Fiscal Policy, Rent Seeking and Growth under Electoral Uncertainty
Theory and Evidence from the OECD

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Abstract: We construct a general equilibrium model of economic growth and optimally chosen fiscal policy, in which individuals compete with each other for a share of government spending and two political parties alternate in power according to electoral uncertainty. The main prediction is that uncertainty about remaining in power results in increased fiscal spending, which in turn distorts incentives by pushing individuals away from productive work to rent-seeking activities; then, distorted incentives hurt growth. This scenario receives empirical support in a dataset of 25 OECD countries over the period 1982-1996. In particular, uncertainty about remaining in power leads to larger government shares in GDP, which in turn exert an adverse effect on the ICRG index measuring incentives and this is bad for growth.

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1. INTRODUCTION

Anecdotal and case study evidence across countries suggests that rent-seeking activities intensify before elections. For instance, lobbying efforts, interest group activity, participation in strikes and demonstrations, etc, indicate that the redistributive struggle escalates in pre-election periods. At the same time, there is econometric evidence of electoral cycles in economic policy. For instance, government spending increases, as political parties become short sighted before elections.[1]

Motivated by the above, in this paper we study whether endogenous fiscal policy can operate as a transmission mechanism through which short-sighted pre-election motives on the part of policymakers lead to stronger rent-seeking activities and lower capital accumulation and economic growth. We first develop a stylized dynamic general equilibrium model that studies the joint determination of fiscal policy, rent-seeking activities and economic growth, when the driving force is uncertainty about remaining in power. Then, we test the predictions of this model by using a data set of 25 OECD countries over the period 1982-1996.

The theoretical model is built upon the neoclassical growth model enriched with public goods financed by optimally chosen income taxes. To this tractable model, we add two things. First, private agents, apart from making their usual consumption/saving decisions, also decide how much effort to allocate to productive work relative to rent seeking activities. In doing so, rent seekers compete with each other for extra fiscal favours.[2] Second, there are two political parties that can alternate in power, so that they choose economic policy by competing with each other and knowing that there is only a non-zero probability of remaining in power in the coming election. We thus combine rent seeking and electoral uncertainty. We also allow for both exogenous and endogenous (state-contingent) re-election probabilities.[3]

The main prediction is that as the probability of remaining in power decreases (or equivalently electoral uncertainty increases), the incumbent party finds it optimal to go for a relatively large size of the public sector. This signals a larger pie that rational atomistic individuals are willing to fight over. Thus, relatively large public sectors in pre-election

[1] For surveys, see e.g. Alesina et al. (1997), Persson and Tabellini (1999), Drazen (2000, chapter 7) and Mueller (2003, chapter 19).

[2] Our rent seeking mechanism is as in e.g. Tullock (1980) and Murphy et al. (1991). See also Mohtadi and Roe (1998, 2003), Mauro (2004) and Park et al. (2005) for similar setups in which rent seekers compete with each other for fiscal favors. That is, the common pool is the tax base. For surveys of the literature of rent seeking and growth, see Drazen (2000, chapter 11) and Persson and Tabellini (2000, chapter 14.4). For a survey of the literature of rent seeking, see Mueller (2003, chapter 15).

[3] Our key electoral mechanism is as in e.g. Alesina and Tabellini (1990), Lockwood et al. (1996), Devereux and Wen (1998), Persson and Tabellini (1999, 2000), Economides et al. (2003) and Malley et al. (2007).

periods distort private incentives by pushing individuals away from productive work to rent seeking activities. In turn, distorted private incentives hurt the macro-economy by adversely affecting capital accumulation and economic growth.

The above predictions are tested for a group of 25 OECD countries with three 5-year periods for each country over 1982-1996. For this group of countries, we use two proxies of uncertainty about remaining in power. First, we construct a measure of electoral uncertainty defined as the average of pre-election dummies over the time periods (see also Fatas and Mihov (2003)) by following the empirical literature on political business cycles (see e.g. Alesina et al. (1997)). In addition, we use a more general measure of the stability of the governments as a proxy for uncertainty about remaining in power and hence shorter horizons. This is obtained from Beck et al. (2000) and captures the extent of turnover of a government's decision makers, as the percentage of the main veto gates (legislature, executive) in a system that have changed hands in any year. Following the literature on weak institutions (see e.g. Acemoglu, Johnson and Robinson, 2005 and the papers cited therein), we use the IRIS dataset, constructed by Knack and Keefer (1995), to obtain the ICRG index as a proxy for rent seeking. Rent seeking from the government budget is expected to be associated with low quality of governance, high corruption and low protection of property rights (which is what the ICRG index measures).

Our empirical results support this causality scenario. In particular, as uncertainty about remaining in power increases, the government share in GDP also increases, which in turn exerts an adverse effect on rent-seeking incentives, as this is captured by a decrease in the ICRG index. Then, increased rent-seeking activity hurts economic growth.

What is the value added of our paper? Our work differs from the existing studies of institutions, rent seeking, fiscal policy and economic growth, because we study a potential channel behind the reduced form relationships that has not been examined so far in the theoretical[4] or empirical[5] literature. The type of endogeneity of fiscal size, as predicted by our

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[4] In the political business cycle literature, electoral instability hurts growth by inducing incumbents to follow shortsighted policies. However, most of this literature abstracts from rent seeking. On the other hand, in the rent-seeking literature, a larger public sector and higher transfers can worsen private incentives and this is bad for growth (see e.g. Mohtadi and Roe (1998, 2003), Mauro (2004) and Park et al. (2005) and the papers cited in Persson and Tabellini (2000, chapter 14.4)). However, most of these models abstract from elections and their effects on private incentives.

[5] For the effects of electoral competition on the conduct of fiscal policy, see e.g. Alesina et al. (1997). For the effects of political variables and the size of government on rent seeking activities, see e.g. Treisman (2000) and Glaeser and Saks (2006). For the effects of weak institutions and extractive activities on economic growth and development, see e.g. Mauro (1995), Knack and Keefer (1995), Hall and Jones (1999) Rodrik (1999), Acemoglu, Johnson and Robinson (2001, 2002) and Acemoglu, Johnson, Robinson and Thaicharoen (2003). For

model, can reconcile several findings of the empirical literature. For instance, single-equation Least Squares regressions that do not deal with the potential endogeneity of government size have so far provided mixed results for the effect of fiscal size on rent seeking.[6] Here, by using IV methods consistent with our model specification, we do find that larger government shares in GDP cause rent-seeking activities. In addition, single-equation regressions have not managed so far to establish a robust significant effect from electoral uncertainty to endogenous outcomes like rent seeking and growth.[7] Again, by examining the fiscal policy channel, we do provide such empirical evidence.

The paper is organized as follows. Section 2 presents the theoretical model. Section 3 presents the empirical analysis. Section 4 closes the paper. Proofs and details on the data are gathered in the Appendix.

2. THEORETICAL MODEL

2.1. Informal description of the model

Our aim is to add rent seeking and electoral uncertainty into a simple model of growth and fiscal policy. To do so, we combine the electoral uncertainty model of e.g. Alesina and Tabellini (1990), Devereux and Wen (1998) and Economides et al. (2003) with the rent-seeking model of e.g. Mauro (2004) and Park et al. (2005).

It is helpful to start by discussing the key features of the model. (i) We build upon the neoclassical growth model enriched with public goods financed by income taxes. (ii) To this model, we add a widely-used two-party political system. The political party that wins the election chooses economic policy during its term in office to maximize the welfare of the representative household knowing that the other party may win the next election with a non-zero probability. (iii) Atomistic individuals can extract from government income (i.e. collected income tax revenue) to increase their own personal wealth. This is at the cost of social resources allocated to public goods. (iv) Rent-seeking behavior, on the part of

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the effects of the size of public sector on economic growth, see the survey in Mueller (2003, chapter 22). Section 3.2 below will provide further details on the empirical literature.

[6] For instance, three recent papers in this literature have provided three different results. Treisman (2000) reports that measures of the size of government are not significantly related with corruption in a world sample; Fisman and Gatti (2002), using similar data with this paper in a sample that includes both developed and developing countries, report that the government share in GDP is reducing corruption; Glaeser and Saks (2006) find a weak positive relationship between bigger governments and corruption, using data for the USA states. Glaeser and Saks (2006) point out the potential problems of not addressing the endogeneity of government size.

[7] See e.g. Alesina et al. (1997) for the effects (or lack of them) of electoral uncertainty on growth, and Treisman (2000) for the effects (or lack of them) of political uncertainty on rent seeking.

individuals, is modeled as in e.g. Murphy et al. (1991). In other words, each individual is allowed to devote effort time to rent seeking by competing with other individuals for a fraction of collected tax revenue. Thus, each individual chooses optimally (in addition to consumption and saving) the allocation of its effort time between productive work and rent seeking activities. (v) In each time-period, the sequence of events is as follows: electoral uncertainty is resolved; in turn, economic policy is chosen by the party that wins the election; finally, private agents make their allocation choices simultaneously. We work with backward induction. (vi) We assume infinite-time horizons, discrete time and certainty (except from probabilistic electoral uncertainty). (vii) We solve for Markov policy strategies, and hence a Markov-perfect equilibrium, so that optimal policies are sub-game perfect and time consistent.

2.2. Firms' problem

There is a constant number F of identical firms indexed by the superscript $f \in F$. Each firm maximizes profits, π^f, given by:

$$\pi_t^f = y_t^f - r_t k_t^f - w_t l_t^f \tag{1}$$

where y_t^f, k_t^f and l_t^f are respectively output, capital input and labor input of firm f at time t; and r_t and w_t are the market interest rate and wage rate respectively.

At the firm level, the production function takes a Cobb-Douglas form:

$$y_t^f = A(k_t^f)^\alpha (l_t^f)^\varepsilon g_t^{1-\alpha-\varepsilon} \tag{2}$$

where $A > 0$, $0 < \alpha < 1$, $0 < \varepsilon < 1$ are parameters and $g_t \equiv \frac{G_t}{F}$ is average (per firm) government production services at t.[8] For a similar production function with CRS in the three factors, see e.g. Lansing (1998).

[8] We could assume that the government also provides public consumption services that give direct utility to households; our results do not depend on this. Note that we use average public spending, rather than total, as an argument in (2) to avoid scale effects.

Each firm chooses k_t^f and l_t^f to maximize (1) subject to (2) by taking wages and interest rates, policy variables and aggregate outcomes as given. The solution of this static problem is standard and is presented in Appendix A.

2.3. Households' problem

There is a constant number H of identical households indexed by the superscript $h \in H$. Each household's inter-temporal utility is:

$$\sum_{t=0}^{\infty} \beta^t \log c_t^h \tag{3}$$

where c_t^h is h's consumption at time t and $0 < \beta < 1$ is the discount rate.

Each household h is endowed with one unit of effort time and then allocates $0 < \theta_t^h \leq 1$ of that unit to productive work and $0 \leq (1-\theta_t^h) < 1$ to rent-seeking competition. The within-period budget constraint of each h is:

$$s_{t+1}^h + c_t^h = (1-\tau_t)(r_t s_t^h + w_t \theta_t^h + d_t^h) + \frac{(1-\theta_t^h)}{\sum_{h=1}^{H}(1-\theta_t^h)} E_t \tag{4}$$

where s_{t+1}^h is h's end-of-period assets, $0 < \tau_t < 1$ is the income tax rate common to all households, d_t^h is h's share of dividends, and E_t is the part of total tax revenue extracted by rent seekers in the economy (see below for the determination of E_t). Thus, given a contestable pie, E_t, rent seekers compete for a fraction of that pie.[9] The initial stock, s_0^h, is given.

Each household h chooses $\{c_t^h, s_{t+1}^h, \theta_t^h\}_{t=0}^{\infty}$ to maximize (3) subject to (4) by taking prices, policy and aggregate outcomes, like $\sum_{h=1}^{H}(1-\theta_t^h)$, as given. The solution of this problem is in Appendix B.

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[9] For a similar rent seeking technology like in (4), see e.g. Murphy et al. (1991), Svensson (2000), Grossman and Mendoza (2003), Park et al. (2005) and Economides et al. (2007). For a survey of rent seeking models, see Mueller (2003, chapter 15).

2.4. *Government budget constraint*

The government runs a balanced budget by taxing households' income at a rate $0 < \tau_t < 1$.

$$G_t + E_t = \tau_t \sum_{h=1}^{H} (r_t s_t^h + w_t \theta_t^h + \pi_t^h) \tag{5a}$$

where G_t is spending on public production services and E_t is the amount grabbed by rent seekers in the economy.[10]

If $0 < (1-b) \leq 1$ denotes the fraction of collected tax revenue extracted by rent-seekers, (5a) is equivalent to:[11]

$$G_t = b\tau_t \sum_{h=1}^{H} (r_t s_t^h + w_t \theta_t^h + d_t^h) \tag{5b}$$

$$E_t = (1-b)\tau_t \sum_{h=1}^{H} (r_t s_t^h + w_t \theta_t^h + d_t^h) \tag{5c}$$

Given $0 < b \leq 1$, the path of the income tax rate $\{\tau_t\}_{t=0}^{\infty}$ summarizes economic policy.

2.5. *Competitive decentralized equilibrium*

Given tax rates $\{\tau_t\}_{t=0}^{\infty}$, a Competitive Decentralized Equilibrium (CDE) is defined to be a sequence of allocations $\{k_t^f, l_t^f, c_t^f, s_{t+1}^h, \theta_t^h, G_t, E_t\}_{t=0}^{\infty}$ and prices $\{r_t, w_t\}_{t=0}^{\infty}$ such that: (i) households maximize utility and firms maximize profits by taking prices, policy variables and aggregate outcomes as given; (ii) all budget constraints are satisfied; (iii) all markets

[10] Fiscal favors to rent seekers can take a variety of forms. For instance, there can be direct transfers in cash (e.g. targeted subsidies and other benefits) and non-cash (e.g. private use of public assets and extra health services), as well as indirect transfers (e.g. measures that increase public sector's demand for an interest group's services). There are also measures that reduce tax burdens (e.g. tax exemptions and loopholes designed to favor special interests) coupled with a rise in the average tax rate to make up for the lost revenues. Obviously, this list is not exhaustive (see e.g. Mueller, 2003, chapter 15, for more examples).

[11] We will assume that b is a parameter reflecting social norms; this is for algebraic simplicity. Alternatively, one could endogenize b. For instance, in equilibrium, b could increase with aggregate per capita rent seeking activities (see e.g. Park et al., 2005, and the references therein). Our key results do not depend on this (see Appendix E for a version of our model with an endogenous b).

clear.[12] We solve for a symmetric equilibrium in which households and firms are alike ex post, and the number of households, H, equals the number of firms, F. Appendix C shows:

Result 1: *In a Competitive Decentralized Equilibrium (given tax policy), private decisions are given by (quantities are in per capita terms):*

$$c_t = [(1-\alpha\beta)(1-\tau_t)+(1-b)\tau_t]A^{\frac{1}{\alpha+\varepsilon}}\theta_t^{\frac{\varepsilon}{\alpha+\varepsilon}}(b\tau_t)^{\frac{1-\alpha-\varepsilon}{\alpha+\varepsilon}}k_t^{\frac{\alpha}{\alpha+\varepsilon}} \quad (6a)$$

$$k_{t+1} = \alpha\beta(1-\tau_t)A^{\frac{1}{\alpha+\varepsilon}}\theta_t^{\frac{\varepsilon}{\alpha+\varepsilon}}(b\tau_t)^{\frac{1-\alpha-\varepsilon}{\alpha+\varepsilon}}k_t^{\frac{\alpha}{\alpha+\varepsilon}} \quad (6b)$$

$$0 < \theta_t = \frac{\varepsilon(1-\tau_t)}{\varepsilon(1-\tau_t)+(1-b)\tau_t} < 1 \quad (6c)$$

Also, the two types of government spending, $g_t \equiv \frac{G_t}{F}$ *and* $e_t \equiv \frac{E_t}{H}$*, are:*

$$g_t = b\tau_t A^{\frac{1}{\alpha+\varepsilon}}\theta_t^{\frac{\varepsilon}{\alpha+\varepsilon}}(b\tau_t)^{\frac{1-\alpha-\varepsilon}{\alpha+\varepsilon}}k_t^{\frac{\alpha}{\alpha+\varepsilon}} \quad (6d)$$

$$e_t = (1-b)\tau_t A^{\frac{1}{\alpha+\varepsilon}}\theta_t^{\frac{\varepsilon}{\alpha+\varepsilon}}(b\tau_t)^{\frac{1-\alpha-\varepsilon}{\alpha+\varepsilon}}k_t^{\frac{\alpha}{\alpha+\varepsilon}} \quad (6e)$$

Equations (6a), (6b), (6c), (6d) and (6e) give c_t, k_{t+1}, θ_t, g_t and e_t as functions of the beginning-of-period capital stock, k_t, and the current value of the policy instrument, τ_t, only.[13] This simple structure will make the political parties' optimisation problems recursive and hence optimal policies will be time consistent (see below).

Equations (6a), (6b), (6d) and (6e) are standard (see e.g. McCallum (1989), Glomm and Ravikumar (1994, 1997), Devereux and Wen (1998) and Economides et al. (2003)), except that here we also have effects from incentives, θ_t.

Equation (6c) gives the solution for θ_t in a CDE, where recall that θ_t denotes the fraction of effort time allocated to work relative to rent seeking. Notice that $\frac{\partial\theta_t}{\partial\tau_t} < 0$ in (6c). That is, the fraction of effort time individuals allocate to work relative to rent seeking decreases with the tax rate, τ_t. This happens because atomistic agents do not internalize the

[12] The market-clearing conditions are $\sum_{f=1}^{F} l_t^{\,f} = \sum_{h=1}^{H}\theta_t^h$, $\sum_{f=1}^{F} k_t^{\,f} = \sum_{h=1}^{H} s_t^h$ and $\sum_{f=1}^{F}\pi_t^{\,f} = \sum_{h=1}^{H} d_t^h$.

[13] As is well known, this convenient solution is thanks to the functional forms used. Namely, full capital depreciation, logarithmic preferences and Cobb-Douglas production functions. See e.g. Sargent (1987, chapter 1).

adverse effect of their rent seeking actions on aggregate output and economic growth. Hence, whenever the tax rate, τ_t, increases, they get the impression that the contestable prize, $E_t = (1-b)\tau_t \sum y_t$, also increases and so attempt to extract a greater share of it by devoting less time to work and more time to rent seeking. This is as in Mohtadi and Roe (1998, 2003), Mauro (2004) and Park et al. (2005). Then, if we solve for θ_t, (6a) and (6b) give the paths of capital and consumption.

Also notice three things in (6a-c). First, $\frac{\partial(k_{t+1}/k_t)}{\partial\theta_t}>0$, which means that gross capital accumulation, $\frac{k_{t+1}}{k_t}$, increases with the fraction of time individuals allocate to work relative to rent seeking. Second, the effect of the tax rate, τ_t, on gross capital accumulation, is given by $\frac{\partial(k_{t+1}/k_t)}{\partial\tau_t}=\overset{(?)}{\frac{\partial(k_{t+1}/k_t)}{\partial\tau_t}}+\overset{(+)}{\frac{\partial(k_{t+1}/k_t)}{\partial\theta_t}}\overset{(-)}{\frac{\partial\theta_t}{\partial\tau_t}}$. Thus, in addition to the standard direct Laffer-curve-type effect, there is an additional indirect effect through the distortion of incentives. The total effect is not monotonic; a sufficient condition for this to be negative, $\frac{\partial(k_{t+1}/k_t)}{\partial\tau_t}<0$, is $\tau_t > 1-\alpha-\varepsilon$, which guarantees that the direct Laffer curve effect is also negative. Third, the effects of rent seeking activities and the tax rate on gross economic growth, $\frac{y_{t+1}}{y_t}$, are qualitatively the same as those of $\frac{k_{t+1}}{k_t}$. Hence, we will use the last two terms interchangeably.

We can now endogenize policy, as summarized by the income tax rate, $\{\tau_t\}_{t=0}^{\infty}$.

2.6. Policy and general equilibrium with exogenous re-election probabilities

To endogenize economic policy, we form a non-cooperative game between two identical political parties, denoted by i and j. Following most of the relevant literature, we start by assuming that the two parties alternate in power according to an exogenous and constant re-election probability (endogenous probabilities are studied below). Specifically, if elections take place in each time-period t, the incumbent party has an exogenous and constant probability $0 \le q \le 1$ of winning the next election and remaining in power at $t+1$, and a probability $0 \le 1-q \le 1$ of losing the election and being out of power at $t+1$. Thus, the transition equation is a two-state Markov process, where the parameter q can be interpreted as the voter bias in favor of the incumbent government, no matter what type.

As is shown below, exogenous re-election probabilities, together with the assumed functional forms (logarithmic preferences, Cobb-Douglas production function and full capital depreciation), enable us to get an exact analytical solution for the optimally chosen tax rate. Also, this optimally chosen tax rate will be state-independent. Hence, the popularity of this setup in the literature (see e.g. Devereux and Wen (1998) and Economides et al. (2003) in the political business cycle literature, as well as Barro (1990) in a popular single-government endogenous growth model).

A general equilibrium is defined as follows: (i) The currently elected party i chooses τ_t to maximize the utility of the representative household in (3) subject to the CDE in (6a)-(6e), and by taking as given the policy of the other party, $j \neq i$, which may be in power at $t+1$. That is, the in-power party plays Nash *vis-a-vis* the out-of-power party. The out-of-power party takes no action until it wins an election. (ii) We solve for Markov policy strategies, i.e. τ_t can be function of the current state of the game only. (iii) We solve for a symmetric Nash equilibrium in Markov policy strategies, i.e. parties' policies will be symmetric *ex post*. Thus, there are no partisan effects. (iv) We assume that political parties do not care about the economy when out of power.[14] (v) The solution for τ_t, and the associated level of government spending, in combination with the CDE, will give a (Markov-perfect) general equilibrium.

From the parties' viewpoint, the state at t is summarized by the inherited capital stock k_t. Let $V^{P_i}(k_t)$ and $V^{N_i}(k_t)$ denote the value functions of party i at time t, when in power and when out of power respectively. These value functions should satisfy the following pair of Bellman equations (party j's problem is symmetric):[15]

$$V^{P_i}(k_t) = \max_{\tau_t^i}[\log c_t + \beta[qV^{P_i}(k_{t+1}) + (1-q)V^{N_i}(k_{t+1})]] \tag{7a}$$

$$V^{N_i}(k_t) = [0 + \beta[(1-q)V^{P_i}(k_{t+1}) + qV^{N_i}(k_{t+1})]] \tag{7b}$$

[14] This is for simplicity. Our results do not change as long as we assume that parties care less about the economy when out of power than when in power. See Economides *et al*. (2003) for details.
[15] This modelling is as in e.g. Alesina and Tabellini (1990), Lockwood et al. (1996), Devereux and Wen (1998) and Economides et al. (2003).

where c_t and k_{t+1} follow (6a) and (6b) respectively. It is straightforward to show that this problem gives (see Appendix D):

Result 2: *In a Markov-perfect general equilibrium of a symmetric Nash game between two political parties, the income tax rate, τ, is constant over time and is a solution to:*

$$\frac{\alpha\beta-b}{(1-\tau)(1-\alpha\beta)+(1-b)\tau}+\frac{(1-\alpha-\varepsilon)(1-\tau)[\varepsilon(1-\tau)+(1-b)\tau]-\varepsilon(1-b)\tau}{(\alpha+\varepsilon)\tau(1-\tau)[(\varepsilon(1-\tau)+(1-b)\tau]}+ \\ +\frac{\beta\left[(1-\alpha-\varepsilon-\tau)[\varepsilon(1-\tau)+(1-b)\tau]-\varepsilon(1-b)\tau\right]}{(\alpha+\varepsilon)\tau(1-\tau)[(\varepsilon(1-\tau)+(1-b)\tau]}\frac{\alpha[q(\varepsilon+\alpha(1-\beta q))+\alpha\beta(1-q)^2]}{[\varepsilon+\alpha(1-\beta)][\varepsilon+\alpha(1+\beta(1-2q))]}=0 \tag{8}$$

Equation (8) is an equation in the tax rate, τ, only. In turn, as said above, the solution for τ, in combination with the DCE in (6a)-(6e), gives a general equilibrium.

The key thing is the effect of electoral uncertainty (q) on the tax rate (τ) and incentives (θ). Since equation (8) is non-linear and cannot be solved analytically, we solve it numerically by using commonly used parameter values (we report that our results are robust to the parameter values chosen). For instance, we start by setting $\alpha=0.4$, $\varepsilon=0.5$, $\beta=0.9$, $b=0.5$, $A=3$ and $q=0.5$, where the assumed value of q reflects the assumption that the two parties face the same degree of electoral uncertainty.[16] In this case, equation (8) gives $\tau=0.104$ and, in turn, equation (6c) gives $\theta=0.895$ (namely, agents allocate 89.5% of their effort time to legal activities, while the rest is allocated to rent seeking).

Using these parameter values, comparative statics for varying values of q imply $\frac{\partial\tau}{\partial q}<0$ and $\frac{\partial\theta}{\partial q}>0$ (see Appendix D for details). In other words, as electoral uncertainty increases (i.e. as q falls), the party in power finds it optimal to go for a larger public sector, where the latter requires a higher income tax rate (τ),[17] and atomistic individuals find it

[16] The values of α and ε (the productivity of capital and labor in private production) are close to the values used in the RBC literature. The value of β (time preference rate) is close to the one used by most studies. The value of b (the share of collected tax revenues which is not grabbed by rent-seekers) is set equal to 0.5. The value of A (aggregate productivity) is set equal to 3 (A works as a scale effect only, so that its value does not affect the key variables).

[17] Addition of public debt would probably lead the party in power to finance a larger public sector today by borrowing rather than raising taxes (see e.g. Lockwood et al., 1996). This would not change our qualitative predictions. Larger public sector and accumulation of public debt will necessitate higher tax rates sooner or later. The anticipation of higher taxes in the future will exert an adverse effect on growth in the present. In other words, when facing a lower probability of getting re-elected, the party in power would choose to tax future generations relatively more in exactly the same (shortsighted) manner as suggested by higher spending/taxes in the present setup; in all cases, shortsighted policies hurt growth.

optimal to allocate less effort to productive work and more effort to rent seeking (i.e. θ falls). Combining these effects, equation (6b), together with (6c) and (8), imply $\frac{\partial(k_{t+1}/k_t)}{\partial q}=\overset{(-)}{\frac{\partial(k_{t+1}/k_t)}{\partial\tau}}\overset{(-)}{\frac{\partial\tau}{\partial q}}+\overset{(+)}{\frac{\partial(k_{t+1}/k_t)}{\partial\theta}}\overset{(-)}{\frac{\partial\theta}{\partial\tau}}\overset{(-)}{\frac{\partial\tau}{\partial q}}>0$. Thus, a lower re-election probability (i.e. a lower q) leads to lower capital accumulation and economic growth.

The mechanism that drives the above results is as follows. When there is electoral uncertainty, and the political parties care less about economic outcomes when out of power than when in power, the party in power cares effectively less about the future. The smaller the probability of re-election, the less the party in office internalizes the future costs of overspending\overtaxing today. This is translated into shortsighted policies, here in the form of a relatively large public sector. Hence, increased electoral uncertainty induces more short-sighted fiscal policies that reduce private investment and eventually hurt growth. This is a standard result in the political business cycle literature (see Persson and Tabellini (1999, section 7.2) and Persson and Tabellini (2000, section 14.2) for details and review of the related literature).[18] [19] What is novel here is that these relatively large public sectors have an additional detrimental effect on private incentives by signaling a larger pie and thus pushing individuals away from productive work to rent-seeking competition for a share of extra fiscal favors. Then, these distorted incentives further hurt growth. In other words, in addition to a direct standard Laffer-curve-type effect, a larger public sector due to elections has an indirect adverse effect on growth via the deterioration of private incentives. This is the scenario we test empirically.

2.7. Policy and general equilibrium with endogenous re-election probabilities

We now study the more general case in which the re-election probability is endogenous. This reflects the idea that the incumbent's chances of remaining in power depend on the performance of the economy before elections. Equivalently, as e.g. Persson and Tabellini (1999, p. 1454) point out, "governments also manipulate state variables to increase their

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[18] Equivalently, when the probability of losing the next election increases, and the incumbent party has no interest in household consumption when out of office, then the value of expected future consumption falls in the party's value function, and this in turn leads the incumbent to make policy choices that favor the present more relative to the future. In our context, this implies a larger than (socially) optimal government size and taxes today as well as lower growth rates.

[19] Note that shortsightedness takes different forms in different models. As said, here takes the form of excessive size of the public sector (relative to the case of a single-party government). But it can also take the form of leaving smaller assets to successor governments (see Devereux and Wen, 1998), delaying improvements in the legal system (see Svensson, 1998), weakening the protection of property rights (see Alesina et al., 1996), a preference for public consumption over public investment (see Malley et al, 2007), etc.

chances of re-election". Here, we assume that the re-election probability, q_{t+1}, follows the state-dependent rule:

$$q_{t+1} = q_0^{(1-\rho_q)} q_t^{\rho_q} \left(\frac{i_t}{i} \right)^{\gamma} \tag{9}$$

where $0 < q_0 < 1$ is a constant, $0 < \rho_q < 1$ is an autoregressive parameter, $i_t \equiv \frac{k_{t+1}}{k_t}$ is gross current capital accumulation (see equation (6b)), i is the model-consistent long-run value of i_t (for any variable x_t, x denotes its long-run value), and $\gamma \geq 0$ is a feedback parameter that measures the effect of the current growth rate on the re-election probability.

We wish to make some comments on our modeling in (9). First, the re-election probability consists of two components: one component relates the current growth performance under the incumbent, while the other reflects exogenous characteristics of the incumbent. Second, there are obviously many intuitive state variables that can affect the re-election probability. Since all of them are equally ad hoc and their choice is eventually an empirical matter, here we prefer to follow Malley et al. (2007) by choosing $\left(\frac{i_t}{i} \right)$. As we show below, this choice gives intuitive results. It is also reasonable in the sense that private investment is the main determinant of economic growth in our model economy.[20] Third, if $\gamma = 0$ and $\rho_q = 0$, equation (9) simplifies to the popular model of the literature where the re-election probability is a parameter, $q_{t+1} = q_0$ (see subsection 2.6 above). Fourth, it has the desired long-run property, $q = q_0$.

While the definition of a general equilibrium remains as above in subsection 2.6, the state variables at t - from the political parties' viewpoint - now include the inherited capital stock, k_t, and the current value of the re-election probability, q_t. Let $V^{P_i}(k_t, q_t)$ and $V^{N_i}(k_t, q_t)$ denote the new value functions of party i at time t when in power and when out of power respectively. These value functions should satisfy the following pair of Bellman equations (party j's problem is symmetric):

[20] See Malley et al. (2007), and in particular the discussion below their equation (14), for a justification of an equation like (9). Actually, our modeling and solution methodology in this subsection are very close to theirs. On the other hand, Malley et al. do not study rent seeking; they focus on the allocation of tax revenue between productive and non-productive government spending, and how it is affected by elections.

$$V^{P_i}(k_t, q_t) = \max_{\tau_t^i}[\log c_t + \beta[q_{t+1}V^{P_i}(k_{t+1}, q_{t+1}) + (1-q_{t+1})V^{N_i}(k_{t+1}, q_{t+1})]] \quad (10a)$$

$$V^{N_i}(k_t, q_t) = 0 + \beta[(1-q_{t+1})V^{P_i}(k_{t+1}, q_{t+1}) + q_{t+1}V^{N_i}(k_{t+1}, q_{t+1})] \quad (10b)$$

where c_t, k_{t+1} and q_{t+1} follow equations (6a), (6b) and (9) respectively.

As is shown below, a non-constant re-election probability in (9) implies that exact analytical solutions for the optimal tax rate and the value functions in (10a)-(10b) cannot be obtained. Nevertheless, we get a first-order approximate analytical solution where the approximation is around the model's long-run solution. We define the long run to be a situation in which variables do not change (for any variable x_t, x denotes its long-run value), which also implies that the re-election probability in (9) is constant, $q = q_0$ (for instance, we choose to set $q = q_0 \equiv 0.5$). This solution methodology follows Campbell and Viceira (2002, chapter 5.1) who also provide references, while the closest model to ours is Malley et al. (2007). Appendix E shows:

Result 3. *Under endogenous re-election probabilities as in (9), in a Markov-perfect general equilibrium of a symmetric Nash game between two political parties, the income tax rate,* τ_t*, is state-contingent and is approximately given by:*

$$\Omega_1 \hat{\tau}_t + \Omega_2 \rho_q \hat{q}_t + \Omega_3 \hat{k}_t = 0 \quad (11)$$

where for any variable x_t, $\hat{x}_t \equiv \frac{x_t - x}{x} \cong \ln(\frac{x_t}{x})$, x *is the model-consistent long-run value of* x_t*, and* Ω_1, Ω_2 *and* Ω_3 *are evaluated in the long run and are defined in Appendix F.*

Therefore, equation (11), jointly with the CDE in equations (6a)-(6e), give an approximate general equilibrium in which economic policy is optimally chosen by two political parties that alternate in power according to an endogenous re-election probability as in (9). Notice that equation (11) implies $\frac{\partial \hat{\tau}_t}{\partial \hat{q}_t} = -\frac{\rho_q \Omega_2}{\Omega_1}$ and $\frac{\partial \hat{\tau}_t}{\partial \hat{k}_t} = -\frac{\Omega_3}{\Omega_1}$. Since Ω_1, Ω_2 and Ω_3 are non-linear expressions we use the same parameter values as above in subsection 2.6 in order to compute them numerically.

Appendix F shows that, with the same parameter values, $\frac{\partial \hat{\tau}_t}{\partial \hat{q}_t} < 0$ and in turn $\frac{\partial \hat{\theta}_t}{\partial \hat{q}_t} > 0$ and $\frac{\partial \hat{i}_t}{\partial \hat{q}_t} > 0$. In other words, the key result of subsection 2.6 remains unchanged: namely, higher political uncertainty pushes parties to short-sighted policies, which in turn trigger rent-seeking activities and hurt capital accumulation and economic growth.

3. EMPIRICAL EVIDENCE

In this section we will test the predictions of the stylized model presented above by using data for 25 OECD countries in three 5-year periods, over 1982-1996.

3.1. Empirical specification

We will consider an econometric model of the following form[21]:

$$\text{size of government} = \lambda_1 * \text{electoral uncertainty} + \text{control variables} \quad (12a)$$

$$\text{rent seeking} = \lambda_2 * \text{size of government} + \text{control variables} \quad (12b)$$

$$\text{growth rate} = \lambda_3 * \text{size of government} + \lambda_4 * \text{rent seeking} + \text{control variables} \quad (12c)$$

Following the model predictions and the discussion above, the effect of electoral uncertainty on the size of government in (12a) should be positive. Then, in (12b), the effect of the size of government on rent seeking behavior should be positive. Finally, in (12c), the effect of rent seeking behavior on growth should be negative, while the effect of the size of government on growth can be either positive or negative.[22] We have also added a number of auxiliary variables (called control variables) to take account of effects not included in our stylized model but usually included in such regressions in empirical work (see below for details). These additional control variables will be useful for instrumenting the endogenous right hand side variables in equations (12b) and (12c).

[21] This specification is based on the basic model with exogenous re-election probabilities (subsection 2.6). As shown above, although extensions of the basic framework can give richer results, the main predictions do not change.

[22] According to the theoretical model, the effects of rent seeking and size of the government on the capital accumulation and economic growth are qualitatively the same. In the empirical part, we focus on the growth rate so that our specification is closer to the empirical growth literature, but we will also examine investment as an endogenous variable.

The model in (12a)-(12c) is a recursive system. The recursive structure follows from the sequence of events in the theoretical model; specifically, the elected government chooses policy by acting as a Stackelberg leader vis-à-vis private agents.[23] Since there may be common shocks that affect simultaneously the endogenous variables, so that the error terms across equations are correlated, OLS estimates of (12b) and (12c) can be biased. Hence, we need valid instruments for the endogenous right hand side variables in (12b) and (12c) in order to apply IV methods (but we also examine standard Least Squares results). As such instruments, we use the exogenous variables appearing in the system. We will test the validity and the relevance of these instruments.

Concerning the data, we would like to make the following general points (further details will be given later).

First, rent-seeking or other extractive activities are hard to measure. Hence, any empirical methodology can only utilize proxy variables, which can hopefully provide adequate description of this type of activities (note that rent seeking from the government budget is an expression of non-productive or extractive incentives, since, as also implied by the theoretical model, when economic agents extract from the tax revenue, they essentially extract from the aggregate, economy-wide income). A widely used (see e.g. the papers reviewed below) proxy of weak institutions is the ICRG index, which is obtained by using the IRIS dataset constructed by Knack and Keefer (1995). This index is essentially a measure of outcomes that result from the permanent "deep parameters" underlying exogenous institutional features. If institutions are weak, so that there is low quality of governance, high corruption and low protection of property rights (which is what the ICRG index measures), we expect extraction activities to thrive and, in particular, rent seeking from the government budget to be widespread. Hence, in the absence of a direct measure of rent seeking, we believe that the ICRG index is a relevant proxy.

Extraction activities can take a variety of forms and, naturally, different authors have used this dataset to obtain proxies for similar activities that in general involve a misallocation

[23] Obviously, by relaxing the Stackelberg leader assumption, or by making different behavioural assumptions for the government (allowing e.g. for corrupt bureaucracies or extractive ruling elites) we could allow for weak institutions, and rent seeking in particular, to affect the size of government. For instance, Acemoglu et al. (2003) present evidence that weak institutions (measured as constraints on the executive) result in higher government consumption spending in a world sample. Here we focus on the effect of the size of the government on rent extraction activities, and by allowing for the size of the government to be endogenous in this regression, we control for potential simultaneity bias.

of resources from productive to extractive activities.[24] Such activities are highly related and, in practice, the available empirical proxies tend to be highly correlated (see e.g. Treisman, 2000, p. 411, Acemoglu et al. 2001, p. 1370, 2003, p. 68 and Persson et al. 2003, p. 967). Probably the most appropriate way to describe these empirical measures is as a proxy of a "cluster of social arrangements" (using the expression from Acemoglu and co-authors, see their papers referred to here) that encompasses the set of incentives economic agents face to engage in productive versus socially harmful, non-productive activities. As these activities are endogenous outcomes (recall also that in the theoretical model the private agents in the economy optimally choose rent-seeking activities, so that rent seeking is an endogenous, choice variable), we explicitly treat the ICRG proxy as an endogenous variable.

A second issue is how to approximate uncertainty about remaining in power. We use two measures. First, we proxy electoral uncertainty by using pre-election dummies, as it has been common practice in the political business cycles literature (see e.g. Alesina et al., 1997). The idea is that the more elections are held in a given time interval (the 5-year period), the higher is the uncertainty that policy makers are facing in this period (this is as in Fatas and Mihov, 2003, and similar to Treisman, 2000). In addition, we use a more general measure of the stability of the governments, obtained from Beck et al. (2000), which captures the extent of turnover of a government's decision makers, as the percentage of the main veto gates (legislature, executive) in a system that have changed hands in any year. This is a useful alternative to the number of elections for the uncertainty about remaining in power, as, for instance, governments might be more uncertain about remaining in power when a party leaves the government coalition or if they lose control over the legislature.

Third, real long-term time series observations are not available for rent seeking and electoral uncertainty, and thus the analysis can only be confined to the medium-term impact of these variables on growth. We use 5-year periods, so that growth regressions make sense (this is not uncommon in the empirical literature that examines the relation between fiscal policy and economic growth). A concern with using a relatively short-time period, such as a 5-year period, when evaluating the growth effects of fiscal policy, is the potential endogeneity of fiscal policy, as there is the risk of short-term covariation such as business cycles correlations (for instance, counter-cyclical fiscal policy). However, we deal with this problem by using instrumental variable regressions.

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[24] For instance, Knack and Keefer (1995) proxy "institutions", Barro (1997) uses the term "rule of law", Hall and Jones (1999) "social infrastructure", Acemoglu et al. (2001, 2002) "extractive institutions", Fisman and Gatti (2002) and Persson, Tabellini and Trebbi (2003) "corruption".

3. 2. *Comparison with the empirical literature*

Equations (12a)-(12c) give a structural model that studies the joint determination of the above three endogenous variables (size of government, rent seeking behaviour, and economic growth) when the driving force is uncertainty about remaining in power. As said above, the contribution of our paper is that we identify a channel through which electoral uncertainty affects the joint determination of these three key variables.[25] This differs from the empirical studies that have concentrated on reduced-form relations to uncover the determinants of these variables.

There is a vast empirical literature on the determinants of economic growth (see e.g. Barro and Sala-i-Martin (2004, chapter 12) and the papers cited there). Focusing on the growth effects of extraction and anti-social activities, Mauro (1995), Knack and Keefer (1995), Barro (1997), Hall and Jones (1999), Rodrik (1999) and Acemoglu et al. (2001,2002), have, among many others, provided evidence that entrenched corruption and poor institutions are a significant impediment to growth. Concerning the growth effects of government spending, there is some general indication that the overall size of the public sector is negatively associated with economic growth; however, this negative association is statistically fragile and sensitive to model specification (see Mueller, 2003, chapter 22, for a review of this literature). There is also evidence (see e.g. Alesina et al, 1996 and Drazen, 2000, chapter 11.6, for a review) that measures of socio-political stability are associated with higher growth in world samples. However, when Alesina et al (1997) investigate the effect of electoral competition on economic outcomes, electoral uncertainty is not found to have a significant direct impact on growth in reduced-form regressions for the OECD countries.

Concerning the determinants of rent seeking, the most extensive study is probably Treisman's (2000) work on the variables explaining the CPI index of perceptions of corruption.[26] In his cross-national study, Treisman reports a negative, albeit not significant, effect of various measures of government intervention and policy on the CPI index. Fisman

[25] Methodologically, therefore, our empirical analysis belongs to the literature of estimating structural models behind the reduced form for these three key endogenous variables. Related examples in this approach include e.g. papers by Perotti (1996), Fatas and Mihov (2003) and Easterly et al. (2006). Perotti employs a recursive system to estimate the effect of income inequality on the growth rate, via some potential channels (one of which is endogenous fiscal policy). Fatas and Mihov present evidence that political factors (the electoral cycle being one of them) affect the volatility (discretion) of fiscal policy, and this is associated with higher output volatility, which is bad for the growth rate. Easterly et al. present evidence that measures of social cohesion affect institutional quality and this, in turn, determines growth.

[26] The CPI index, developed by Transparency International, focuses on the extent of corruption in government. As we discuss below, we prefer to use instead the ICRG index as a measure of rent seeking activities, because it has a sufficiently long-time series dimension and is a more general measure of rent seeking than bureaucratic corruption. It should be noted, however, that the CPI and the ICRG indices are highly correlated (see Treisman (2000, p. 411) and Persson et al. (2003, p. 967)).

and Gatti (2002), on the other hand, report a significant effect of the government share in GDP in reducing corruption. Glaeser and Saks (2006) find a weak positive relationship between bigger governments and corruption, using data for the USA states (a positive relationship between bigger governments and corruption for the USA states is also reported in Goel and Nelson, 1998). Treisman (2000) also reports that political uncertainty, as measured by the average number of leaders the country had per year in the preceding period (see p. 414 on how this period is defined), is not significantly associated with (perceived) corruption in any of his regressions. However, Persson, Tabellini and Trebbi (2003) have recently documented a link between electoral rules and corruption.

Finally, concerning the effects of elections on fiscal policy, Alesina et al. (1997, chapter 7) provide evidence that government spending increases in pre-electoral periods (Drazen (2000, chapter 7) and Mueller (2003, chapter 19) survey the literature). A more general study of the empirical determinants of the size of public sector can be found in Persson and Tabellini (2003, chapter 3), who discuss estimates of the effects of several intuitive variables on different measures of the size of government (although political uncertainty is not included as a possible explanatory variable).

In summarizing the empirical evidence so far, it is probably fair to say that the empirical literature has not been able to establish a robust direct effect of electoral uncertainty on economic outcomes such as rent seeking and economic growth, in reduced-form regressions of (12b) and (12c). This literature has, however, already established a significant positive effect of electoral uncertainty on the size of the government in equations of the form of (12a). In addition, regarding (12c), a significant negative effect of measures of extraction activities on economic growth has been obtained in a number of studies. In any case, it seems that the weakest link in our proposed channel for the effect of electoral uncertainty is the effect of the size of the government on rent seeking in equation (12b), as mixed results have been obtained in the literature. As Glaeser and Saks (2006, p.1065) point out, endogeneity problems have to be dealt with in this type of regression, an issue we pay particular attention to.

3.3. Data

We have collected data for 25 OECD countries, over the years 1982-1996 (the time period is determined by the availability of the Knack and Keefer, 1995, commonly used ICRG index), so that we can have three 5-year periods/observations for each country. Details on the data used can be found in Appendix G. Here we present the basic points.

To measure electoral uncertainty, we construct a pre-election dummy and then take the average of this pre-election dummy over the five-year period, denoting the resulting variable as *elections*.[27] A larger value means more elections in these five years, so that incumbent parties face a larger probability of losing power on average. In addition, we use a proxy for the stability of the governments from the Beck et al. (2000) database (this is denoted as *instability*, and is again the average over the five-year periods). A larger value in *instability* means that more key decision makers dropped from the government, so that the stability of the government is reduced and hence the uncertainty about remaining in power is increased.

To obtain a measure of extraction activities, as said above, we use the *ICRG* index from the IRIS dataset. This dataset has been used in a series of papers (see, among many others, Knack and Keefer (1995), Barro (1997), Hall and Jones (1999), Rodrik (1999), Acemoglu et al. (2001, 2002), Fisman and Gatti (2002) and Persson et al. (2003)). Although there exist other datasets that can also provide a measure of rent extraction activities (like e.g. the *CPI* index explained above), the *ICRG* index is the only panel dataset on rent seeking and has a sufficiently long-time series dimension (1982-1997) which makes it suitable for our purposes. By taking advantage of its time series dimension, we get three 5-year averages of this index (this variable is appropriately defined so that higher values indicate more rent seeking; see Appendix G for details).

The Penn World Tables (PWT), version 6.1 (Heston et al., 2002), provide us with the real GDP per capita in constant prices, which is then used to obtain the five-year average of annual growth rates (denoted as *growth rate*), as well as the government consumption share in GDP in constant prices, which is also averaged over the 5-year period to give us the variable denoted *govshare*, which will be used as our primary measure of fiscal size.[28]

The set of control variables used is based on previous studies (see the papers referred to earlier). In particular, in the growth regression we first include the log of the initial level of

[27] Fatas and Mihov (2003) also use the average number of elections (over a 25 year period, 1975-2000) in order to control for the effect of electoral cycles in the shaping of fiscal policy in a cross-section of countries. As discussed above, Treisman (2000) uses a similar proxy for political uncertainty as well, by constructing a measure of the average number of government leaders per year in the recent period.

[28] This is the general government consumption component of GDP. It does not include public investment, interest payments, subsidies and other transfers. Note however that a large part of government spending on goods and services, included in *govshare*, has investment features and/or complements private resources in the production process (e.g. salaries of teachers, professors and doctors and spending on police or the judiciary system). The PWT measure has been used e.g. Barro (1997), Barro and Sala-i-Martin (2004), Fisman and Gatti (2002), Hall and Jones (1998) and Rodrick (1998), among many others. See the Appendix G for more details and the discussion below on results by using alternative measures of fiscal spending from the OECD Economic Outlook and the World Development Indicators (WDI) datasets.

GDP in each country (the 1981 observation), which is denoted as *lgdp* and is obtained from the Penn World Tables, to control for convergence effects. Potential growth promoting factors considered include human capital, which is measured by the average years of education (denoted as *education*), the degree of a country's openness to trade, for which we use the Penn World Tables measure (denoted here as *openness*) and the investment share in GDP (denoted as *investment*), which is again obtained from the Penn World Tables. As potential determinants of rent seeking, we use *lgdp*, *education*, *openness* and a measure of the degree of political freedom – or of the quality of democracy – by using the Gastil Index (so that we denote this variable *gastil*). We expect all these variables to be inversely related to rent seeking. Finally, as control variables in the fiscal policy regression, we use: *lgdp*, as Wagner's law suggests that richer countries should have bigger public sectors; *openness*, following Rodrik's (1998) proposition that more open economies may prefer larger public sectors as an insurance against terms of trade risk; the age dependency ratio (denoted as *agedep*), as demographic evolutions may put pressure on the public budget; and the area of the country (denoted as *surface*), as there may be more scope for government intervention, in the form of addressing externalities and providing public goods, in bigger countries. More details on the justification for including the above variables in these regressions can be found in the papers reviewed in the previous subsection; more information on the data is given in Appendix G.

3.4. Basic results

The basic results are presented in Table 1 below. The first two columns present Least Squares estimates of the size of government equation, using the two measures of uncertainty about remaining in power. We report standard errors that are robust to arbitrary heteroskedasticity and arbitrary intra-country serial correlation. We see that the political uncertainty variables are both significant, thus supporting the proposition that shorter time horizons from the point of view of the policymakers result into more government spending. Note that higher values of both *elections* and *instability* imply an increase in the uncertainty about remaining in power.

Table 1 here

Regarding the control variables, the most significant effect is that of *openness*, which seems to verify Rodrik's (1998) proposition for the OECD. On the other hand, richer countries do not have larger public sectors, as Wagner's law suggests. The two remaining controls, *surface* and *agedep* have the expected signs and *surface* is significant as well. [29] Regarding *surface*, we report that we have also used the (log of) population of the countries as a measure of their size, as Alesina and Wacziarg (1998) suggest that in countries with more population, one would expect a smaller government share in GDP, because the cost of public goods can be spread over a larger pool of taxpayers (i.e. there are increasing returns in the provision of public goods). This has the expected negative sign in our regressions, but it is insignificant, without affecting the aforementioned results. Similar results regarding population have been obtained in Persson and Tabellini (2003, chapter 3). The significant positive effect of *surface* in our regressions is consistent with the negative effect of population density that Alesina and Wacziarg (1998) report. In these regressions we also include time dummies (denoted as *D(87-91)* and *D(92-96)*. These time dummies are negative and highly significant, which is consistent with a common trend in recent years in the OECD countries towards lower public spending.

We then move on to estimating the effect of *govshare* on rent seeking activities, as the latter are measured by the ICRG index. Given the potential endogeneity of *govshare* in this regression, we will use the variables in the previous equation (for *govshare*) as well as the exogenous determinants of *ICRG* as instruments for *govshare* in GMM procedures.[30] Thus, the additional instruments, used to identify *govshare* are *elections*, *agedep*, *surface*, *D(87-91)* and *D(92-96)* in column 3 and *instability*, *agedep*, *surface*, *D(87-91)* and *D(92-96)* in column 4. We treat the time dummies as instruments since we have found that they are not significant in explaining *ICRG* – they are, however, highly significant in the *govshare* regression (see also below on this). As can be seen, a higher value of *govshare* is significant in increasing *ICRG*, which is consistent with an aggravation of rent extraction activities, as the theoretical model predicts.

It is also worth noting that all the control variables are significant in this regression, with the expected signs. Richer and more open countries, more political freedom and an educated population all result in a decrease in *ICRG* (less rent seeking). With the exception of *gastil*, these results for the control variables have also been obtained in the literature, in different samples and specifications, although we are not aware of a study where these variables have all been significant in the same specification. The effect of initial income is

[29] Persson and Tabellini (2003, chapter 3), in a world sample for the nineties, find significant demographic effects on total government expenditure (that includes social security). In our specification for the OECD, demographic effects do not seem to be robustly related with the government share in GDP.

[30] The GMM estimator used here is optimal under arbitrary heteroskedasticity and arbitrary intra-country serial correlation. We have also estimated the regressions with endogenous right hand side variables with 2SLS. As the results are similar, we do not present 2SLS results to save on space.

probably the more robust finding. For instance, Treisman (2000), Fisman and Gatti (2002), Persson and Tabellini (2003, chapter 3) and Glaeser and Saks (2006) all find that initial income reduces rent extraction activities. Positive effects of openness on decreasing extraction activities are obtained in e.g. Ades and Di Tella (1999) and Treisman (2000). Glaeser and Saks (2006) find strong evidence for the effect of education in reducing corruption. Perhaps the more interesting result here is the effect of political freedom, as the above studies have not been able to document a robust effect. In our sample, this effect is clearly significant.

A fundamental concern with IV regression methods is whether the instruments are valid and relevant. We try to address these issues. We start with validity, by implementing standard over-identifying restrictions tests. The Hansen statistic gives a *p-value* of 0.353 in column 3 and 0.555 in column 4, which is clearly consistent with the null that the instruments are uncorrelated with the error term. Of particular interest may be testing whether the time dummies are correctly excluded from the regression and hence whether they are indeed valid instruments. Therefore, we also report a C test for the orthogonality of the time dummies. The *p-value* supports the use of the time dummies as instruments. Hence, we can have some confidence that our instruments are valid.[31]

Next, we want to see whether the instruments are relevant. Recent research has shown that there can be severe problems with IV estimation and testing procedures, if the instruments are only weakly related with the endogenous variable (see e.g. Dufour, 2003 and Andrews and Stock, 2005, for reviews). A weak instruments problem is usually suspected by a small F-statistic of the test that the joint effect of the excluded instruments on the endogenous variable is zero in the first stage regression (or, equivalently, by a low partial R^2). In our case, the first stage F-statistics are high, much higher than 10, which is the value proposed by Staiger and Stock (1997) as a rule of thumb "critical" value for identifying potential weak instrument problems when there is one endogenous regressor.

In any case, to make sure that the effect of *govshare* on *ICRG* is not affected by the relevance of our instruments, we also examine tests for the significance of the parameter estimate of *govshare* that are robust to weak instruments. We focus on the Anderson and Rubin (1949) (AR) test, as this can be extended to allowing for heteroskedasticity and serial correlation in the error term (see e.g. Chernozhukov and Hansen, 2006)). The AR test is in

[31] The tests reported are robust to arbitrary heteroskedasticity and arbitrary intra-country serial correlation. Many of the tests and estimators in this paper have been implemented using the routines written by Baum, Schaffer and Stillman (2006). We are particularly grateful to Mark Schaffer for his help.

addition robust to a number of misspecifications (in particular, to the specification of the relationship for the endogenous variable and to excluded instruments, see Dufour, 2003 and Dufour and Taamouti, 2006, for more details). The test statistics in Table 1 easily reject the null of a zero effect of *govshare* on ICRG.

Finally, we turn to the growth regression. In columns 5 and 6 we present GMM results when *ICRG* and *govshare* are treated as endogenous variables and the instruments used to identify them are *elections*, *uncertainty*, *agedep*, *surface* and *gastil* (column 5) or *instability*, *uncertainty*, *agedep*, *surface* and *gastil* (column 6).[32] The results with respect to the endogenous variables are in accordance with both the predictions of the theory and previous empirical findings. In particular, *ICRG* is found to be negative and significant, while *govshare* is not significant. The first result is consistent with the hypothesis that rent seeking is bad for growth, while the second could imply that OECD countries are around the optimal size with respect to the size of the government share in GDP. With respect to the control variables, we see that *lgdp* is significantly negative, which is consistent with conditional convergence, while *openness* and *education* are not significant (we carefully deal with the case of *investment* in subsection 3.6 below). A number of studies (see subsection 3.2 above) have found a positive effect of these last two variables on economic growth. A potential explanation for their insignificance here can be that they are both highly related to decreases in *ICRG*, so that when they are used as instruments for *ICRG*, a large part of their positive impact on *growth* is already controlled for.[33]

A Hansen over-identification test cannot reject the null that the instruments are not correlated with the error in the second stage regression (such tests do reject the null when the time dummies are used as instruments, and so does the C orthogonality test for the dummies). However, the first stage F-statistics are relatively low, especially for *govshare*. Therefore, we also test the null that the joint effect of *ICRG* and *govshare* in the structural equation is zero,

[32] For instance, the assumption behind using *gastil* as an instrument for *govshare* and *ICRG* in the *growth* regression is that (at least in the OECD countries) political freedom does not affect economic growth other than through the size of government and the incentives that it creates for economic agents to engage in extractive activities. The same argument applies for the other instrumental variables. We assess statistically this assumption by means of overidentification tests in our regressions.

[33] Barro (1997) proposes a similar argument to explain the insignificance of levels of schooling in the female population in growth regressions in world samples. In particular, he suggests that female schooling may be important to growth indirectly, via improving other growth promoting factors, such as health indicators (e.g. infant mortality ratios). Barro finds that in world samples only years of secondary and higher education of the male population have a direct effect on growth, because, he argues, they are a better proxy for human capital. We report that, in our specification, years of secondary and higher schooling, for the male or total population, are not significant in the growth regression.

by using the Anderson-Rubin test. This clearly rejects the null, indicating that these two variables are jointly significant in explaining *growth*.

3.5. Discussion

The results in the previous section support the proposed transmission mechanism for the effect of electoral uncertainty on the macro economy. As already said, a crucial link for this mechanism is the effect of fiscal spending on rent extraction activities, because there is mixed evidence in the literature regarding this. A difference in our study, compared to the papers reviewed above, is that we focus on the OECD countries. However, it is also important that we treat our fiscal size variable (*govshare*) as an endogenous variable. Table 2 presents Least Squares estimates of (9b) and (9c) to illustrate why this is important.

Table 2 here

As can be seen in this Table, in column 1, *govshare* is still positive in OLS regressions in the OECD, however the estimated coefficient is much smaller than the GMM estimates. This suggests that there are important downward biases in the Least Squares estimates. In other words, shocks that decrease the *ICRG* index (i.e. reduce extraction activities) may also increase *govshare*. For instance, the implementation of an institutional change, designed to decrease rent seeking, like, e.g. an increase in checks for government policies to examine whether they favor particular lobbies, may require higher government expenditure to finance it.

It is also interesting to see what a Least Squares regression of the *growth* equation gives. Estimates from such a regression are given in column 4 in Table 2. As can be seen, *ICRG* is still significant, but the estimated coefficient is much smaller (in absolute value) compared to the GMM estimates. This could happen if positive income shocks (i.e. positive productivity shocks) are also increasing rent-seeking effort, if rent seekers perceive them as an increase in the contestable prize (for instance, the discovery of a new natural resource). In this case, the “true” effect of *ICRG* on *growth* may be larger than the Least Squares estimate.

It may be also interesting to examine whether electoral uncertainty has a direct effect on *ICRG* and *growth* in Least Squares regressions. Columns 2-3 and 5-6 in Table 2 show that including *elections* or *instability* in these regressions results in insignificant estimates for these variables (we report that these variables are not significant if used as explanatory variables in the structural equations of Table 1 as well). This basically reproduces the findings of the literature and highlights the importance of the fiscal policy channel.

3.6. Robustness and extensions

In this section, we try to address some robustness issues. First, we wish to deal with the issue of including investment as an explanatory variable in the growth regression.

As discussed in sub-section 2.5, our model predicts that capital accumulation and growth have the same qualitative properties. So far, we have focused on the growth rate as the dependent variable, but it is also interesting to examine the effects of rent seeking on investment as well. In addition, since the empirical literature has considered the investment share in GDP as a potential determinant of economic growth in growth regressions, we also examine the effects of including *investment* in the *growth* equation, so that our specification is closer to previous empirical work. This can be a useful test, as it can provide information on whether the effect of rent seeking on growth is only realized via the disincentives it creates for private capital accumulation, or, if there is an additional effect, by hindering the efficient allocation of factor inputs in general. For instance, Mauro (1995) finds that if he controls for investment in his growth regressions, his measure of extraction activities (the Business International indices of corruption) loses its explanatory power, while Knack and Keefer (1995) find that the ICRG index retains its statistical significance even if investment is controlled for.

Table 3 here

Column 1 in Table 3 presents results when *investment* is included in the *growth* equation as an explanatory variable.[34] The investment share is not significant, while the estimated coefficient of *ICRG*, although a bit smaller (in absolute value) than Table 1, is still significant. The validity of the instruments is again supported by the Hansen test, while the AR test rejects the null of joint zero effect of the endogenous variables on the growth rate. Obviously, the smaller (in absolute value) coefficient of *ICRG* is consistent with the hypothesis that a part of the effect of *ICRG* on *growth* occurs via the disincentives for private

[34] According to the theoretical model, as noted above, investment (or the growth rate of capital) is an endogenous variable. This would imply that including it as an explanatory variable in a growth regression could introduce endogeneity bias in the estimates. Keeping this concern in mind, we note that the main purpose of this regression is to contextualize our results *vis-a-vis* the literature. In practice, it is not easy to find additional instruments - that satisfy both the validity and relevance requirements - for *investment* in the *growth* regression. Such problems are avoided when we consider a regression of *investment* on *govshare* and *ICRG* below.

investment. However, these results suggest that rent seeking also seems to induce a misallocation of resources that is more general than the decrease in investment. A direct way to examine whether rent seeking affects investment in our sample is to consider a regression where *investment* is the dependent variable. Results of such a regression are presented in column 2 of Table 3. As can be seen, higher rent seeking activities are indeed a disincentive for investment.

We would also like to examine what happens if we use alternative measures of the government fiscal size (so far we have been using the government consumption share in GDP from the Penn World Tables). Such an alternative measure can be obtained by using OECD data on the government consumption and government investment, to construct the government share in GDP (this is denoted as *govoecd*). An advantage of the Penn World Tables data is that they are PPP adjusted and therefore more suitable for international comparisons. An additional advantage is that they are available for all the countries and time periods we work with, while, in contrast, by using the OECD measure our sample size drops from 75 to 65. The advantage from using the OECD data is that we can include government investment in the government share in GDP (in practice this is small component of government spending, about 2%-3% of GDP for most OECD countries). The results from using *govoecd* are presented in Table 4. As can be seen, the main results still go through. An exemption is that *elections* is not significant in explaining *govoecd*, but the rest of the results and the discussion from the previous analysis using the *govshare* measure generally carry over for the *govoecd* measure.

Table 4 here

We report that a more general measure of the fiscal size of the government "total expenditures of the central government to GDP", available from the World Development Indicators (WDI), is found to be significantly related to the *instability* proxy but not to *elections*. However, we cannot find evidence that it is related to the ICRG index. This seems to suggest that the additional components of government spending included in "total expenditures", i.e. interest payments and transfer payments (which in the OECD largely consist of pensions) are not associated with rent seeking. Most of the total government expenditure in the OECD is made up of transfer payments (this is, actually, the main difference between government consumption spending and total expenditure, see e.g. Tanzi and Schuknecht, 2000). When using transfers instead of *govshare* in the previous regressions, we found indeed that the channel does not work. By contrast, our econometric results suggest that the fiscal policy channel of electoral uncertainty works through what Tanzi and Schuknecht (2000) call "real expenditure" or "the part of government spending that absorbs or uses economic resources directly" (p. 24). It is an interesting issue for further research to carefully investigate which components of government expenditure are causing and which are deterring rent seeking activities.[35]

In our analysis so far we have not included country dummies in our regressions as control variables, because we want to use both the within and the cross-country information in the data. Actually, most of the empirical studies of rent seeking rely on cross-country differences, which is completely partialled out if we include country dummies. It is interesting however to exploit the time series dimension of the ICRG index and examine which of the results hold looking at the within variation only. We would expect the results involving the ICRG index to be more sensitive, as the variation of this index across countries is larger than within countries. The results from including country dummies are presented in Table 5.

Table 5 here

Two points are worth making before discussing the results. First, since we cannot include time invariant variables together with the country dummies, we had to drop the variables *lgdp* and *surf* from the control variable list in our regressions. Regarding *surf*, we use instead a measure of population density, as in e.g. Alesina and Wacziarg (1998), that is time varying. This variable is obtained by dividing population by surface. Regarding initial GDP, we cannot use the initial GDP of each time period, as this would imply using future values of an endogenous variable in the system as exogenous regressors. Second, since the country effects are not appended any more in the error term, there is no apparent reason to expect that the error term will be serially correlated within countries. Hence, we report standard errors that are robust to heteroskedasticity (we also report that standard errors that are robust in addition to arbitrary serial correlation are not very different).[36]

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[35] We do not use tax revenue as a measure of fiscal size, as this is not a good proxy of the distortions that the fiscal size exerts on private incentives, especially rent seeking incentives. For instance, Tanzi and Davoodi (2001) report empirical evidence that less rent seeking and better institutions increase the tax revenue collected by the government.

[36] We present results using *govshare* only. With *govoecd* 65 observations are available, which implies that adding an additional 25 country dummy set in the control variables results in a big drop in degrees of freedom. Estimates are generally insignificant in this case.

Starting with the regression for the fiscal size, we see that although both proxies for political uncertainty have the correct sign, only the *elections* variable is significant. No other control variable is significant in this regression (except for the time dummies). Looking at the GMM regressions for rent seeking, we note that for the results presented in columns 3 and 4 we have not included *agedep* in the set of instruments, as the Hansen over-identification test rejects in this case. The estimated coefficients for *govshare* are again positive, but not statistically significant. However, it is the AR test that is more important in these regressions, as the first stage F-statistics reveal that the instruments are not highly correlated with *govshare* within countries. Then, when *instability* is used as an instrument for *govshare*, in column 4, the AR test rejects the zero null, hence implying a significant effect from *govshare* to *ICRG*. We also report that adding *agedep* in the instrument list increases the first stage F-statistics and *govshare* is significant in this case, but, as said above, the validity (Hansen) test rejects. Note also that in these regressions only *education* is significant as a determinant of *ICRG*. Finally, we see that in the *growth* regression, both *govshare* and *ICRG* are negative, while the AR test clearly rejects the null. In the *investment* regression, *ICRG* is negative and significant, while the AR test again rejects the null. Note again that the control variables in the *growth* equation are not significant.

Overall, we would say that although the results are not as clear when looking at the within country variation only, in general they are consistent with the theoretical predictions and the previous analysis.

4. CONCLUDING REMARKS

We have solved a general equilibrium model to study the link between fiscal policy, incentives and economic growth in the presence of uncertainty about remaining in power. The focus was on the effects of electoral uncertainty and party competition on the choice of fiscal policy and rent seeking incentives and in turn on the macro-economy. The main prediction is that when a party cares less for voters when out of office, uncertainty about remaining in power pushes governments to follow relatively shortsighted policies in the form of a larger public sector, which in turn increases rent seeking activities and thus hurts the economy.

This prediction was tested using data for 25 OECD countries for the time period 1982-1996. The main result is that uncertainty about remaining in power does matter for economic outcomes and that its effects take place via the channel of fiscal policy. Consistent with this channel, our evidence here suggests that the fiscal size of the government increases extractive activities. Empirical evidence regarding this link has been, so far, fairly weak, mainly because of endogeneity problems. We believe that in this paper we have provided both a conceptual, theoretical framework to deal with this issue and a valid and relevant identification for empirical evaluation.

We close with some remarks. First, we focused on the adverse effects of electoral uncertainty. However, political competition between selfish political parties can also lead to the implementation of efficient policies (e.g. elections can control the moral hazard behavior of politicians). Here, we have not studied these issues. Hence, the policy message is obviously not against elections**.** Second, several OECD (especially EU) countries have recently announced, or adopted, fiscal policy rules that are expected to reduce the ability of policymakers to follow opportunistic policies. It would therefore be interesting to examine, as a future extension when more data on recent periods become available, whether these rules have been successful in mitigating opportunistic policymaking.

Finally, we wish to point out that what we found is that larger public sectors, as measured by a larger government share in GDP, are bad for incentives and hence indirectly bad for growth. However, all government spending need not be bad for incentives, as there may be types of expenditure that help to reduce rent seeking (for instance, spending on the improvement of the judiciary system or on education). Further research is thus needed on the compositional effects of government spending on extractive incentives. Moreover, government spending may have important (positive or negative) direct effects on economic growth. The study of the growth effects of fiscal policy is a multi-dimensional issue, as it depends, among others, on the composition and the efficiency of government spending (see, e.g. Angelopoulos et al., 2007a, 2007b).

APPENDICES

Appendix A: Firm's problem

The first-order conditions with respect to k and l are simply:

$$r_t = \alpha \frac{y_t^{\ f}}{k_t^{\ f}} \tag{A.1a}$$

$$w_t = \varepsilon \frac{y_t^{\ f}}{l_t^{\ f}} \tag{A.1b}$$

Appendix B: Household's problem

The first-order conditions include the budget constraint (4) and:

$$\frac{c_{t+1}^h}{c_t^h} = \beta(1-\tau_{t+1})r_{t+1} \tag{B.1a}$$

$$(1-\tau_t)w_t = \frac{1}{\sum_{h=1}^{H}(1-\theta_t^{\ h})}E_t \tag{B.1b}$$

Appendix C: Result 1

The market-clearing conditions are $\sum_{f=1}^{F} l_t^{\ f} = \sum_{h=1}^{H}\theta_t^h$, $\sum_{f=1}^{F} k_t^{\ f} = \sum_{h=1}^{H} s_t^h$ and $\sum_{f=1}^{F}\pi_t^{\ f} = \sum_{h=1}^{H} d_t^h$. We assume that the number of households equals the number of firms and focus on a symmetric equilibrium. Combining (2), (5b), (A.1a) and (A.1b), we get for output:

$$r_t k_t + w_t\theta_t + d_t \equiv y_t = A^{\frac{1}{\alpha+\varepsilon}}\theta_t^{\frac{\varepsilon}{\alpha+\varepsilon}}(b\tau_t)^{\frac{1-\alpha-\varepsilon}{\alpha+\varepsilon}}k_t^{\frac{\alpha}{\alpha+\varepsilon}} \tag{C.1a}$$

Combining (B.1b), (A.1b), (5c) and (C.1a), we get:

$$0 < \theta_t = \frac{\varepsilon(1-\tau_t)}{\varepsilon(1-\tau_t)+(1-b)\tau_t} < 1 \tag{C.1b}$$

Moreover, we conjecture that c_t and k_{t+1} are proportional to the product $(1-\tau_t)A^{\frac{1}{\alpha+\varepsilon}}\theta_t^{\frac{\varepsilon}{\alpha+\varepsilon}}(b\tau_t)^{\frac{1-\alpha-\varepsilon}{\alpha+\varepsilon}}k_t^{\frac{\alpha}{\alpha+\varepsilon}}$, where the assumed degrees of proportionality are time invariant undetermined coefficients (see also e.g. McCallum, 1989, pp. 21-22). Substituting these conjectures into (B.1a), we obtain:

$$k_{t+1} = \alpha\beta(1-\tau_t)A^{\frac{1}{\alpha+\varepsilon}}\theta_t^{\frac{\varepsilon}{\alpha+\varepsilon}}(b\tau_t)^{\frac{1-\alpha-\varepsilon}{\alpha+\varepsilon}}k_t^{\frac{\alpha}{\alpha+\varepsilon}} \quad \text{(C.1c)}$$

Also, combining (A.1a), (A.1b), (C.1a), (5b) and (5c), we get:

$$g_t \equiv \frac{G_t}{F} = b\tau_t A^{\frac{1}{\alpha+\varepsilon}}\theta_t^{\frac{\varepsilon}{\alpha+\varepsilon}}(b\tau_t)^{\frac{1-\alpha-\varepsilon}{\alpha+\varepsilon}}k_t^{\frac{\alpha}{\alpha+\varepsilon}} \quad \text{(C.1d)}$$

$$e_t \equiv \frac{E_t}{H} = (1-b)\tau_t A^{\frac{1}{\alpha+\varepsilon}}\theta_t^{\frac{\varepsilon}{\alpha+\varepsilon}}(b\tau_t)^{\frac{1-\alpha-\varepsilon}{\alpha+\varepsilon}}k_t^{\frac{\alpha}{\alpha+\varepsilon}} \quad \text{(C.1e)}$$

Finally, using (A.1a), (A.1b), (C.1a), (C.1c) and (C.1e) into (4) we get:

$$c_t = \left[(1-\alpha\beta)(1-\tau_t)+(1-b)\tau_t\right]A^{\frac{1}{\alpha+\varepsilon}}\theta_t^{\frac{\varepsilon}{\alpha+\varepsilon}}(b\tau_t)^{\frac{1-\alpha-\varepsilon}{\alpha+\varepsilon}}k_t^{\frac{\alpha}{\alpha+\varepsilon}} \quad \text{(C.1f)}$$

Appendix D: Result 2

As usually, we work in two steps.

Step 1: Since the underlying model is log-linear, we guess that the two value functions in (7a)-(7b) take the form:

$$V^{P_i}(k_t) = u_0^{P_i} + u_1^{P_i}\log k_t \quad \text{(D.1a)}$$

$$V^{N_i}(k_t) = u_0^{N_i} + u_1^{N_i}\log k_t \quad \text{(D.1b)}$$

where $(u_0^P, u_1^P, u_0^N, u_1^N)$ are time-invariant undetermined coefficients. Party j solves an analogous problem. If we use these conjectures into (7a)-(7b), differentiate the right-hand side of (7a) with respect to τ_t^i, and impose the *ex post* symmetry conditions $\tau_t^i = \tau_t^j \equiv \tau_t$, $u^{P_i} = u^{P_j} \equiv u^P$ and $u^{N_i} = u^{N_j} \equiv u^N$, the first-order condition for τ_t is:

$$\begin{aligned} &\frac{\alpha\beta - b}{(1-\tau_t)(1-\alpha\beta)+(1-b)\tau_t} + \frac{(1-\alpha-\varepsilon)(1-\tau_t)[\varepsilon(1-\tau_t)+(1-b)\tau_t]-\varepsilon(1-b)\tau_t}{(\alpha+\varepsilon)\tau_t(1-\tau_t)[(\varepsilon(1-\tau_t)+(1-b)\tau_t]} + \\ &+\frac{\left[(1-\alpha-\varepsilon-\tau_t)[\varepsilon(1-\tau_t)+(1-b)\tau_t]-\varepsilon(1-b)\tau_t\right]}{(\alpha+\varepsilon)\tau_t(1-\tau_t)[(\varepsilon(1-\tau_t)+(1-b)\tau_t]}\beta[qu_1^P+(1-q)u_1^N]=0 \end{aligned} \quad \text{(D.2)}$$

which includes the undetermined coefficients.

Step 2: We use the above (i.e. the conjectures (D.1a)-(D.1b) for the value functions, as well as (D.2) for the control variable) back into the Bellman equations in (7a)-(7b), group terms and equate coefficients on both sides. The solution of the Riccati equations gives the values of the undetermined coefficients in the guessed value functions. Notice that the crucial coefficients are u_1^P and u_1^N; namely, these are the coefficients that matter in the solution for optimal policy in (D.2). The relevant Riccati equations imply:

$$u_1^P = \frac{\alpha[\varepsilon + \alpha(1-\beta q)]}{[\varepsilon + \alpha(1-\beta)][\varepsilon + \alpha(1+\beta(1-2q))]} \tag{D.3a}$$

$$u_1^N = \frac{\alpha^2 \beta(1-q)}{[\varepsilon + \alpha(1-\beta)][\varepsilon + \alpha(1+\beta(1-2q))]} \tag{D.3b}$$

Then, if we go back to (D.2) and substitute for u_1^P and u_1^N from (D.3a) and (D.3b), we get equation (8) in the main text.

Study of equation (8)

Total differentiation of equation (8) implies:

$$\frac{\partial(.)}{\partial\tau}d\tau + \frac{\partial(.)}{\partial q}dq = 0 \tag{D.4}$$

where the partials are:

$$\begin{aligned}\frac{\partial(.)}{\partial\tau} = & -\frac{(\alpha\beta-b)^2}{[(1-\alpha\beta)(1-\tau)+(1-b)\tau]^2} - \frac{1-\alpha-\varepsilon}{(\alpha+\varepsilon)\tau^2} + \frac{\varepsilon(1-b)[(1-b)(1-2\tau)-2\varepsilon(1-\tau)]}{(\alpha+\varepsilon)(1-\tau)^2[(\varepsilon(1-\tau)+(1-b)\tau]^2} + \\ & +\beta\left[\frac{-\tau(1-\tau)-(1-\alpha-\varepsilon-\tau)(1-2\tau)}{(\alpha+\varepsilon)\tau^2(1-\tau)^2} + \frac{\varepsilon(1-b)[(1-b)(1-2\tau)-2\varepsilon(1-\tau)]}{(\alpha+\varepsilon)(1-\tau)^2[\varepsilon(1-\tau)+(1-b)\tau]^2}\right]\frac{\alpha[q(\varepsilon+\alpha(1-\beta q))+\alpha\beta(1-q)^2]}{[\varepsilon+\alpha(1-\beta)][\varepsilon+\alpha(1+\beta(1-2q))]}\end{aligned} \tag{D.5a}$$

$$\begin{aligned}\frac{\partial(.)}{\partial q} = & \beta\left[\frac{(1-\alpha-\varepsilon-\tau_t)[\varepsilon(1-\tau)+(1-b)\tau]-\varepsilon(1-b)\tau}{(\alpha+\varepsilon)\tau(1-\tau)[\varepsilon(1-\tau)+(1-b)\tau]}\right] \\ & \left[\frac{\alpha[\varepsilon+\alpha(1-2\beta)][\varepsilon+\alpha(1-\beta)][\varepsilon+\alpha(1+\beta(1-2q))]+2\alpha^2\beta[[\varepsilon+\alpha(1-\beta q)q+\alpha\beta(1-q)^2]][\varepsilon+\alpha(1-\beta)]}{[\varepsilon+\alpha(1-\beta)]^2[\varepsilon+\alpha(1+\beta(1-2q))]^2}\right]\end{aligned} \tag{D.5b}$$

In general, it is not possible to sign analytically the above two partials and hence the sign of $\frac{\partial\tau}{\partial q}$. Numerical solutions over the full range of $0<q<1$ (while all other parameters are as in subsection 2.6) are reported in Table D.1 and imply $\frac{\partial\tau}{\partial q}<0$. Notice that the same numerical solutions imply that the above two partials, $\frac{\partial(.)}{\partial\tau}$ and $\frac{\partial(.)}{\partial q}$, are both negative, i.e.

$$\frac{d\tau}{dq} = -\frac{\overset{(-)}{\partial(.)/\partial q}}{\underset{}{\overset{(-)}{\partial(.)/\partial\tau}}} < 0.$$

Table D.1 here

Appendix E: Endogenous extraction ($1-b_t$)

Following Park et al. (2005), we assume that, in equilibrium, $1-b_t$ is a positive function of the average (per capita) effort time spent in extraction activities, $\frac{\sum_{j=1}^{J}(1-\theta_t^j)}{J}$, in each period t. In particular, we assume a linear function of the form:

$$1-b_t \equiv \delta_0 + \delta_1 \frac{\sum_{j=1}^{J}(1-\theta_t^j)}{J} \tag{E.1}$$

where $0 \le \delta_0 + \delta_1 < 1$. The constant term, $\delta_0 \ge 0$, captures the possibility of transfers independently of rent seekers' pressure, while $\delta_1 \ge 0$ translates lobbies' effort into actual extraction. It is straightforward to show that the CDE (given by (6a)-(6e)) changes to:

$$c_t = \left[(1-\alpha\beta)(1-\tau_t)+[\delta_0+\delta_1(1-\theta_t)]\tau_t\right] A^{\frac{1}{\alpha+\varepsilon}} \theta_t^{\frac{\varepsilon}{\alpha+\varepsilon}} \left[1-\delta_0-\delta_1(1-\theta_t)\right]^{\frac{1-\alpha-\varepsilon}{\alpha+\varepsilon}} (\tau_t)^{\frac{1-\alpha-\varepsilon}{\alpha+\varepsilon}} k_t^{\frac{\alpha}{\alpha+\varepsilon}} \tag{E.2a}$$

$$k_{t+1} = \alpha\beta(1-\tau_t) A^{\frac{1}{\alpha+\varepsilon}} \theta_t^{\frac{\varepsilon}{\alpha+\varepsilon}} \left[1-\delta_0-\delta_1(1-\theta_t)\right]^{\frac{1-\alpha-\varepsilon}{\alpha+\varepsilon}} (\tau_t)^{\frac{1-\alpha-\varepsilon}{\alpha+\varepsilon}} k_t^{\frac{\alpha}{\alpha+\varepsilon}} \tag{E.2b}$$

$$\theta_t^2 - \frac{\varepsilon(1-\tau_t)+(\delta_0+\delta_1)\tau_t}{\delta_1\tau_t}\theta_t + \frac{\varepsilon(1-\tau_t)}{\delta_1\tau_t} = 0 \tag{E.2c}$$

$$g_t = \left[1-\delta_0-\delta_1(1-\theta_t)\right]^{\frac{1}{\alpha+\varepsilon}} \tau_t A^{\frac{1}{\alpha+\varepsilon}} \theta_t^{\frac{\varepsilon}{\alpha+\varepsilon}} (\tau_t)^{\frac{1-\alpha-\varepsilon}{\alpha+\varepsilon}} k_t^{\frac{\alpha}{\alpha+\varepsilon}} \tag{E.2d}$$

$$e_t = (\delta_0+\delta_1\theta_t)\tau_t A^{\frac{1}{\alpha+\varepsilon}} \theta_t^{\frac{\varepsilon}{\alpha+\varepsilon}} \left[1-\delta_0-\delta_1\theta_t\right]^{\frac{1-\alpha-\varepsilon}{\alpha+\varepsilon}} (\tau_t)^{\frac{1-\alpha-\varepsilon}{\alpha+\varepsilon}} k_t^{\frac{\alpha}{\alpha+\varepsilon}} \tag{E.2e}$$

Study of equation (E.2c)

Assume that τ is time invariant (we show below that this is indeed the case) so that θ is also time invariant. Equation (E.2c) is then a second-order polynomial in θ. Assuming existence, there are two roots, say θ_1 and θ_2, where:

$$\theta_1 + \theta_2 = \frac{\varepsilon(1-\tau)+(\delta_0+\delta_1)\tau}{\delta_1\tau} > 0 \tag{E.3a}$$

$$\theta_1\theta_2 = \frac{\varepsilon(1-\tau)}{\delta_1\tau} > 0 \tag{E.3b}$$

(E.3a)-(E.3b) imply that θ_1 and θ_2 are both positive. Then, if the product $(\theta_1-1)(\theta_2-1)$ is negative, one root is higher than 1, and one root is less than 1. It can be easily shown by using (E.3a)-(E.3b) that this is indeed the case, and hence there is only one well-defined solution, that is one root less than unity. Working with this root, total differentiation of (E.2c) implies:

$$\theta_\tau \equiv \frac{\partial\theta}{\partial\tau} = \frac{\varepsilon(1-\theta)}{\tau[2\delta_1\tau\theta - \varepsilon(1-\tau) - (\delta_0 + \delta_1)\tau]} \tag{E.4a}$$

$$\theta_{\tau\tau} \equiv \frac{\partial^2\theta}{\partial\tau^2} = -\frac{\varepsilon\theta_\tau\tau[2\delta_1\tau\theta - \varepsilon(1-\tau) - (\delta_0+\delta_1)\tau] + \varepsilon(1-\theta)[4\delta_1\tau\theta - \varepsilon + 2\varepsilon\tau - 2(\delta_0+\delta_1)\tau + 2\delta_1\tau^2\theta_\tau]}{\tau^2[2\delta_1\tau\theta - \varepsilon(1-\tau) - (\delta_0+\delta_1)\tau]^2} \tag{E.4b}$$

Policy and general equilibrium with exogenous re-election probabilities and endogenous extraction

Working as in subsection 2.6 and Appendix D it is straightforward to show that in a Markov-perfect general equilibrium of a symmetric Nash game between the two political parties, in which the degree of extraction is determined endogenously as in (E.1), the income tax rate, τ, is constant over time and is a solution to:

$$\frac{\alpha\beta - 1 + \delta_0 + \delta_1(1-\theta_\tau) - \delta_1\tau\theta_\tau}{(1-\tau)(1-\alpha\beta) + [\delta_0 + \delta_1(1-\theta)]\tau} + \frac{\varepsilon\tau[1-\delta_0-\delta_1(1-\theta)]\theta_\tau + \delta_1(1-\alpha-\varepsilon)\tau\theta\theta_\tau + (1-\alpha-\varepsilon)\theta[1-\delta_0-\delta_1(1-\theta)]}{(\alpha+\varepsilon)\tau\theta[1-\delta_0-\delta_1(1-\theta)]} +$$
$$+\frac{\alpha\beta[q(\varepsilon+\alpha(1-\beta q))+\alpha\beta(1-q)^2]}{[\varepsilon+\alpha(1-\beta)][\varepsilon+\alpha(1+\beta(1-2q))]}\left[-\frac{1}{1-\tau} + \frac{\varepsilon\tau[1-\delta_0-\delta_1(1-\theta)]\theta_\tau + \delta_1(1-\alpha-\varepsilon)\tau\theta\theta_\tau + (1-\alpha-\varepsilon)\theta[1-\delta_0-\delta_1(1-\theta)]}{(\alpha+\varepsilon)\tau\theta[1-\delta_0-\delta_1(1-\theta)]}\right] = 0 \tag{E.5}$$

where θ follows from (E.2c) and θ_τ is given by (E.4a). The solution for τ, in combination with the DCE in (E.2a)-(E.2e), gives a general equilibrium. Notice that equations (E.5) and (E.2c) constitute a system of two equations in τ and θ only. Since this system is non-linear and cannot be solved analytically, we solve it numerically by using the parameter values already used in subsection 2.6. Regarding δ_0 and δ_1 we use the values used by Park et al. (2005) that is $\delta_0 = 0.5$ and $\delta_1 = 0.2$. Then equations (E.5) and (E.2c) give $\tau = 0.100$ and $\theta = 0.896$ respectively.

Study of equation (E.5)

We now study the comparative static properties of (E.5). Total differentiation of equation (E.5) implies:

$$\frac{\partial(.)}{\partial\tau}d\tau + \frac{\partial(.)}{\partial q}dq = 0 \tag{E.6}$$

where the partials are:

$$\frac{\partial(.)}{\partial\tau}=-\frac{\delta_1(2\theta_\tau+\tau\theta_{\tau\tau})[(1-\alpha\beta)(1-\tau)+(\delta_0+\delta_1(1-\theta))\tau]+[\alpha\beta-1+\delta_0+\delta_1(1-\theta)-\delta_1\tau\theta_\tau]^2}{[(1-\alpha\beta)(1-\tau)+(\delta_0+\delta_1(1-\theta))\tau]^2}+$$

$$+[1+\beta(qu_1^P+(1-q)u_1^N)]\left[\frac{\varepsilon\theta\theta_{\tau\tau}-\varepsilon(\theta_\tau)^2}{(\alpha+\varepsilon)\tau^2}+\frac{\delta_1(1-\alpha-\varepsilon)(1-\delta_0-\delta_1(1-\theta))\theta_{\tau\tau}-\delta_1^2\theta_\tau^2(1-\alpha-\varepsilon)}{(\alpha+\varepsilon)(1-\delta_0-\delta_1(1-\theta))^2}-\frac{1-\alpha-\varepsilon}{(\alpha+\varepsilon)\tau^2}\right]- \quad \text{(E.7a)}$$

$$-\beta[qu_1^P+(1-q)u_1^N]\frac{1}{(1-\tau)^2}$$

$$\frac{\partial(.)}{\partial q}=\beta\left[-\frac{1}{1-\tau}+\frac{\varepsilon\theta_\tau}{(\alpha+\varepsilon)\theta}+\frac{\delta_1(1-\alpha-\varepsilon)\theta_\tau}{(\alpha+\varepsilon)(1-\delta_0-\delta_1(1-\theta))}+\frac{1-\alpha-\varepsilon}{(\alpha+\varepsilon)\tau}\right]\left[u_1^P-u_1^N+\frac{\alpha^2\beta(2q-1)}{[\varepsilon+\alpha(1+\beta(1-2q))]^2}\right] \quad \text{(E.7b)}$$

where u_1^P and u_1^N are the same as in (D.3a)-(D.3b) and where θ_τ and $\theta_{\tau\tau}$ follow from (E.4a) and (E.4b) respectively.

In general, it is not possible to sign analytically the above two partials and hence the sign of $\frac{\partial\tau}{\partial q}$. Numerical solutions are reported in Table E.1 and imply $\frac{\partial\tau}{\partial q}<0$. Notice that the same numerical solutions imply that the above two partials, $\frac{\partial(.)}{\partial\tau}$ and $\frac{\partial(.)}{\partial q}$, are both negative, so that

$$\frac{d\tau}{dq}=-\frac{\overset{(-)}{\partial(.)/\partial q}}{\underset{(-)}{\partial(.)/\partial\tau}}<0.$$

Table E.1 here

Appendix F: Result 3

We work as above but now we get an approximate solution only. Specifically, we get a first-order approximate solution around its long run. We work in three steps: First, given the structure of the model, we assume that the value functions in (10a)-(10b) are log-linear in the state variables, k_t and q_t. In turn, we derive the optimality condition in (10a), impose symmetricity ex post, and take a first-order approximation of this optimality condition. Second, we solve for the long run. Third, we take a first-order approximation of the Bellman equations in (10a)-(10b), use into them the approximate expressions from the first step, group terms and equate coefficients on both sides. The solution of the Riccati equations will give the values of the undetermined coefficients of the value functions that can approximately solve the problem.

Step 1: We use the log-linear value functions:

$$V^{P_i}(k_t,q_t)=u_0^{P_i}+u_1^{P_i}\log k_t+u_2^{P_i}\log q_t \quad \text{(F.1a)}$$

$$V^{N_i}(k_t,q_t)=u_0^{N_i}+u_1^{N_i}\log k_t+u_2^{N_i}\log q_t \tag{F.1b}$$

where the $u's$ are time-invariant undetermined coefficients. There are analogous conjectures for party j. If we use these value functions into (10a)–(10b), differentiate the right-hand side of (10a) with respect to the control variable τ_t^i, impose the ex post symmetry conditions $\tau_t^i=\tau_t^j$, $u^P=u^{P_i}=u^{P_j}$, $u^N=u^{N_i}=u^{N_j}$, and take a first-order linear approximation of this optimality condition around the long-run solution presented below in step 2, we obtain equation (11) in the text, where (upper bars denote long-run values):

$$\begin{aligned}\Omega_1\equiv&-\frac{(\alpha\beta-b)^2\bar{\tau}}{[(1-\alpha\beta)(1-\bar{\tau})+(1-b)\bar{\tau}]^2}-\frac{1-\alpha-\varepsilon}{(\alpha+\varepsilon)\bar{\tau}}+\frac{\varepsilon(1-b)\bar{\tau}[(1-b)(1-2\bar{\tau})-2\varepsilon(1-\bar{\tau})]}{(\alpha+\varepsilon)(1-\bar{\tau})^2[(\varepsilon(1-\bar{\tau})+(1-b)\bar{\tau}]^2}+\\&+\beta(u_1^N+\gamma u_2^N+q_0B)\left[-\frac{(1-\alpha-\varepsilon)(1-2\bar{\tau})+\bar{\tau}^2}{(\alpha+\varepsilon)\bar{\tau}(1-\bar{\tau})^2}+\frac{\varepsilon(1-b)\bar{\tau}[(1-b)(1-2\bar{\tau})-2\varepsilon(1-\bar{\tau})]}{(\alpha+\varepsilon)(1-\bar{\tau})^2[(\varepsilon(1-\bar{\tau})+(1-b)\bar{\tau}]^2}\right]+\\&+\beta\gamma q_0\left[\frac{[(1-\alpha-\varepsilon-\bar{\tau})[(\varepsilon(1-\bar{\tau})+(1-b)\bar{\tau}]-\varepsilon(1-b)\bar{\tau}]^2}{\bar{\tau}[(\alpha+\varepsilon)(1-\bar{\tau})[(\varepsilon(1-\bar{\tau})+(1-b)\bar{\tau}]]^2}\right][2B-\gamma(\bar{V}^P-\bar{V}^N)]\end{aligned} \tag{F.2a}$$

$$\Omega_2\equiv\beta q_0\left[\frac{(1-\alpha-\varepsilon-\bar{\tau})[\varepsilon(1-\bar{\tau})+(1-b)\bar{\tau}]-\varepsilon(1-b)\bar{\tau}}{(\alpha+\varepsilon)\bar{\tau}(1-\bar{\tau})[\varepsilon(1-\bar{\tau})+(1-b)\bar{\tau}]}\right][B+\gamma(u_2^P-u_2^N)] \tag{F.2b}$$

$$\Omega_3\equiv\frac{\beta\gamma q_0}{\alpha+\varepsilon}\left[\frac{(1-\alpha-\varepsilon-\bar{\tau})[\varepsilon(1-\bar{\tau})+(1-b)\bar{\tau}]-\varepsilon(1-b)\bar{\tau}}{(\alpha+\varepsilon)\bar{\tau}(1-\bar{\tau})[\varepsilon(1-\bar{\tau})+(1-b)\bar{\tau}]}\right][(\alpha-\varepsilon)(u_1^P-u_1^N)-2\gamma\varepsilon(u_2^P-u_2^N)+\gamma(\bar{V}^P-\bar{V}^N)] \tag{F.2c}$$

where

$$B\equiv u_1^P-u_1^N+\gamma[u_2^P-u_2^N+(\bar{V}^P-\bar{V}^N)].$$

Step 2: Long-run solution. We define the long run to be a situation in which all variables do not change (for any variable x_t, x denotes its long-run value) and in which $q=q_0\equiv 0.5$ (in the long run, $\bar{V}^P-\bar{V}^N=\log\bar{c}$). This solution is the solution of subsection 2.6 under exogenous re-election probabilities (see Appendix D) if we also set $q\equiv 0.5$. In turn, having solved for the long-run tax rate, $\bar{\tau}$, we can obtain the long-run solutions for the effort time, the capital stock and the consumption as follows:

$$\bar{\theta}=\frac{\varepsilon(1-\bar{\tau})}{\varepsilon(1-\bar{\tau})+(1-b)\bar{\tau}} \tag{F.3a}$$

$$\bar{k}=(\alpha\beta)^{\frac{\alpha+\varepsilon}{\varepsilon}}A^{\frac{1}{\varepsilon}}b^{\frac{1-\alpha-\varepsilon}{\varepsilon}}(1-\bar{\tau})^{\frac{\alpha+\varepsilon}{\varepsilon}}\bar{\theta}\bar{\tau}^{\frac{1-\alpha-\varepsilon}{\varepsilon}} \tag{F.3b}$$

$$\bar{c}=[(1-\alpha\beta)(1-\tau)+(1-b)\tau]A^{\frac{1}{\alpha+\varepsilon}}\bar{\theta}^{\frac{\varepsilon}{\alpha+\varepsilon}}(b\bar{\tau})^{\frac{1-\alpha-\varepsilon}{\alpha+\varepsilon}}\bar{k}^{\frac{\alpha}{\alpha+\varepsilon}} \tag{F.3c}$$

Step 3: In this step, (i) we use (F.1a)-(F.1b) into (10a)-(10b); (ii) we linearize (10a)-(10b) around the long-run solution and substitute for $\hat{\tau}_t$ from equation (11) in the main text; (iii) we group terms and equate coefficients on $\hat{k}_t$ and $\hat{q}_t$ on both sides of the two linearized Bellman equations. The resulting Ricatti equations will enable us to get a solution for the undetermined coefficients. In particular, we obtain the following four Ricatti equations in u_1^P, u_2^P, u_1^N and u_2^N.

$$u_1^P=-\Omega_{31}\left[\frac{(\alpha\beta-b)\bar{\tau}}{(1-\alpha\beta)(1-\bar{\tau})+(1-b)\bar{\tau}}+\frac{(1-\alpha-\varepsilon)(1-\bar{\tau})[\varepsilon(1-\bar{\tau})+(1-b)\bar{\tau}]-\varepsilon(1-b)\bar{\tau}}{(\alpha+\varepsilon)(1-\bar{\tau})[\varepsilon(1-\bar{\tau})+(1-b)\bar{\tau}]}\right]+\frac{\alpha}{\alpha+\varepsilon}-$$
$$-\Omega_{31}\beta\left[\frac{(1-\alpha-\varepsilon-\bar{\tau})[\varepsilon(1-\bar{\tau})+(1-b)\bar{\tau}]-\varepsilon(1-b)\bar{\tau}}{(\alpha+\varepsilon)(1-\bar{\tau})[\varepsilon(1-\bar{\tau})+(1-b)\bar{\tau}]}\right][q_0u_1^P+(1-q_0)u_1^N+\gamma(q_0u_2^P+(1-q_0)u_2^N+q_0\log\bar{c})]+ \quad \text{(F.4a)}$$
$$+\frac{\beta}{\alpha+\varepsilon}[\alpha(q_0u_1^P+(1-q_0)u_1^N)-\gamma\varepsilon(q_0u_2^P+(1-q_0)u_2^N+q_0\log\bar{c})]$$

$$u_2^P=-\Omega_{21}\left[\frac{(\alpha\beta-b)\bar{\tau}}{(1-\alpha\beta)(1-\bar{\tau})+(1-b)\bar{\tau}}+\frac{(1-\alpha-\varepsilon)(1-\bar{\tau})[\varepsilon(1-\bar{\tau})+(1-b)\bar{\tau}]-\varepsilon(1-b)\bar{\tau}}{(\alpha+\varepsilon)(1-\bar{\tau})[\varepsilon(1-\bar{\tau})+(1-b)\bar{\tau}]}\right]-$$
$$-\Omega_{21}\beta\left[\frac{(1-\alpha-\varepsilon-\bar{\tau})[\varepsilon(1-\bar{\tau})+(1-b)\bar{\tau}]-\varepsilon(1-b)\bar{\tau}}{(\alpha+\varepsilon)(1-\bar{\tau})[\varepsilon(1-\bar{\tau})+(1-b)\bar{\tau}]}\right][q_0u_1^P+(1-q_0)u_1^N+\gamma(q_0u_2^P+(1-q_0)u_2^N+q_0\log\bar{c})]+ \quad \text{(F.4b)}$$
$$+\beta\rho(q_0u_2^P+(1-q_0)u_2^N+q_0\log\bar{c})$$

$$u_1^P=-\Omega_{31}\beta\left[\frac{(1-\alpha-\varepsilon-\bar{\tau})[\varepsilon(1-\bar{\tau})+(1-b)\bar{\tau}]-\varepsilon(1-b)\bar{\tau}}{(\alpha+\varepsilon)(1-\bar{\tau})[\varepsilon(1-\bar{\tau})+(1-b)\bar{\tau}]}\right][(1-q_0)u_1^P+q_0u_1^N+\gamma((1-q_0)u_2^P+q_0u_2^N-q_0\log\bar{c})]+$$
$$+\frac{\beta}{\alpha+\varepsilon}[\alpha((1-q_0)u_1^P+q_0u_1^N)-\gamma\varepsilon((1-q_0)u_2^P+q_0u_2^N-q_0\log\bar{c})] \quad \text{(F.4c)}$$

$$u_2^P=-\Omega_{21}\beta\left[\frac{(1-\alpha-\varepsilon-\bar{\tau})[\varepsilon(1-\bar{\tau})+(1-b)\bar{\tau}]-\varepsilon(1-b)\bar{\tau}}{(\alpha+\varepsilon)(1-\bar{\tau})[\varepsilon(1-\bar{\tau})+(1-b)\bar{\tau}]}\right][(1-q_0)u_1^P+q_0u_1^N+\gamma((1-q_0)u_2^P+q_0u_2^N-q_0\log\bar{c})]+ \quad \text{(F.4d)}$$
$$+\beta[(1-q_0)u_2^P+q_0u_2^N-q_0\log\bar{c}]\rho_q$$

where $\Omega_{21}=\dfrac{\Omega_2}{\Omega_1}$, and $\Omega_{31}=\dfrac{\Omega_3}{\Omega_1}$.

(F.4a)-(F.4b) constitute a non-linear equation system that cannot be solved analytically. Therefore we solve it numerically by using the same parameter values as in subsection 2.6. Regarding ρ and γ, we set $\rho=0.8$ and $\gamma=0.5$ (we report that our results are robust to the parameter values chosen). After having a numerical solution for the undetermined coefficients, we can go back to (F.2a)-(F.2c) to calculate numerically the signs of Ω_1, Ω_2 and Ω_3. Numerical results are reported in Table F.1 below.

Table F.1 here

Notice that equation (11) in the main text implies $\frac{\partial \hat{\tau}_t}{\partial \hat{q}_t} = -\frac{\rho_q \Omega_2}{\Omega_1}$ and $\frac{\partial \hat{\tau}_t}{\partial \hat{k}_t} = -\frac{\Omega_3}{\Omega_1}$, and numerical results from Table E.1 above give $\frac{\partial \hat{\tau}_t}{\partial \hat{q}_t} < 0$ and $\frac{\partial \hat{\tau}_t}{\partial \hat{k}_t} > 0$. Then, it follows $\frac{\partial \hat{i}_t}{\partial \hat{q}_t} > 0$, where $i_t \equiv \frac{k_{t+1}}{k_t}$.

Appendix G: Data description.

We have collected data for 25 OECD countries, over the years 1982-1996 (where the choice of the time period is dictated by the availability of the rent-seeking index). The countries are: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Korea, Mexico, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States.We use three 5-year periods/observations for each country.

Growth rate: The Penn World Tables (PWT), version 6.1 (see Heston et al., 2002) dataset provides us with the real GDP per capita in constant prices, which is then used to obtain the five-year average of annual growth rates.

Size of government (govshare): We use the Penn World Tables measure of the government share in GDP in constant prices, averaged over the 5-year period. This is the general government consumption component of GDP and includes spending on goods and services like education and health (e.g. the salaries of professors and doctors and spending on non-capital goods), national defense, public administration, police and the judiciary system. It does not include capital formation by the government, as this item is included in the Penn World Tables in the "investment share in GDP in constant prices".

Size of government (govoecd): We use OECD data (obtained from the Economic Outlook No. 81) on government consumption, government investment and GDP in constant prices, to construct the government share in GDP. This is averaged over the -year periods.

ICRG: We use the IRIS dataset (version IRIS-3, obtained by *countrydata.com*). This index contains annual values for indicators of the quality of governance, corruption and violation of property rights over the period 1982-1997, as constructed by Stephen Knack and the IRIS Center, University of Maryland, from monthly ICRG data provided by Political Risk Services. There are five subjective indices available by the IRIS dataset: "corruption in government", "rule of law", "risk of repudiation of government contracts", "risk of expropriation" and "quality of bureaucracy", with higher scores indicating better outcomes. Note that from these indices, "corruption in government", "rule of law", and "quality of bureaucracy" range in value from 0 to 6, whereas "risk of repudiation of government contracts" and "risk of expropriation" are scaled from 0 to 10. The aggregate measure of rent seeking is then constructed from these variables at a 50-point scale by first converting "corruption in government", "rule of law", and "quality of bureaucracy" to a 10-point scale and summing them up with the other two indices. This variable is then multiplied by -1, so that higher scores indicate worse incentives (more rent seeking).

Elections: We have collected data on elections for the 25 OECD countries for the time period 1982-1997 from various sources, since we have found that there are some differences between the datasets available, regarding the dates of elections. Our principal source is the Database on Political Institutions (DPI) (see Beck et al. 2000). Other useful sources include the Elections Results Archive, developed by the Center on Demographic Performance at Binghamton University (cdp.binghamton.edu/era) and the International Institute for Demography and Electoral Assistance (www.idea.int/vt/index.cfm). Here, we use the series *legelec* (the date when there were legislative elections) in the original DPI dataset, except for the following cases (where we have cross checked with other databases):

Greece: In 1989, there were elections held in both June and November, but the DPI reports only the June elections. In 1990, there were elections held in April, which are not reported in DPI. There were no elections in 1995, as DPI reports.

Ireland: In 1982 there were elections both in February and November (on Ireland, see also www.electionsireland.org). DPI reports elections only in February.

Netherlands: DPI reports elections in May 1991. This is not confirmed in any other dataset on elections we have looked at.

USA: We use only the presidential elections, as is customary in the literature (see e.g. Alesina et al. (1997)).

We then construct a pre-election dummy that takes the value of one at the year before the election and zero otherwise. Specifically, suppose that there is an election held in a country in month x of a given year. Then, the year of the election is assigned the value x/12, and the previous year the value (12-x)/12. *Elections* is the average of this pre-election dummy over the five-year period.

Instability: This is obtained from Beck et al. (2001). It measures the extent of turnover in any one year of a government's key decision makers, by dividing the number of exits between year t and t+1, by the total number of veto players in year t. The variable is on a 0-1 scale, with zero representing no exits and one representing the exit and replacement of all veto players. Thus, higher values indicate more instability. The average of this variable over the 5-year periods is used.

lgdp: This is the logarithm of initial level of GDP in each country (the 1981 observation). It is obtained from the Penn World Tables, using the real GDP per capita in constant prices.

Political freedom (gastil): *gastil* is the 5-year average of the negative of the Gastil index developed by the Freedom House, so that higher scores imply more political freedom. The Gastil index is available at www.freedomhouse.org

Openness: The data are obtained from the Penn World Tables. *Openness* is the sum of exports plus imports (in constant prices) over GDP (in constant prices). We use the average value over the 5-year period.

Education: We use the average years of education in the beginning of each 5-year period for each country. Data are available from the Barro and Lee (2001) dataset, available at www.cid.harvard.edu/ciddata/ciddata.html

Age dependency ratio: This is the ratio of dependents - people younger than 15 and older than 64 - to the working-age population - those aged 15-64, averaged over the time periods. This is available from the World Development Indicators (WDI).

Surface: The area of a country, in thousands of km^2, obtained from the World Development Indicators (WDI).

Investment share: The share of investment in GDP, averaged over the 5-year periods, is obtained from the Penn World Tables.

Table D.1

General equilibrium with exogenous re-election probabilities

q	τ	θ
0.1	0.110	0.889
0.2	0.108	0.891
0.3	0.107	0.892
0.4	0.105	0.894
0.5	0.104	0.895
0.6	0.102	0.897
0.7	0.100	0.899
0.8	0.098	0.901
0.9	0.095	0.904

Notes: $\alpha = 0.4$, $\varepsilon = 0.5$, $\beta = 0.9$, $b = 0.5$ and $A = 3$.

Table E.1

General equilibrium with exogenous re-election probabilities and endogenous extraction

q	τ	θ
0.1	0.106	0.889
0.2	0.105	0.890
0.3	0.103	0.892
0.4	0.101	0.894
0.5	0.100	0.896
0.6	0.098	0.897
0.7	0.096	0.900
0.8	0.094	0.902
0.9	0.092	0.904

Notes: $\alpha = 0.4$, $\varepsilon = 0.5$, $\beta = 0.9$, $\delta_0 = 0.5$, $\delta_1 = 0.2$, and $A = 3$.

Table F.1

Numerical Solution of u_1^P, u_1^N, u_2^P, u_2^N, $\bar{\tau}$, $\bar{\theta}$, $\bar{k}$, $\bar{c}$, Ω_1, Ω_2 and Ω_3

u_1^P	0.578
u_1^N	0.146
u_2^P	0.041
u_2^N	-0.003
$\bar{\tau}$	0.104
$\bar{\theta}$	0.895
$\bar{k}$	0.582
$\bar{c}$	1.129
Ω_1	-1.574
Ω_2	-0.151
Ω_3	0.013

Notes: $\alpha = 0.4$, $\varepsilon = 0.5$, $\beta = 0.9$, $b = 0.5$, $A = 3$, $\gamma = 0.5$ and $\rho_q = 0.8$.

TABLE 1: The effects of electoral uncertainty on government's fiscal size, rent seeking and economic growth (basic results)

Dep. variable: ***fiscal size*** *(govshare)*	**(1) Least Squares**	**(2) Least Squares**	Dep. variable: ***rent seeking*** *(ICRG)*	**(3) GMM**	**(4) GMM**	Dep. variable: ***growth rate***	**(5) GMM**	**(6) GMM**
elections	10.688** (4.917)	-	*govshare*	0.299** (0.067)	0.307** (0.062)	*govshare*	0.050 (0.088)	0.047 (0.093)
instability	-	7.074** (3.490)	*Gastil*	-2.152** (0.839)	-2.099** (0.726)	*ICRG*	-0.451** (0.095)	-0.443** (0.111)
lgdp	-0.554 (2.309)	-0.473 (2.152)	*Lgdp*	-5.746** (1.503)	-6.471** (1.569)	*lgdp*	-7.201** (0.836)	-7.520** (0.979)
openness	0.095** (0.025)	0.094** (0.026)	*openness*	-0.080** (0.013)	-0.081** (0.012)	*openness*	-0.019 (0.012)	-0.022 (0.013)
agedep	6.338 (7.944)	5.471 (7.149)	*education*	-0.919** (0.253)	-0.919** (0.248)	*education*	0.067 (0.216)	0.064 (0.212)
surface	0.0004** (0.0001)	0.0005** (0.0001)	*Constant*	15.420 (15.054)	22.303 (15.406)	*D(87-91)*	0.208 (0.442)	0.255 (0.455)
D(87-91)	-3.193** (0.893)	-3.290** (0.780)	Hansen over-identification test	$\chi^2_{(4)} = 4.410$ (0.353)	$\chi^2_{(4)} = 3.013$ (0.555)	*D(92-96)*	-1.539* (0.832)	-1.509* (0.857)
D(92-96)	-6.200** (1.063)	-6.453** (1.061)	C- orthogonality test (time dummies)	$\chi^2_{(2)} = 2.403$ (0.3007)	$\chi^2_{(2)} = 1.135$ (0.567)	*constant*	50.956** (6.996)	54.643** (6.671)
constant	8.202 (25.177)	9.947 (23.254)	First-stage F-statistic	$F(5,24) = 29.84$ (0.000)	$F(5,24) = 30.89$ (0.000)	Hansen over-identification test	$\chi^2_{(2)} = 2.878$ (0.2371)	$\chi^2_{(2)} = 3.694$ (0.1577)
			AR test (robust to weak instruments)	$\chi^2_{(5)} = 50.75$ (0.000)	$\chi^2_{(5)} = 57.02$ (0.000)	First-stage F-statistic (*ICRG*)	$F(4,24) = 4.95$ (0.004)	$F(4,24) = 4.97$ (0.004)
						First-stage F-statistic (*govshare*)	$F(4,24) = 5.39$ (0.003)	$F(4,24) = 5.45$ (0.002)
						AR test (robust to weak instruments)	$\chi^2_{(4)} = 34.41$ (0.000)	$\chi^2_{(4)} = 27.52$ (0.000)

Notes: 1. There are 75 observations. 2. Standard errors that are robust to arbitrary heteroskedasticity and arbitrary intra-country serial correlation are shown in parentheses below the estimated coefficients. An asterisk denotes significance at the 10% level and two asterisks at the 5% level. 3. In column (3), the instruments used to identify govshare in the GMM estimation are elections, agedep, surface, D(87-91) and D(92-96). In column (4), the instruments used to identify govshare are instability, agedep, surface, D(87-91) and D(92-96). In column (5), the instruments used to identify govshare and ICRG are elections, agedep, surface and gastil. In column (6), the *instruments used to identify govshare and ICRG are instability, agedep, surface and gastil. 4. The Hansen test is a test of overidentifying restrictions.Under the null, the test statistic is distributed as chi-squared in the number of overidentifying restrictions (the p-value is reported in parenthesis. Hansen's statistic reported in this Table is robust to heteroskedasticity and intra-country serial correlation. 5. The C statistic is used to test for the exogeneity of a subset of instruments (here for the exogeneity of the time dummies).Under the null that the additional, suspect instruments are valid, the C statistic is distributed as chi-squared in the number of instruments tested (the p-value is reported in parenthesis). The C statistic reported here is the difference of the Hansen statistic of the equations with and without the time dummies. 6. The 1st stage F-statistic tests the hypothesis that the coefficients on all the excluded instruments are zero in the 1st stage regression of the endogenous regressor on all instruments (the p-value is reported in parenthesis). This regression is robust to heteroskedasticity and intra-country serial correlation 7. AR is the Anderson and Rubin (1949) statistic, a test of the significance of the endogenous regressors in the structural equation that is robust to the presence of weak instruments. Under the null that the coefficients of the endogenous regressors in the structural equation are jointly equal to zero, the Anderson-Rubin statistic follows a chi-squared distribution with degrees of freedom the number of excluded instruments. The Anderson-Rubin statistic reported is robust to heteroskedasticity and intra-country serial correlation.*

TABLE 2: Least Squares estimation of the rent seeking and growth regressions

Dep. variable: ***rent seeking*** *(ICRG)*	**(1) Least Squares**	**(2) Least Squares**	**(3) Least Squares**	Dep. variable: ***growth rate***	**(4) Least Squares**	**(5) Least Squares**	**(6) Least Squares**
govshare	0.130**	0.123*	0.135**	*govshare*	-0.051	-0.046	-0.046
	(0.065)	(0.071)	(0.065)		(0.037)	(0.038)	(0.038)
gastil	-2.159**	-2.159**	-2.093**	*ICRG*	-0.132*	-0.130*	-0.140**
	(0.832)	(0.832)	(0.831)		(0.072)	(0.072)	(0.071)
lgdp	-5.484**	-5.418**	-5.547**	*Lgdp*	-4.272**	-4.256**	-4.322**
	(1.786)	(1.817)	(1.839)		(1.044)	(1.052)	(1.025)
openness	-0.064**	-0.063**	-0.066**	*openness*	0.006	0.005	0.005
	(0.018)	(0.019)	(0.018)		(0.007)	(0.007)	(0.007)
education	-1.036**	-1.034**	-1.100**	*education*	0.232	0.230	0.197
	(0.214)	(0.212)	(0.223)		(0.176)	(0.175)	(0.181)
elections	-	2.186	-	*elections*	-	-1.377	-
		(3.829)				(1.272)	
instability	-	-	-3.777	*instability*	-	-	-1.415
			(3.559)				(1.434)
constant	15.090	13.744	16.963	*D(87-91)*	-0.015	-0.012	-0.006
	(17.588)	(18.705)	(18.186)		(0.370)	(0.352)	(0.360)
				D(92-96)	-1.388**	-1.362**	-1.329**
					(0.432)	(0.433)	(0.432)
				constant	35.714**	36.019**	36.326**
					(8.235)	(8.327)	(8.011)

Notes: 1. There are 75 observations. 2. Standard errors that are robust to arbitrary heteroskedasticity and arbitrary intra-country serial correlation are shown in parentheses below the estimated coefficients. An asterisk denotes significance at the 10% level and two asterisks at the 5% level.

TABLE 3: Economic growth, rent seeking and private investment

Dep. variable: ***growth rate***	**(1) GMM**	Dep. variable: ***investment***	**(2) GMM**
govshare	0.071 (0.080)	*govshare*	-0.468 (0.274)
ICRG	-0.334** (0.135)	*ICRG*	-1.158** (0.309)
Lgdp	-5.993** (1.414)	*Lgdp*	-10.498* (5.442)
Openness	-0.012 (-0.99)	*Openness*	-0.0605 (0.036
Education	0.046 (0.197)	*Education*	-0.598 (0.508)
D(87-91)	0.090 (0.432)	*D(87-91)*	-1.204 (1.306)
D(92-96)	-1.120 (0.747)	*D(92-96)*	-5.545 (2.467
Investment	0.080 (0.053)	*Constant*	42.216** (4.05)
Constant	42.216** (10.422)		
Hansen over-identification test	$\chi^2_{(2)} = 2.850$ (0.240)	Hansen over-identification test	$\chi^2_{(2)} = 3.344$ (0.187)
First-stage F-statistic (*ICRG*)	$F(4,24) = 1.81$ (0.158)	First-stage F-statistic (*ICRG*)	$F(4,24) = 4.95$ (0.004)
First-stage F-statistic (*govshare*)	$F(4,24) = 3.85$ (0.014)	First-stage F-statistic (*govshare*)	$F(4,24) = 5.39$ (0.003)
AR test (robust to weak instruments)	$\chi^2_{(4)} = 12.10$ (0.016)	AR test (robust to weak instruments)	$\chi^2_{(4)} = 34.51$ (0.000)

Notes: See the notes in Table 1. The instruments used to identify the endogenous variables in the GMM estimation are elections, agedep, surface and gastil.

TABLE 4: The effects of electoral uncertainty on government's fiscal size, rent seeking and economic growth (using OECD data for fiscal size)

Dep. variable: ***fiscal size*** *(govoecd)*	**(1) Least Squares**	**(2) Least Squares**	Dep. variable: ***rent seeking*** *(ICRG)*	**(3) GMM**	**(4) GMM**	Dep. variable: ***growth rate***	**(5) GMM**	**(6) GMM**
elections	-1.981 (3.530)	-	*Govoecd*	0.606** (0.227)	0.386** (0.139)	*govoecd*	-0.137 (0.195)	-0.275 (0.213)
instability	-	9.944** (5.126)	*Gastil*	-3.632** (1.053)	-3.079** (0.883)	*ICRG*	-0.294* (0.164)	-0.362** (0.175)
lgdp	4.344 (2.806)	4.171 (2.680)	*Lgdp*	-5.238** (2.599)	-5.183** (2.179)	*lgdp*	-6.908** (1.659)	-6.667** (1.682)
openness	0.061** (0.017)	0.069** (0.015)	*openness*	-0.103** (0.031)	-0.087** (0.026)	*openness*	0.004 (0.015)	0.010 (0.016)
agedep	4.952 (11.239)	9.719 (0.80)	*education*	-1.197** (0.302)	-1.184** (0.314)	*education*	0.367** (0.152)	0.206 (0.196)
surface	-0.0001 (0.0002)	-0.0001 (0.0002)	*D(87-91)*	-	-	*D(87-91)*	-0.289 (0.602)	-0.630 (0.643)
D(87-91)	-1.565** (0.587)	-1.535** (0.630)	*D(92-96)*	-	-	*D(92-96)*	-1.870** (0.761)	-2.301** (0811)
D(92-96)	-2.002** (0.926)	-2.006** (0.893)	*Constant*	2.288 (24.919)	6.381 (21.569)	*constant*	55.543** (9.409)	54.731** (9.540)
constant	-21.927 (25.422)	-21.315 (24.131)	Hansen over-identification test	$\chi^2_{(4)} = 4.274$ (0.370)	$\chi^2_{(4)} = 4.322$ (0.115)	Hansen over-identification test	$\chi^2_{(2)} = 2.596$ (0.273)	$\chi^2_{(2)} = 0.715$ (0.699)
			C- orthogonality test (time dummies)	$\chi^2_{(2)} = 1.817$ (0.403)	$\chi^2_{(2)} = 2.361$ (0.307)	First-stage F-statistic (*ICRG*)	$F(4,21) = 16.25$ (0.000)	$F(4,21) = 8.58$ (0.000)
			First-stage F-statistic	$F(5,21) = 4.41$ (0.006)	$F(5,24) = 3.30$ (0.023)	First-stage F-statistic (*govshare*)	$F(4,21) = 2.58$ (0.067)	$F(4,21) = 1.41$ (0.263)
			AR test (robust to weak instruments)	$\chi^2_{(5)} = 70.62$ (0.000)	$\chi^2_{(5)} = 79.90$ (0.000)	AR test (robust to weak instruments)	$\chi^2_{(4)} = 15.53$ (0.003)	$\chi^2_{(4)} = 13.97$ (0.007)

Notes: As in Table 1, except that govoecd has replaced govshare and that t here are 65 observations.

TABLE 5: The effects of electoral uncertainty on government's fiscal size, rent seeking and economic growth (controlling for country effects)

Dep. variable: ***fiscal size*** *(govshare)*	**(1) Least Squares**	**(2) Least Squares**	Dep. variable: ***rent seeking*** *(ICRG)*	**(3) GMM**	**(4) GMM**	Dep. variables: ***growth rate or investment***	**(5) GMM** Dep. variable: **growth rate**	**(6) GMM** Dep. variable: **investment**
elections	7.173* (3.892)	-	*govshare*	0.080 (0.119)	0.145 (0.136)	*govshare*	-0.428** (0.142)	0.517 (0.291)
instability	-	2.059 (3.530)	*Gastil*	-0.419 (1.085)	-1.020 (1.081)	*ICRG*	-0.023 (0.123)	-1.106** (0.176)
openness	-0.093 (0.088)	-0.088 (0.100)	*openness*	-0.051 (0.036)	-0.033 (0.041)	*openness*	0.032 (0.037)	0.035 (0.061)
agedep	11.527 (14.918)	12.185 (15.839)	*education*	-2.464** (1.036)	-2.562** (1.057)	*education*	0.551 (0.761)	-3.341** (0.806)
density	0.108 (0.074)	0.099 (0.080)	Hansen over-identification test	$\chi^2_{(3)} = 6.145$ (0.104)	$\chi^2_{(3)} = 4.759$ (0.190)	*D(87-91)*	-1.270** (0.547)	3.139** (1.120)
D(87-91)	-2.313** (0.806)	-2.384** (0.814)	First-stage F-statistic	$F(4,43) = 2.04$ (0.105)	$F(4,43) = 1.27$ (0.298)	*D(92-96)*	-3.644** (0.940)	1.886 (1.632)
D(92-96)	-4.082** (1.422)	-4.202** (1.561)	AR test (robust to weak instruments)	$\chi^2_{(4)} = 6.64$ (0.156)	$\chi^2_{(4)} = 8.98$ (0.061)	Hansen over-identification test	$\chi^2_{(2)} = 0.775$ (0.678)	$\chi^2_{(2)} = 3.703$ (0.157)
						First-stage F-statistic (*ICRG*)	$F(4,42) = 5.63$ (0.001)	$F(4,42) = 5.63$ (0.001)
						First-stage F-statistic (*govshare*)	$F(4,42) = 1.50$ (0.218)	$F(4,42) = 1.50$ (0.218)
						AR test (robust to weak instruments)	$\chi^2_{(4)} = 25.90$ (0.000)	$\chi^2_{(4)} = 107.39$ (0.000)

Notes:1. All regressions include a dummy for each country. There are 75 observations. 2. Standard errors that are robust to arbitrary heteroskedasticity are shown in parentheses below the estimated coefficients. An asterisk denotes significance at the 10% level and two asterisks at the 5% level. 3. In column (3), the instruments used to identify govshare in the GMM estimation are elections, density, D(87-91) and D(92-96). In column (4), the instruments used to identify govshare are instability, density, D(87-91) and D(92-96). In columns (5) and (6), the instruments used to identify govshare and ICRG are elections, agedep, gastil and density.4. The Hansen statistics reported in this Table are robust to heteroskedasticity. 5. The F-statistics are obtained from 1st stage regressions that are robust to heteroskedasticity. 6. The Anderson and Rubin (1949) statistics are robust to heteroskedasticity.

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