner solutions.

$$g = \sqrt{\left(\frac{g_c}{\psi} + g\right) g_l}$$

The government thus faces a choice between the loss in efficiency implied by centralized production (captured by the parameter ψ), and the "leakage" caused by corruption in case of decentralized production (captured by ϕ). This trade-off can be represented as a cost minimization problem

$$\min_{g_l, g_c} (\theta_l + \theta_c) = \phi g_l + g_c \qquad s.t.$$

$$g = \sqrt{\left(\frac{g_c}{\psi} + g\right) g_l}$$

We then obtain the following solution (see appendix A):

$$\psi < \phi \Rightarrow \begin{cases} g_l = \sqrt{\frac{\psi}{\phi}} g \\ g_c = \left(\sqrt{\phi\psi} - \psi\right) g \end{cases}$$

$$\psi \geqslant \phi \Rightarrow \begin{cases} g_l = g \\ g_c = 0 \end{cases} \tag{7}$$

If the relative efficiency of g_c decreases (larger ψ), or monitoring efficiency increases (smaller ϕ) then g_c will decrease and g_l will increase. A more effective monitoring implies a larger share of spending by the more efficient local government. Notice also that the existence of an efficiency loss ψ implies that the central government may decide to provide the public good entirely through the local government (if $\psi \geq \phi$). Equation (7) embeds the first of the results we were looking for: an increase in corruption (or lower monitoring efficiency) yield a lower share of local government in the provision of the public good.

4.3.3 The Determination of the Optimal Amount of g

The final step is to determine the optimal level of public spending g, and to relate it to the overall effectiveness of public spending, where "effectiveness" has to be understood in the broad sense of comprising the corruption loss resulting from the rent seeking behavior of local bureaucrats (ϕ), and/or the technical inefficiency of the central government (ψ). From equation (7) we can compute the total amount of taxes collected θ as:

$$\theta = \theta_l + \theta_c = \phi g_l + g_c = \lambda g$$

where

$$g_c = 0 \Rightarrow \lambda = \phi \tag{8a}$$

$$g_c \neq 0 \Rightarrow \lambda = 2\sqrt{\psi\phi} - \psi \tag{8b}$$

Since the amount of taxes collected is a proportion τ of total income ($\theta = \tau y$), we can further write

$$g = \frac{\theta}{\lambda} = \frac{\tau y}{\lambda} = \frac{\tau A k^{1-\alpha} g^{\alpha}}{\lambda}$$

$$g = k \left(\frac{\tau A}{\lambda}\right)^{1/(1-\alpha)} \tag{9}$$

Remember from equation (2) that the after tax marginal product of capital is $MPK = (1-\tau)(1-\alpha)Ak^{-\alpha}g^{\alpha}$, that given equation (9) can be rewritten as

$$MPK = (1-\tau)(1-\alpha)A^{1/(1-\alpha)}\left(\frac{\tau}{\lambda}\right)^{\alpha/(1-\alpha)}$$

This is equivalent to the standard textbook formulation of Barro (1990), with the exception of the λ term, capturing the burden represented by central government inefficiency and corruption losses. The central government's problem, therefore, becomes to choose τ such that the MPK is maximized. This yields the following first-order condition:

$$\frac{d(MPK)}{d\tau} = A^{\frac{1}{1-\alpha}}\frac{(\alpha-\tau)}{\tau}\left(\frac{\tau}{\lambda}\right)^{\frac{\alpha}{1-\alpha}} = 0$$

which gives the familiar condition for maximizing the growth rate of the

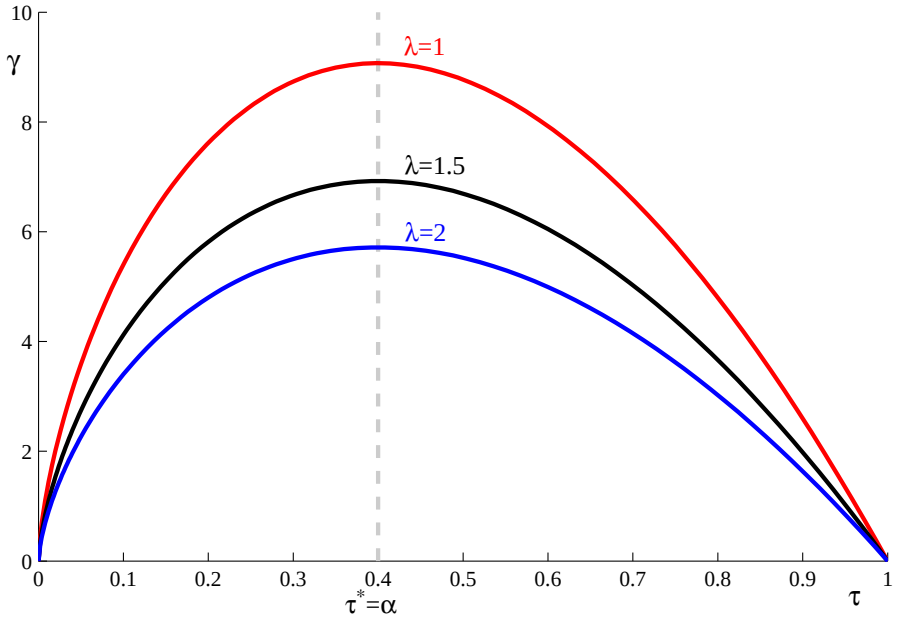

Figure 3: Relation between tax rate and growth for different values of λ. $\lambda = 1$ corresponds to the Barro benchmark. The optimal tax rate $\tau^* = \alpha(= 0.4)$ is independent of λ. We assumed $A = 10$, $\alpha = 0.4$, $\sigma = 1$, $\rho = 0$.

economy:

$$\tau^* = \alpha \tag{10}$$

Thus, the optimal tax rate is equal to the level obtained in the benchmark, and is not affected by the existence of efficiency and corruption losses. The hump-shaped relationship between τ and γ, familiar from Barro, is depicted

in figure 3. The corruption/efficiency burden does not affect the tax rate, but it has an effect on the growth rate of the economy.

To solve for the optimal government spending g, we use equations (10) and (9):

$$\begin{aligned} g^* &= k\left(\frac{\alpha A}{\lambda}\right)^{1/(1-\alpha)} \\ \frac{g^*}{y} &= \frac{\alpha}{\lambda} \end{aligned} \tag{11}$$

Remember that in Barro (1990) $g^*/y = \alpha$. Thus, to compare our results to this benchmark, we have to look into the value of λ, defined in equation (8). In the case of excessive inefficiency of the central government, and/or of low corruption losses, production is carried on only by the local government, and equation (8a) shows that $\lambda = \phi \geq 1$. In the case of an interior solution, requiring $\phi > \psi$, we have $\lambda = 2\sqrt{\psi\phi} - \psi$ (equation 8b). Even in this case, then, $\phi > \psi$ implies $\lambda > 1$. Thus,

$$\lambda > 1 \Rightarrow \frac{g^*}{y} = \frac{\alpha}{\lambda} < \alpha$$

We can conclude that whether the public good is provided by the central government, or by the local government, its level will fall short of what it would in the benchmark case. In other words, corruption affects the growth rate of the economy because it induces to a suboptimal level of decentralization. This explains why in table 4 corruption is not significant when included in the regression with the share of subnational expenditure. At the same time, we showed that the existence of potential corruption does not affect the optimal tax rate.

4.3.4 The Effects of Corruption on the Composition and the Amount of Public Spending

In our model, the possibility of corruption is summarized by a single parameter, ϕ, that decreases to the level of 1 as the effectiveness of monitoring increases. A more corrupt local government (high ϕ) implies both a bias towards excessive direct provision of the public good by the central government, and an overall under-provision of the public good with respect to the level that would be optimal without corruption. In fact, with perfect monitoring technology ($\phi = 1$) equations (8a) and (11) would yield $\lambda = 1$ and $g/y = \alpha$, respectively, which is the familiar "optimal size of government"

result of the Barro model. As for the ratio between central and local government provision of the public good, from the internal solution of equation (7) we have

$$\frac{g_c}{g_l} = \phi - \sqrt{\phi\psi}$$

which can be seen to be decreasing in ϕ. As the corruption loss increases ($\phi \to \infty$), g_l tends to zero, and the production of the public good is carried on by the less efficient central government. Conversely, as ϕ decreases, the use of g_c decreases, and goes to zero for $\psi \geq \phi$. Our model provides an alternative mechanism to explain why the Decentralization Theorem may fail to apply, even absent the spillovers. Of course, the possibility of corruption and rent seeking is not the only mechanism that may cause an insufficient degree of decentralization. For example, Hoyt (1991) develops an intuition already present in Oates (1972), showing how competition for the tax base by local governments yields insufficient fiscal revenues and public investment. On a different note, Besley and Coate (2003) build a model in which departures from Oates' optimal balance arise from conflicts of interest between citizens of different jurisdictions. In our setting the balance between local and central provision of the public good is distorted not because of the interaction of local governments, but because of the principal-agent relationship between central and local authorities.

5 Conclusion

The simple model presented in this paper shows that the existence of potentially corrupt local bureaucrats reduces the scope for fiscal decentralization, and yields an overall insufficient level of productive public goods. Our theoretical and empirical results are particularly interesting when we relate them to the recent empirical literature on growth, corruption and decentralization.

We already mentioned several studies (Zhang and Zou 1998; Jin, Qian, and Weingast 2005) of the relationship between fiscal decentralization and growth in the Chinese provinces, whose conclusions could be explained by a mechanism highlighted in our model. In particular, Jin, Qian, and Weingast (2005) show that the positive effects of decentralization on growth critically rely on designing a good system of fiscal incentives for local governments aimed at avoiding rent-seeking: "decentralization of authority is meaningless if the central government takes away all revenue generated in the local economy as a result of local government's action" (Jin, Qian, and Weingast 2005, p. 1124). In terms of the model parameters, this corresponds to implementing decentralization only when a sufficiently good monitoring technology

(high δ) is in place, so that the corruption loss ϕ is minimized. As we mentioned, Zhuravskaya (2000), Blanchard and Shleifer (2001) and (Jin, Qian, and Weingast 2005), argue that insufficient control of local bureaucrats by the central government was the main reason why the decentralization process in Russia was much less successful than in China. In both countries decentralization took place, which in our model would correspond to the case of $\phi \leq \psi$. Nevertheless, this happened in Russia for high levels of ϕ and ψ, so that transfer of power to local governments generated higher rent-seeking and lower growth than in China, where corruption loss ϕ was kept low by maintaining strong party control of provincial and community leaders.

Our paper may also help look in a different way at the literature on decentralization and corruption. A recent article by Fisman and Gatti (2002) makes a thorough empirical analysis of this issue by looking at the cross-country relationship between fiscal decentralization and corruption as measured by a number of different indices. They find, as we do, an inverse relationship between fiscal decentralization and corruption. Our paper suggests, however, that this analysis should be extended to yield robust conclusions on the direction of causality, as in fact, within our setting it would be the extent of corruption that determines the degree of decentralization chosen by the central government, and not vice versa. Finally, using a cross-section of 15 European countries, Cassette and Paty (2010) showed that greater fiscal decentralization leads to higher aggregate public expenditure which also fits with our model, as a particular low-corruption scenario.

The paper leaves, nevertheless, a number of questions unanswered. The main one is whether multiple equilibria may potentially arise, caused by the interaction between the extent of corruption, the growth rate, and the monitoring capacities of the government. Our model could be modified to yield such multiple equilibria, similar in spirit to those of the already cited work by Blackburn, Bose, and Haque (2006). This question is left for future work.

Table 1: Description of Variables

Name	Label	Description	Source
Corrupt	Corruption	10 minus the Transparency International index, average over 1997-2002	Transparency International
GDP2001	GDP in 2001	Gross domestic product for the year 2001	World Bank
SubnatExp	Decentralization	Share of subnational expenditure, average over 1997-2002	World Bank
GovtDebt	Government Debt	Government Debt as a percentage of GDP, average over 1997-2002	World Bank
Open	Openness	Share of exports and imports in GDP, average over 1997-2002	World Bank
Pop	Population	Population in millions, average over 1997-2002	World Bank
Elf85	Ethnolinguistic fractionalization	Index of ethnolinguistic fractionalization for the year 1985	Roeder (2001)
Feder	Federation	Dummy variable taking the value of one if a country is a constitutional federation	Enikolopov and Zhuravskaya (2007)
DemAge	Democracy Age	Number of years since the beginning of the last democratic regime for the year 1997	Constructed based on data in Enikolopov and Zhuravskaya (2007)
LO	Legal Origin	Legal origin of the country's commercial law	La Porta, Lopez-de Silanes, Shleifer, and Vishny (1999)

Table 2: Decentralization and Corruption. Full Sample

Dependent variable: Subnational Expenditure			
	(1)	(2)	(3)
Intercept	37.15**	31.65**	39.52**
	(8.30)	(7.22)	(8.65)
Corrupt	-1.651**	-1.323**	-1.693**
	(-2.81)	(-2.40)	(-2.26)
Pop	2.64e-08**	2.24e-08**	2.14e-08**
	(3.64)	(3.41)	(3.64)
Open	-0.0674**	-0.0519*	-0.0641**
	(-2.10)	(-1.77)	(-2.33)
Feder		10.36**	12.86**
		(3.19)	(4.02)
Elf85		5.006	14.12**
		(0.83)	(2.36)
DemAge		-0.115**	-0.0632
		(-2.14)	(-1.28)
LO_English			-14.51**
			(-2.59)
LO_French			-16.21**
			(-2.98)
LO_German			-6.497
			(-1.01)
LO_Socialist			-4.488
			(-0.73)
N	62	62	62
Adj. R^2	0.279	0.428	0.558

t-statistics in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$

Table 3: Decentralization and Corruption: The OECD Countries

Dependent variable: Subnational Expenditure			
	(1')	(2')	(3')
Intercept	36.79**	35.39**	36.97**
	(6.58)	(6.78)	(6.85)
Corrupt	-3.133**	-3.090**	-2.670**
	(-3.07)	(-3.03)	(-2.39)
Pop	8.15e-08*	4.46e-08	5.28e-08
	(1.97)	(1.15)	(1.38)
Open	-0.0427	-0.0234	-0.0260
	(-1.00)	(-0.61)	(-0.71)
Feder		15.90**	15.86**
		(3.38)	(3.06)
Elf85		-13.60	-4.594
		(-1.41)	(-0.44)
DemAge		-0.0703	-0.102
		(-0.39)	(-0.56)
LO_English			-6.460
			(-1.17)
LO_French			-10.77**
			(-2.44)
LO_German			-3.457
			(-0.57)
N	31	31	31
Adj. R^2	0.309	0.491	0.549

t-statistics in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$

Table 4: Growth and Corruption

Dependent variable: Per capita GDP Growth 2002-2007			
	(1)	(2)	(3)
Intercept	0.0568***	0.0848***	0.0493**
	(4.72)	(5.14)	(2.29)
Open	0.000176***	0.000130**	0.000178***
	(3.18)	(2.49)	(3.35)
GDP2001	-0.00146***	-0.00114***	-0.00104***
	(-8.24)	(-3.22)	(-3.08)
GovtDebt	-0.000283***	-0.000366***	-0.000301***
	(-3.07)	(-4.02)	(-3.34)
SubnatExp	0.000662**		0.000608**
	(2.70)		(2.37)
Corrupt		-0.00895*	-0.00473
		(-1.93)	(-1.00)
$Corrupt^2$		0.00124**	0.000866*
		(2.43)	(1.71)
N	43	43	43
Adj. R^2	0.667	0.653	0.691

t-statistics in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

Appendix

A Solving for the Optimal Shares of Local and Central Government

Consider again our initial problem:

$$\min_{g_l, g_c} \theta = \phi g_l + g_c \qquad \text{s.t. } g = \sqrt{(\frac{g_c}{\psi} + g) g_l}$$

Define

$$x = \frac{g_c}{\psi} + g$$

Then

$$\begin{aligned} g_l &= \frac{g^2}{x} \\ g_c &= (x - g)\,\psi \end{aligned} \tag{A1}$$

Our problem becomes

$$\min_x \frac{\phi g^2}{x} + (x - g)\,\psi \qquad \text{s.t. } g = const.$$

The first order condition is

$$-\frac{\phi g^2}{x^2} + \psi = 0$$

which yields

$$x = \sqrt{\frac{\phi}{\psi}} g$$

This can be substituted back into (A1) to obtain the solution in the text:

$$\begin{aligned} g_c &= (x - g)\,\psi = \left(\sqrt{\phi\psi} - \psi\right) g \\ g_l &= \frac{g^2}{x} = \sqrt{\frac{\psi}{\phi}} g \end{aligned}$$

B Government Shares and λ-value with a Generic Production Function

The *ad-hoc* formulation for public good production that we chose in the text is not necessary to yield our results. Let's consider a generic production function for the public good

$$g = f(g_c, g_l),$$

and define $f_l = \partial g/\partial g_l$, and $f_c = \partial g/\partial g_c$.The cost minimization problem becomes,

$$\min(\theta_l + \theta_c) = \phi g_l + g_c \quad s.t.$$

$$g = f(g_c, g_l)$$

which yields the following standard solution:

$$\phi = \frac{f_l}{f_c}$$

For any production function with convex isoquants, an increase in the corruption loss will imply, *via* an increase of the marginal rate of technical substitution, an increase of the ratio g_c/g_l, and a reduction of total production g.

If for example we take a Cobb-Douglas production function, $g = g_c^{\psi} g_l^{1-\psi}$, we can compute

$$\frac{g_c}{g_l} = \frac{\psi}{1-\psi}\phi$$

that is increasing in the relative productivity of g_c, ψ, and in the corruption loss ϕ. As in the text, the total amount of taxes collected θ is

$$\theta = \theta_l + \theta_c = \phi g_l + g_c = \lambda g$$

where

$$\lambda = \left(\frac{1-\psi}{\psi}\right)^{\psi} \phi^{(1-\psi)} + \left(\frac{\psi\phi}{(1-\psi)}\right)^{1-\psi}$$

$$= \frac{\phi^{1-\psi}}{\psi^{1-\psi}\psi^{\psi}}$$

All the terms in the denominator are smaller than one, so that we can conclude that $\lambda > 1$. With a Cobb-Douglas production function, inefficiency and corruption yield the same qualitative results we had in the text, namely $g/y < \alpha$ and a bias towards g_c.

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