ELECTORAL UNCERTAINTY, FISCAL POLICY
AND ECONOMIC GROWTH
Theory and evidence from the UK and a panel of
parliamentary democracies

Dimitrios Asteriou*
George Economides**
Apostolis Philippopoulos***
and
Simon Price*

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Abstract: We study the link between elections, fiscal policy and economic growth. The set-up is a general equilibrium model of endogenous growth and optimal fiscal policy, in which two political parties can alternate in power. The party in power chooses jointly how much to tax and how to allocate its total expenditure between productive and non-productive activities. The main prediction is that as the probability of re-election falls, forward-looking governments find it optimal to follow relatively shortsighted fiscal policies, and that this is bad for private investment and economic growth. This prediction is tested by using government popularity data for the UK, and data on the duration of governments for 20 parliamentary democracies. The results are consistent with the theory.

Keywords: Political uncertainty, economic growth, optimal policy, the composition of public expenditure.
JEL classification numbers: D9, E6, H1, H5.

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** City University, London, UK.
*** Athens University of Economics and Business, Athens, Greece.
Corresponding author: Apostolis Philippopoulos, Athens University of Economics and Business, 76 Patission street, Athens 10434, Greece. Tel: +30-1-8203413. Fax: +30-1-8214122. Email: aphil@aueb.gr
I. INTRODUCTION

There is clear evidence in most OECD countries for two propositions.\(^1\) Firstly, the size of the public sector (total government expenditures as a share of GDP) has increased substantially since the early 1960s. Secondly, public investment as a share of GDP shows a declining trend, while other components of government spending (e.g. government consumption, transfers and government wages) show a sharply upward movement. The consequently higher tax burden and the changes in the composition of government expenditure are sometimes argued to have reduced economic growth.\(^2\) In this paper, we offer an explanation for this by developing a general equilibrium model that looks at the impact of electoral uncertainty, and specifically re-election probabilities, on the conduct of fiscal policies and economic growth. Empirical evidence from a number of countries is consistent with the model.

The idea that sociopolitical instability hinders economic growth is not new.\(^3\) One argument is that it increases uncertainty and that this reduces growth through lower investment. Empirical growth regressions have employed various sociopolitical indices (e.g. measures of democracy, political violence and government stability) as growth determinants [see Barro (1991) and Chen and Feng (1996)]. Barro (1996), Levine and Zervos (1996) and Easterly and Rebelo (1993) add indicators of political instability to cross-section regressions in which the dependent variable is either growth or investment. Hibbs (1973), Gupta (1990) and Alesina and Perotti (1996) measure political instability by constructing indices which summarise data on the occurrence of political violence and unrest. Brunetti (1998) provides a comparative test of different measures of policy volatility in cross-country growth regressions and concludes that all these measures are negatively related to economic growth.

But our explanation and evidence differ. We look at the government’s joint decisions on how much to tax and how to allocate its total expenditure between consumption and production activities. Forward-looking governments, with uncertain prospects of re-election, find it optimal to follow relatively shortsighted fiscal policies, and this is eventually bad for economic growth through lower private capital

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\(^1\) See e.g. Alesina (1999) and the references cited therein.

\(^2\) See e.g. Kneller, Bleaney and Gemmell (1999), Alesina (1999) and the references cited therein.

\(^3\) A recent survey of this literature is in Drazen (2000, chapter 11.6).
accumulation. Also, to the extent that we test how economic growth is affected by re-election probabilities (measured by the incumbent’s popularity), we provide evidence different from that of the literature that has mostly focused on the effects of sociopolitical instability.

We construct a general equilibrium model of endogenous growth and optimal fiscal policy, in which the government imposes income taxes to finance both public consumption services (that provide direct utility to households) and public production services (that provide production externalities to firm’s capital, and hence generate Barro-type long-term growth). Two political parties can alternate in power according to an exogenous re-election probability. The elected party forms a government that chooses the income tax rate and the allocation of total tax revenues between public consumption and public production services during its term in office. Parties aim to maximize utility of a representative household. In doing so, the political parties play Nash vis-à-vis each other, and Stackelberg vis-à-vis households and firms. We solve for Markov strategies, and hence a Markov-perfect general equilibrium in which optimal policies are time consistent.

The main results are as follows. When the probability of being re-elected decreases, the total government expenditure-to-output ratio (and the associated required tax rate) increases, while the share of tax revenue used to finance public production services decreases. Both fiscal policy instruments work in the same direction, so that - in equilibrium - a lower re-election probability leads to lower private capital accumulation and output growth. The mechanism is as follows. When there is electoral uncertainty and the political parties do not care (or care relatively little) about economic outcomes when out of power, they effectively face a quasi-

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4 The theoretical literature on politics and fiscal policy is very rich [for surveys, see Alesina et al. (1997) and Persson and Tabellini (1999)]. Here, the focus is on the link between elections, fiscal policy and growth [see also e.g. Devereux and Wen (1998) and Darby, Li and Muscatelli (1998)]. Other related papers include Calvo and Drazen (1997) who show how political instability distorts the future path of private investment decisions, and Svensson (1993) who studies how political instability makes governments less inclined to make improvements to the legal system.

5 Darby et al. (1998) also study the case in which the incumbent government chooses both the tax policy and the allocation between the two types of government activities. One difference from our paper is that they assume no private capital. By contrast, here we use a standard general equilibrium model of endogenous growth and optimal fiscal policy, in which productive government expenditures can stimulate economic growth by increasing the productivity of private capital. That is, we extend Barro’s (1990) popular model of endogenous growth and public finance [see also Park and Philippopoulos (2000)]. Our model also differs from Devereux and Wen (1998) and Economides and Philippopoulos (1999), because here we include both consumption and production government activities. In terms of modeling the electoral system, our paper is close to Alesina and Tabellini (1990) and Lockwood et al. (1996).
finite time horizon. The higher the electoral uncertainty (i.e. the smaller the probability of being re-elected), the less they care about the future. As a result, when in power, they go for shortsighted, inefficient policies; inefficiency here takes the form of a relatively high tax burden, a preference for non-productive activities with short-term benefits, and eventually lower economic growth through lower private capital accumulation.

To test this model we do not require indices of political instability, as such, but instead measures of re-election probabilities. We examine two data sets. We start with a single country (the UK) where, uniquely, there is both an effective two-party system and good data on government’s popularity [see Price and Sanders (1994)]. By using popularity, as a measure of ex ante re-election probabilities, we remain faithful to the theoretical model. Then, we also use a more general framework where electoral uncertainty is measured by an ex post measure of governmental duration, for a small panel of twenty parliamentary democracies. The main theoretical prediction, i.e. that lower re-election probabilities lead to lower GDP growth, cannot be rejected by the data.

There is an obvious link with one strand of the political business cycle. Alesina et al. (1997, chapter 5) have been unique in modelling re-election probabilities explicitly in a rational partisan model of surprise inflation and unemployment. They look at US presidential elections and calculate the probability

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6 The mechanism is as in Lockwood et al. (1996), who also provide support from the political science literature that this is indeed the case [see Laver and Hunt (1992)]. Darby et al. (1998) also show the effects of political uncertainty on the government’s effective discount rate and on policies chosen. Note that this mechanism is different from that in Rogoff and Sibert (1988) where the incumbent government manipulates policy instruments in an attempt to increase its re-election probability, or from that in Persson and Svensson (1989) and Alesina and Tabellini (1990) where the incumbent government uses strategically the state variables (e.g. public debt) to reduce the choices of its successor [for a survey, see e.g. Persson and Tabellini (1994)].

7 Here, we take elections as given, and ask how electoral uncertainty affects the macro-economy. Then, elections are typically inefficient. Of course, there are clear arguments supporting the endogenous evolution of elections. For instance, elections control the moral hazard of policymakers, help voters to select the most competent policymaker, or help voters to choose the policymaker whose ideology is closer to the majority of the voters [for a survey, see e.g. Persson and Tabellini (1994)].

8 Standard sociopolitical indices (e.g. measures of democracy, political violence, strikes, etc) measure something else; namely, instability, and therefore policy uncertainty. Duration of government is related to instability, but nevertheless the probability of the government falling in any period is given by the inverse of duration. Thus, duration is related to what we want to measure, the probability of the government falling (it is ex post, of course). We continue to be faithful to the theoretical model.

9 In the rational partisan model, private agents anticipate the inflation bias associated with political parties, when they make their nominal contracts. The bias is related to the parties’ preferences; arguably left-leaning parties have a larger inflation bias than right parties. Before an election, the electoral outcome, and hence the inflation bias, is unknown. Thus, there is a post-election inflation surprise, which leads to temporary and variable output effects. Most studies test this model with a
of electoral victory by using a simple formula taken from option pricing theory. Here, we also estimate re-election probabilities for the UK. But our model differs. In the rational partisan model there are only surprise post-election demand effects that have an expected value of zero. In our model, election probabilities have a permanent, long-run effect upon real variables. Thus, it is not electoral surprises that matter for growth, but re-election probabilities themselves. We proxy these with contemporaneous electoral support, and subsume partisan post-election effects into the error term. There is no reason to suppose that this will bias our results.

The rest of the paper is organized as follows. Section II solves for a competitive equilibrium. Section III solves for optimal fiscal policies in a political equilibrium. Empirical results are in section IV. Section V closes the paper.

II. THE ECONOMY AND COMPETITIVE EQUILIBRIUM

We set up a closed economy with a private sector and two political parties. The private sector consists of a representative household and a representative firm. The household consumes, works and saves in the form of capital. The firm uses capital and labor to produce a single good. The party in power finances the provision of public services by taxing the household’s income. We assume discrete time and infinite time-horizons. In this section, we solve for a competitive equilibrium, given economic policy and the electoral process.

Behavior of the household

The representative household maximizes intertemporal utility:

\[ \sum_{t=0}^{\infty} \beta^t u(c_t, h_t) \]  \hspace{1cm} (1a)

\[ \text{simple post-election dummy. However, it is clear that the surprise depends upon the ex ante re-election probability.}^{10} \]

\[ \text{In turn, Alesina et al. use their estimated probabilities to estimate the impact of electoral surprises on post-election outcomes (like growth and unemployment). They find that the more surprised is the public, the larger the post-election impact, as is predicted by the rational partisan model. See below for more discussion.}^{11} \]

\[ \text{Our reading is that evidence for rational partisan political business cycles is rather weak so this is a reasonable assumption. For a rather rich model applied to the UK, see Alogoskoufis et al. (1992).}^{12} \]
where \( c_t \) and \( h_t \) are respectively private consumption and public consumption at time \( t \), and \( 0 < \beta < 1 \) is the discount rate. The utility function is increasing and concave in its two arguments, and also satisfies the Inada conditions. For algebraic simplicity, we assume that \( u(\cdot) \) is additively separable and logarithmic. Thus,

\[
u(c_t, h_t) = \log c_t + \delta \log h_t
\]

(1b)

where \( \delta \geq 0 \) is the weight given to public consumption services relative to private consumption.

At any \( t \), the household rents its predetermined capital, \( k_t \), to the firm and receives \( r_t k_t \), where \( r_t \) is the market return to capital at \( t \). It also supplies inelastically one unit of labor services per time-period so that the labor income is \( w_t \). Further, it receives profits, \( \pi_t \). Thus, the budget constraint at time \( t \) is:

\[
k_{t+1} + c_t = (1 - \theta_t)(r_t k_t + w_t + \pi_t)
\]

(2)

where \( 0 < \theta_t < 1 \) is the income tax rate. For algebraic simplicity, we assume full capital depreciation. The initial capital stock, \( k_0 \), is given.

The household acts competitively by taking prices, tax policy and public services as given. We will solve the household’s optimization problem by using dynamic programming. From the household’s viewpoint, the state variables at time \( t \) are the predetermined capital stock, \( k_t \), and current economic policy. As we show below, the independent policy instruments at any \( t \) are the income tax rate, \( \theta_t \), and the share of total tax revenues used to finance public production services, \( b_t \). Then, let \( V(k_t; \theta_t, b_t) \) denote the value function of the household at any \( t \). This value function must satisfy the Bellman equation:

\[
V(k_t; \theta_t, b_t) = \max_{c_t, h_t} \left[ \log c_t + \delta \log h_t + \beta V(k_{t+1}, \theta_{t+1}, b_{t+1}) \right]
\]

(3)
Using (2) for \( c_t \) into (3), the first-order condition for \( k_{t+1} \) and the envelope condition for \( k_t \) are respectively:\(^{12}\)

\[
\frac{1}{c_t} = \beta V_k(k_{t+1}, \theta_{t+1}, b_{t+1})
\]

(4a)

\[
V_k(k_t, \theta_t, b_t) = \frac{(1-\theta_t)r_t}{c_t}
\]

(4b)

**Behavior of the firm**

Following e.g. Barro (1990) and Barro and Sala-i-Martin (1995, chapter 4), we assume that public services can provide production externalities to private firms. Following the same authors, we also assume that technology at the firm’s level takes a Cobb-Douglas form. Thus, the production function of the representative firm is:\(^{13}\)

\[
y_t = Ag_t^{1-\alpha} k_t^\alpha
\]

(5)

where \( g_t \) is public production services at time \( t \), \( A > 0 \) and \( 0 < \alpha < 1 \).

The firm maximizes profits, \( \pi_t \), given by:

\[
\pi_t \equiv y_t - r_t k_t - w_t
\]

(6)

The firm acts competitively by taking prices and public services as given. This is a static problem. The first-order conditions, that also imply zero profits, are:

\[
r_t = \alpha Ag_t^{1-\alpha} k_t^{\alpha-1}
\]

(7a)

\[
w_t = (1-\alpha)Ag_t^{1-\alpha} k_t^\alpha
\]

(7b)

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\(^{12}\) For applications, see e.g. Sargent (1987). (4a)-(4b) give the Euler equation, \( \frac{c_{t+1}}{c_t} = \beta (1-\theta_{t+1})r_{t+1} \).
Government budget constraint

At each time $t$, the government runs a balanced budget by taxing the household’s income at a rate $0 < \theta_t < 1$. Thus, since $h_t + g_t$ is total government expenditures, we have:

$$h_t + g_t = \theta_t (r_t k_t + w_t + \pi_t)$$

(8a)

Without any loss of generality, we assume that a share $0 < b_t < 1$ of total tax revenues finances public production services, $g_t$, and the rest $0 < 1 - b_t < 1$ finances public consumption services, $h_t$. Thus, (8a) can be decomposed into:

$$g_t = b_t \theta_t (r_t k_t + w_t + \pi_t)$$

(8b)

$$h_t = (1 - b_t) \theta_t (r_t k_t + w_t + \pi_t)$$

(8c)

where (8a)-(8c) make clear that $\theta_t$ and $b_t$ summarize economic policy at each $t$.

Competitive decentralized equilibrium (given economic policy)

Given $\{\theta_t, b_t\}_{t=0}^\infty$, a Competitive Decentralized Equilibrium (CDE) is defined to be a sequence of allocations $\{k_t, c_t, h_t, g_t\}_{t=0}^\infty$ and prices $\{r_t, w_t\}_{t=0}^\infty$ such that: (i) households maximize utility and firms maximize profits, given prices and economic policy; (ii) all markets clear; (iii) the government budget constraint is satisfied. This CDE is described by equations (1)-(8) above. The rest of this section will take advantage of the specific functional forms used to get a closed-form solution for this CDE. This will help us to get clear, analytical results.

We start with economy-wide output. Using (7a), (7b) and (8b) into (5), we get:

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13 As there is one unit of labor inelastically supplied, $y_t$ and $k_t$ can be interpreted as per capita output and capital respectively.

14 Thus, there is no public debt. This is for algebraic simplicity. Debt simply allows another mechanism for smoothing activity.

15 See also Park and Philippopoulos (2000).
\[ y_t = \left( b_t \theta_t \right)^{\frac{1-\alpha}{\alpha}} k_t \]  

(9)

so that the model is a variant of the linear \( AK \) model of endogenous growth. Also, as in Barro (1990), the coefficient \( A \) is a function of policy instruments. Equation (9) also implies that the realized, or social, return to capital is \( \frac{\partial y_t}{\partial k_t} = A^\alpha \left( b_t \theta_t \right)^{\frac{1-\alpha}{\alpha}} \).

Using (8b) and (9) into (7a), we get:

\[ r_t = \alpha A^\alpha \left( b_t \theta_t \right)^{\frac{1-\alpha}{\alpha}} \]  

(10)

which is the return that drives private consumption-saving decisions in a CDE. Since \( 0 < \alpha < 1 \), the realized, or social, return to capital implied by (9) exceeds the perceived, or private, return in (10). In other words, in the presence of production externalities, the decentralized growth rate is inefficiently low.

Then, Appendix A shows the following result:  

**Result 1:** In a Competitive Decentralized Equilibrium (given any Markov economic policy), optimal private consumption and capital accumulation are:

\[ c_t = \left( 1 - \alpha \beta \right) A^\alpha (1 - \theta_t \left( b_t \theta_t \right)^{\frac{1-\alpha}{\alpha}} k_t \]  

(11a)

\[ k_{t+1} = \alpha \beta A^\alpha (1 - \theta_t \left( b_t \theta_t \right)^{\frac{1-\alpha}{\alpha}} k_t \]  

(11b)

It is also useful for what follows to present the solutions for the two types of public services, \( g_t \) and \( h_t \), in a CDE. Using (10), (8b) and (8c) become respectively:

\[ g_t = (A \theta_t)^{\frac{1}{\alpha}} k_t \]  

(11c)

\[ h_t = (1 - b_t) b_t^{\frac{1}{\alpha}} A^\alpha \theta^\alpha k_t \]  

(11d)

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16 This closed-form solution follows from the special structure of the model. In particular, it is due to log-linear utility functions, Cobb-Douglas production functions and full capital depreciation [see e.g. Stokey and Lucas (1989, chapter 4) and Sargent (1987, chapter 1)]. For a similar application, see Kollintzas et al. (2000).
To summarize this section, equations (11a), (11b), (11c) and (11d) give $c_t$, $k_{t+1}$, $g_t$ and $h_t$ respectively in a CDE. This is for any Markov fiscal policy, where the latter is summarized by the current tax rate, $\theta_t$, and the current allocation of tax revenues between public production and public consumption services, $b_t$. The next section will endogenize the choice of $\theta_t$ and $b_t$. Note that the CDE is a function of the predetermined capital stock, $k_t$, and the current policy instruments, $\theta_t$ and $b_t$. This will make the political parties’ optimization problem recursive and hence policies will be time consistent.\(^{17}\)

Before we move on to optimal policy, consider two results which hold for any feasible, exogenous policy. First, (11b) implies that the sign of $\frac{\partial k_{t+1}}{\partial \theta_t}$ is the sign of $(1-\alpha-\theta_t)$. That is, if $(1-\alpha-\theta_t) > 0$, $k_{t+1}$ increases with $\theta_t$, while if $(1-\alpha-\theta_t) < 0$, $k_{t+1}$ decreases with $\theta_t$. In other words, the effect of the income tax rate on the economy’s growth rate is an inverse U-curve. At low tax rates ($0 < \theta_t < 1-\alpha < 1$), an increase in the tax rate increases growth. At high tax rates ($1-\alpha < \theta_t < 1$), growth declines with the tax rate. This is as in e.g. Barro (1990) and Alesina and Rodrik (1994). Intuitively, when the tax rate is initially low, any marginal increase will lead to higher tax revenues and higher public production services which increase the productivity of private capital; this more than offsets the distortionary effect of higher taxation. The opposite happens when the tax rate is initially high. Second, (11b) implies $\frac{\partial k_{t+1}}{\partial b_t} > 0$.

That is, a higher share of tax revenues used to finance public production services vis-à-vis public consumption services always stimulates private capital accumulation.

III. OPTIMAL ECONOMIC POLICY AND POLITICAL EQUILIBRIUM

To endogenize economic policy, we form a Nash game between two political parties, denoted by $i$ and $j$, which can alternate in power according to an exogenous re-election probability.\(^{18}\) For simplicity, we assume that elections take place in each

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\(^{17}\) For details, see Kollintzas et al. (2000).

\(^{18}\) Having endogenous re-election probabilities would not change our main results. For instance, assume that the re-election probability increases with economic growth. This would give an incentive to the party in power to follow more long-sighted policies (so as to stimulate growth) than in the case in
Thus, the party in power at time $t$ has a probability $0 \leq q \leq 1$ of winning the next election and remaining in power in the next time-period $t+1$, and a probability $0 \leq 1-q \leq 1$ of losing the election and remaining out of power at $t+1$. The elected party chooses the current policy instruments, $\theta_i$ and $b_i$, to maximize the utility of the representative household. In doing so, it plays Stackelberg *vis-a-vis* private agents (households and firms). It also plays Nash *vis-a-vis* the other political party which may be in power in the next time period.

In particular, the Political Equilibrium (PE) is defined as follows: (i) Each time-period $t$, the elected party $i$ chooses $\theta_i$ and $b_i$ to maximize (1a)-(1b) subject to the CDE, i.e. equations (11a)-(11d) above, and by taking as given the policy of the other party, $j \neq i$, which may be in power at $t+1$. (ii) We solve for symmetric Nash equilibria. That is, since the two parties are assumed to be alike, strategies are symmetric ex post. (iii) Parties do not care about policy outcomes when out of power. (iv) We solve for Markov policy strategies. That is, $\theta_i$ and $b_i$ will be functions of the current value of the economy-wide state variables. Note that this also confirms the solution to the private agents’ optimization problem in the previous section (see Result 1 above). (v) The solution for $\theta_i$ and $b_i$, in combination with the CDE above, will finally give a Markov-perfect general equilibrium, which we call Political Equilibrium (PE). This PE is similar to the one in Economides and Philippopoulos (1999).

**Problem formulation**

We solve the problem by using dynamic programming. From the political parties’ viewpoint, the state variable at any time $t$ is the economy’s inherited stock of which the reelection probability is exogenous, but it would still be the case that, since the reelection probability is less than one, policies are less long-sighted than in the case without electoral uncertainty. See Economides and Philippopoulos (1999).

See also Alesina and Tabellini (1990) and Devereux and Wen (1998) for a similar electoral calendar. However, see Lockwood et al. (1996) for a richer model in which the electoral cycle lasts two time-periods so that the elected party can remain in power for two periods. Our main results do not depend on this: the important thing is that there is a non-zero probability that at some point in time the party in power may lose an election and be out of power.

Thus, we do not study partisan effects. This is partly for simplicity because we want to focus on how electoral uncertainty affects the macro-economy. Also, partisan effects do not have a persistent impact on growth [for empirical evidence, see Alesina et al. (1997)]. However, see Lockwood et al. (1996) for a public finance model, which combines electoral, partisan and stabilizing motives.
Let $V^P_i(k_t)$ and $V^N_i(k_t)$ be respectively the value functions of party $i$ when in power, and when out of power, at time $t$. Then, $V^P_i(k_t)$ and $V^N_i(k_t)$ must satisfy the following pair of Bellman equations:

\[
V^P_i(k_t) = \max_{\theta_t, b_t} \left[ \log c_t + \delta \log h_t + \beta q V^P_i(k_{t+1}) + \beta (1-q) V^N_i(k_{t+1}) \right] \tag{12a}
\]

\[
V^N_i(k_t) = 0 + \beta (1-q) V^P_i(k_{t+1}) + \beta q V^N_i(k_{t+1}) \tag{12b}
\]

where $c_t, k_{t+1}$ and $h_t$ follow (11a), (11b) and (11d) respectively. Notice that in (12a), the incumbent has a probability $q_t$ of remaining in power and a probability $(1-q_t)$ of losing the coming election. In (12b), the party out of power knows that there is a probability $q_t$ of continuing to be out of power and a probability $(1-q_t)$ of coming back to power in the next election.\(^{22}\) Also notice that, when out of power, parties do not care about policy outcomes; hence the zero in (12b).

Inspection of the above problem reveals that we have to solve a dynamic programming problem with a log-linear payoff function and Cobb-Douglas constraints. Thus, the functional formulation of the policymakers' problem is similar to that of the private agents'. This means that the value functions in (12a)-(12b) are expected to be of the log-linear form $V^P_i(k_t) = u^P_0 + u^P_1 \log k_t$ and $V^N_i(k_t) = u^N_0 + u^N_1 \log k_t$, where $u^P_0, u^P_1, u^N_0, u^N_1$ are undetermined coefficients.

**Optimal policy and general equilibrium**

Using the above guess functions into (12a)-(12b), differentiating the right-hand side of (12a) with respect to $\theta_t$ and $b_t$, imposing the symmetricity conditions $\theta_t = \theta_t \equiv \theta_t$, $b_t = b_t \equiv b_t$, $u^P = u^P \equiv u^P$ and $u^N = u^N \equiv u^N$, the first-order conditions for $\theta_t$ and $b_t$ in a symmetric Nash equilibrium are respectively:

\[
\frac{\delta (1-q_t)}{(1-\alpha - \theta_t)} + \left[ 1 + \beta [qu^P_t + (1-q)u^N_t] \right] = 0 \tag{13a}
\]

\(^{21}\) This is for simplicity. It can be easily shown that our results do not change if we assume that parties care less about outcomes when out of power than when in power. Laver and Hunt (1992) provide empirical evidence that this is indeed the case in most democratic countries.
\[
\frac{\delta (1-\alpha-b_i)}{(1-\alpha)(1-b_i)} + [1 + \beta (q u_t^p + (1-q) u_t^Y)] = 0 \tag{13b}
\]
so that it directly follows:

\[
\frac{(1-\theta_i)}{(1-\alpha - \theta_i)} = \frac{(1-\alpha - b_i)}{(1-\alpha)(1-b_i)} < 0 \tag{13c}
\]

The optimality conditions (13a)-(13c) imply three things: First, \( \theta_i > 1 - \alpha \) and \( b_i > 1 - \alpha \). That is, along the optimal path, both policy instruments are higher than the productivity of public production services. By contrast, in Barro (1990)-type models, \( \theta_i = 1 - \alpha \) all the time. This is because here there are also public consumption services. Second, since \( (1-\alpha - \theta_i) < 0 \), it follows from (11b) that \( k_{i+1} \) decreases with \( \theta_i \) along the optimal path. Intuitively, when policy is chosen endogenously, it is not possible any further increases in tax policy actions to be welfare-increasing.\(^{23}\) Third, the two policy instruments, \( \theta_i \) and \( b_i \), move in opposite direction in each period. Intuitively, when the government allocates a larger share of tax revenues to public production services (i.e. \( b_i \) increases), it can afford a lower tax rate (i.e. \( \theta_i \) decreases) since public production services stimulate private investment and hence increase the tax base. That is, \( \theta_i \) and \( b_i \) are substitutes along the optimal path.\(^{24}\)

In turn, Appendix B shows:

**Result 2:** In a Political Equilibrium, the income tax rate, \( \theta_i \), and the share of total tax revenues used to finance public production services, \( b_i \), are constant over time and equal to:

\[
1-\alpha < \theta_i \equiv \theta = \frac{\delta + (1-\alpha)\Omega}{\delta + \Omega} < 1 \tag{14a}
\]

\[
1-\alpha < b_i \equiv b = \frac{(1-\alpha)(\delta + \Omega)}{\delta + (1-\alpha)\Omega} < 1 \tag{14b}
\]

\(^{22}\) That is, if \( q > 0.5 \), the incumbent has an electoral advantage. See Alogoskoufis et al. (1992).

\(^{23}\) When policy was exogenous in the end of the previous section this was true only for particular parameters. Now it follows from the first-order conditions.

\(^{24}\) See also Park and Philippopoulos (2000) for similar results in a different model.
where,
\[
\Omega \equiv 1 + \beta [qu^p_i + (1-q)u^N_i] = \frac{(1+\delta)(1-\beta q)}{1-\beta [\beta + 2q(1-\beta)]} > 0
\]  

(14c)

It is worth noticing two properties of the above solution (14a)-(14c). Firstly, it is optimal to keep the policy instruments flat over time. This is a tax smoothing result. This type of policy introduces fewer intertemporal distortions. Secondly, (14c) implies that the “effective discount rate”, \( \Omega \), increases with the probability of being reelected, \( q \); that is, \( \frac{\partial \Omega}{\partial q} > 0 \). In other words, as the probability of being reelected increases, policymakers care effectively more about the future. In turn, (14a) and (14b) imply \( \frac{\partial \theta}{\partial q} = \frac{\partial \Omega}{\partial q} < 0 \) and \( \frac{\partial b}{\partial q} = \frac{\partial b}{\partial \Omega} \frac{\partial \Omega}{\partial q} > 0 \). In other words, as the probability of being reelected increases, the total government expenditures-to-output ratio (and the associated required tax rate, \( \theta \)) decreases, while the share of tax revenues used to finance government production services, \( b \), increases. Finally, since \( k_{t+1} = y_{t+1} = \alpha \beta A^\alpha (1-\theta) \left( b \theta \right)^{1-\alpha} \) is decreasing in \( \theta \) and increasing in \( b \) along the optimal path, it follows that, as \( q \) increases, both policy instruments work in the same direction leading to an increase in capital and output growth.

The intuition is as follows. When there is electoral uncertainty (in the sense that there is a non-zero probability of being out of power in the next election), and the political parties care less about economic outcomes when out of power then when in power, they face a quasi-finite time horizon [see also Lockwood et al. (1996)]. As a result, the party in power, which is the party that sets policy, cares less about the future. Specifically, the higher the electoral uncertainty (i.e. the smaller the probability of being re-elected), the less it cares about the future. In our model, higher electoral uncertainty pushes policymakers to go for a higher total expenditures-to-output ratio and also spend more on non-productive activities relative to productive

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25 Algebraically, this again follows from the structure of the model (see above).

26 This follows from (8a), i.e. \( \frac{g_t + h_t}{y_t} = \theta_t \). If we had public debt, the main results would not change, since the unavoidable increase in tax rates can only be delayed.
activities. In turn, the effects of these two policy instruments work in the same direction and discourage private capital accumulation and economic growth.

We summarize results in the following proposition:

**Proposition 1:** There is a unique Markov-perfect general equilibrium in Nash strategies among political parties. In this Political Equilibrium, when the probability of being re-elected decreases, it is optimal for policymakers to follow short-sighted fiscal policies (in the form of high total expenditure-to-output ratio and low share of tax revenues used to finance government production services) and this is bad for capital accumulation and economic growth.

**IV. TESTING THE THEORY**

In this section we test the theory presented in the previous sections on UK and European data. Following the empirical literature [see Alesina et al. (1997) and Drazen (2000)], one could distinguish effects on policy instruments from effects on economic outcomes. For policy instruments, our model predicts that when the probability of re-election decreases, total government expenditures as a share of GDP increase, and the proportion of resources devoted to productive public services decreases. For final outcomes, our model predicts that when the probability of re-election decreases (since both policy instruments work in the same direction), economic growth decreases.

There is now a rich empirical literature on political effects on (fiscal and monetary) policy instruments. The general result seems to be that fiscal policy is relatively loose in pre-election years [for surveys, see Alesina et al. (1997, chapter 7) and Drazen (2000, chapter 7)]. Besides, in the context of our model, Roubini and Sachs (1989) show that political instability (measured by the dispersion of political power within the ruling group) is positively correlated with the government spending to GDP ratio in the OECD countries. Devereux and Wen (1998) also show that the Barro and Lee index of sociopolitical instability has a positive effect on the government spending to GDP ratio. This evidence provides some empirical support for our first prediction for policy instruments, namely that total government expenditures as a share of GDP increase when electoral uncertainty increases.
However, our second prediction for policy instruments, namely that the proportion of resources devoted to productive public services decreases when electoral uncertainty increases, is more difficult to test.

In particular, were we able to distinguish and measure productive and unproductive government expenditures directly, we could try to explain their ratio in terms of electoral uncertainty. Unfortunately, although there is an important literature on the role of public investment and infrastructure capital (discussed briefly in Appendix C), it is very difficult to identify these two categories. Even investment in infrastructure is not necessarily productive; we would need to know the rate of return at the margin in order to assess this. And much of current “unproductive” expenditure is certainly productive (and even has the characteristics of investment in many cases). Examples include expenditure on education, or expenditure on social security programs [see e.g. Atkinson (1999)]. Given these problems (discussed in more detail in Appendix C), we are forced to look for evidence in outcomes, and in particular in economic growth. In other words, we adopt a reduced-form approach.

Before we move on, it is worth noting that Drazen (2000) follows a similar approach, when he studies the effect of income inequality on growth. In particular, he also decomposes the reduced-form effect into two effects (see pp. 517-8): the effect of inequality on redistributive policies (he calls it “political mechanism”) and, in turn, the effect of policies on economic growth (he calls it “economic mechanism”). He reports that empirical support for the two mechanisms is weak. He therefore focuses on reduced-form effects from sociopolitical instability on growth, which are significant. He also reports a positive relation between income inequality and sociopolitical instability.

Therefore, we look for effects on outcomes. The prediction is that GDP growth decreases as the probability of re-election declines. Our first task is to measure the re-election probability. The obvious mechanism is to use opinion poll

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27 Despite our reservations, we did experiment with the idea that popularity affects the composition of government spending (broken down into transfers, current expenditure and capital formation) in the UK. We found no evidence of any effects. For example, a regression in ECM form of the log ratio of transfers and current spending to public investment yields an ECM coefficient of -0.023 with t-ratio – 0.16.

28 There is already a big empirical literature on the effects of political variables on economic outcomes [for a survey, see Alesina et al. (1997, chapter 6)]. Although the argument is not concluded, it seems that there is little evidence of an electoral cycle in growth or unemployment. However, here we test for the effects of re-election probabilities on growth, not for electoral effects.
evidence of government popularity.\(^{29}\) Although such series are not available for all countries on a consistent basis for long periods, there are data for the UK. The UK has another useful characteristic; namely, the simple majority electoral system encourages the existence of large parties, so that power in the UK has alternated between Conservative and Labour administrations over the post-war period. This means that the government lead over the opposition is a simple and unambiguous indication of future electoral success.\(^ {30}\) Note that the only other bi-party system where good data exists is the US. As we said above, Alesina et al. (1997, chapter 5) have modeled re-election probabilities explicitly by looking at US presidential elections.\(^ {31}\) However, here the question relates to presidential ratings. There is no opposition as such for most of the President’s term, so the “lead” is not well defined. Moreover, the US system has profound checks and balances, including mid-term elections to the House of Representatives and the Senate. There is clear evidence [see Alesina and Rosenthal (1995)] that US voters use mid-term elections to balance the ticket. In the UK, there is some evidence that voters use by-elections to achieve the same effect [see Price and Sanders (1998)]. They may use local and European elections in the same way, but the centralised structure of the UK government means that one can disregard these influences.

For other countries, this kind of data is not only unavailable, but is also inappropriate, as electoral systems typically do not have only two parties alternating in government. However, an alternative measure of ex-post stability exists. This is the duration of a government in parliamentary democracies. Woldendorp, Keman and

\(^{29}\) See Nannestad and Paldam (1994) for a survey of the international literature which seeks to explain this and related variables.

\(^{30}\) There are some issues to consider. Opinion poll data is based on the reply to the question: “If there were an election tomorrow, for which party would you vote?” There is evidence that sampling and other methods have introduced bias at some points. Moreover, the question refers to the present, rather than to the future election date. However, popularity is very close to a random walk [see Chrystal and Peel (1986)], so the figure today is a good estimate of future popularity.

\(^{31}\) Alesina et al. assume poll results are distributed normally and follow a random walk with drift. Under these assumptions, the probability of electoral victory can be calculated by using a simple formula from option pricing theory. The problem is particularly simple in their case, as there are simply two presidential candidates, either of whom requires a simple majority, and the election date is known. In principle, what matters is the probability that at the time of the future election, the vote share exceeds 50% (although in the light of the 2000 election, it is clear there is still a margin of uncertainty from the electoral college and mismeasured votes). If the vote share is 51% ten minutes before the election, then (ignoring sampling error) the probability of victory is close to one. Thus, the closer is the election, the closer is the probability to one or zero. At points distant from an election, then (disregarding any drift) the probability tends to a half. For parliamentary democracies the problem is more complex, because the election victory depends on seats won. In the case of countries like the UK, the problem is complicated further by the endogeneity of election dates.
Budge (1993) provide data on precisely this for 20 countries in the post-war period. We will therefore use this for cross-sectional tests of our hypothesis.

**Time series results for the UK**

Our first test examines the relationship between UK growth and a transformation of the government lead over the opposition. Our regressions are reduced forms where all factors, apart from government popularity and some cyclical effects, are captured in the dynamics. We adopt two approaches of filtering GDP: firstly, working in growth rates; and secondly, with a Hodrick Prescott filter.

Following the literature [see Drazen (2000)], we begin with a general regression of the form:

\[
x_t = a + \sum_{i=1}^{4} b_i x_{t-i} + \sum_{i=1}^{4} c_i z_{t-i} + \sum_{i=1}^{4} d_i g_{t-i}
\]

(15)

where \( x \) is GDP growth, \( z \) is the deviation of GDP from the Hodrick-Prescott filtered trend and \( g \) is a logit transformation of popularity.\(^{32}\) If \( p \) denotes the government’s share of support (where the denominator is Labour plus Conservative support; i.e. we ignore third parties, which is a reasonable assumption in the UK), then the link between \( g \) and \( p \) is given by:

\[
g_t = \ln\left(\frac{p_t}{1-p_t}\right)
\]

(16)

The logit is the standard “log-odds” transform used in popularity studies and many other applications. Derived from an underlying logistic distribution of voter preferences, it implies that the effect of a rise in support is greatest at the 50% support level. By contrast, at very low or very high levels of popularity, an extra vote makes very little difference to the outcome.\(^{33}\)

There is clearly an issue of causality. High growth may itself lead to a higher lead. To address this, the lead is lagged in this regression. It is also relevant that,

\(^{32}\) \( z \) is included to capture cyclical effects not modelled in the dynamics.

\(^{33}\) We tried three other alternative transforms but as the results were essentially the same, we only report those for the logit.
although there is clear evidence that popularity is related to several economic factors, there is some evidence that for the UK growth is not one of these [see Price and Sanders (1994)].

Table 1 below reports the results of estimating this relationship, excluding insignificant lags on popularity. The results are precisely what we expect. Growth in popularity leads to a positive coefficient significant at 5% level on a one-sided test. There is no evidence for serial correlation: the F version of the LM test for 8th order autocorrelation has a p value of 0.21. Moreover, the equation is stable. A Chow test with a breakpoint at 1979q4 has a p value of 0.34, and 0.61 at 1989q4. On the other hand, there are outliers in 1973q1 and 1979q2, easily explicable in terms of British economic history. 34 Dummying those out introduces serial correlation that cannot be removed with a more complex lag structure. The table reports the results after the Newey West correction has been applied. The conclusions are unchanged. The final results presented show the results from 1979q3 on, a watershed in UK politics. The results are once again very much the same. It is remarkable that this very simple model produces results, which show that a rise in the probability of being re-elected raises growth in the UK.

Table 1 here

An alternative method is to look at innovations to GDP and the lead defined in terms of deviations from the HP filter. The results are similar to the growth regressions, and are reported in Table 2 below. Once again, the base equation has no autocorrelation (p value 0.28) and is stable (with breakpoint 1979q4, p value 0.47; 1989q4, 0.72).

Table 2 here

34 Specifically, the year 1973 marked the Barber “dash for growth”, associated with extremely expansionary policies leading to a record growth of GDP. The year 1979 marked the transition to Mrs Thatcher’s new monetarist policy.
Cross-sectional results for a small panel

We now turn to the cross-sectional evidence. We have data for 20 countries between 1970 and 1990. Annual macroeconomic data exist, but it would not be sensible to use the government duration figures at this frequency, so we work with decennial figures. This provides a panel of 60 observations. Again, we work with growth rates as the dependent variable. We regress $x_a$ on government duration, using a fixed effect model. We account for heteroscedasticity with GLS. As we are working in decennial averages, we do not model dynamics. In estimation, we allow for a slow-down in productivity growth after 1970. The results are reported in Table 3 below. Column 1 shows that there is insignificant evidence for a positive effect of government duration on growth. The coefficients on the decennial trend growth coefficients are very close, and when we impose identical coefficients (column 2) duration becomes significant. So we can again identify a positive link between growth and government duration, in line with the theoretical predictions of the model.

Table 3 here

However, inference is not entirely straightforward, as there is a problem of simultaneity; governments that successfully achieve high growth may last longer. Unlike in the time series, we cannot lag duration, which may well be caused by growth. Instrumental variable estimation is the obvious solution, but it is hard to think of valid instruments (that are highly correlated with government duration but are not caused by, or cause, growth). Thus, our results are supportive of the model but cannot confirm it.

V. CONCLUSIONS AND EXTENSIONS

In this paper, we developed a political economy general equilibrium model that looked at the impact of electoral uncertainty on fiscal policies, and consequently economic growth. Our main theoretical prediction is that low re-election probabilities induce incumbent policymakers to follow shortsighted policies (here, in the form of

35 Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Iceland, Ireland, Israel, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Sweden, Switzerland and the UK.
36 The formal test of equality is $F(1,48)=3.85$ which is just insignificant at 5%: $p=.0542$. 
too large public sectors and too high non-productive activities), and this is bad for capital accumulation and output growth. We also found empirical evidence that low re-election probabilities are associated with low GDP growth.

There are two possible extensions. First, the mechanism that drove our results was the effective discount rate. That is, electoral uncertainty pushes the political parties to effectively care relatively little about the future. Other mechanisms can be influential lobbies, special interest groups, bureaucracy, etc [see e.g. Alesina (1999) and Drazen (2000, chapter 14)]. It would therefore be interesting to add more political distortions of this type, and then try to identify which one is responsible for shortsighted economic policies. Second, because of lack of meaningful data on economic policy instruments, and their exact role, we were forced to look for reduced-form evidence on economic outcomes. However, the task still remains to go back to effects on policy instruments, and try to check how political distortions affect the allocation between productive policies with medium- and long-term benefits (e.g. public education, training, etc) and non-productive policies with only short-term benefits (e.g. transfers, subsidies, unemployment benefits, etc).
APPENDICES

Appendix A: Proof of Result 1

Inspection of the log-linear objective function [see equation (1b)] and the Cobb-Douglas constraint [see equation (9)], and given that economic policy is Markov, implies that the conjecture:

\[ V(k_t, \theta_t, b_t) = u_0 + u_1 \log k_t + u_2 \theta_t + u_3 \log \theta_t + u_4 \log b_t \]

where \( u_0, u_1, u_2, u_3, u_4 \) are undetermined coefficients, can be a solution of the dynamic programming problem in (3).

Using this conjecture, the optimality conditions (4a) and (4b), together with (7a)-(7b), give (11b) in the text. In turn, (11b) and (2) give (11a). Then, plugging (11a) and (11b) back into (3), using the above conjecture, and equating coefficients on both sides of the Bellman equation, we can solve for \( u_0, u_1, u_2, u_3, u_4 \). For instance, we get \( u_1 = \frac{1}{1 - \beta} > 0 \). Note that the above conjecture for the value function can solve the dynamic programming problem because fiscal policies are assumed to be Markov (as indeed is the case when we solve the policymakers’ optimization problem in Appendix B below). That is, the values of \( u_0, u_2, u_3, u_4 \) cannot be fully determined before we also solve for optimal policy. This is as it should be, since this is a general equilibrium model in which policy instruments are chosen endogenously [see also Economides and Philippopoulos (1999) and Kollintzas et al. (2000)]. By contrast, when policy is exogenous, we only need to assume a statistical process that drives policy instruments over time [see e.g. Sargent (1987, chapters 1 and 3)].

Appendix B: Proof of Result 2

(13a) and (13b) directly imply (14a) and (14b) respectively. So, the problem is to solve for \( \Omega = 1 + [\beta q u^p + (1 - q) u^N] \). Inspection of the first-order conditions (13a) and (13b) reveals that, if the conjectures \( V^P(k_t) = u_0^p + u_1^p \log k_t \) and \( V^N(k_t) = u_0^N + u_1^N \log k_t \) can solve the dynamic programming problem (12a)-(12b), then \( \theta_t \) and \( b_t \) have to be constant along the optimal path. Plugging (13a) and (13b) into (12a)-(12b) and equating coefficients, we get the Riccati equations, \( u_1^p = 1 + \delta + \beta [q u_1^p + (1 - q) u_1^N] \) and
\[ u_i^N = \beta [qu_i^N + (1-q)u_i^P] \], which are solved for \( u_i^P \) and \( u_i^N \). Thus, \( u_i^P = \frac{(1+\delta)(1-\beta q)}{1-\beta[\beta+2(1-\beta)]} > 0 \)

and \( u_i^N = \frac{\beta(1+\delta)\delta(q-1)}{1-\beta[\beta+2(1-\beta)]} > 0 \). In turn, \( \Omega = 1 + \beta [qu_i^P + (1-q)u_i^N] = u_i^P - \delta = \frac{(1+\delta)(1-\beta q)}{1-\beta[\beta+2(1-\beta)]} \), This also completes the solution for the CDE in Appendix A above.

**Appendix C: Productive vs. non-productive government expenditures**

There is a rich literature that examines the composition of government expenditure and the effect on economic growth.\(^{37}\) Most of this draws a simple distinction between government consumption and infrastructure investment, assuming that the latter is productive. Easterly and Rebello (1993) follow the approach pioneered by Barro, and run regressions explaining the rate of growth for around 100 countries, with government spending as an explanatory variable. They break down expenditures into different categories. Infrastructure investment, and especially transport and communication, are correlated with growth. Naturally, this can not immediately be used to infer anything about causality. However, the problem with their results is arguably not that there are no effects, but that the coefficient is implausibly large, a recurrent theme in the literature. In a carefully executed paper, Devarajan, Swaroop and Zou (1996) look at 43 developing countries and find that an increase in current expenditure has a positive effect on growth, but public investment has a negative one.\(^{38}\) This supports our view that a simple identification of “investment” and “productive” is inappropriate.\(^{39}\)

Other evidence is from the many attempts to estimate production structures, usually for a single country. In an influential but controversial paper, Aschauer (1989b) estimated a production function for the US private business sector. He reports that “a ‘core’ infrastructure of streets, highways, airports, mass transit sewers, water systems, etc, has most explanatory power for productivity”. Aschauer (1989c) produced similar results for G7 countries. In a related paper for the US, Aschauer (1989a) looks at the relation between public and private investment. On the other hand, Holtz-Eakin (1994) finds that there are no public sector capital productivity effects using US state level panel data. He argues that, once state effects are

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\(^{37}\) A recent survey of the empirical growth literature is in Temple (1999).

\(^{38}\) This is not necessarily to imply all public capital is unproductive; these are marginal changes.

\(^{39}\) For some related discussion see Balassone and Franco (2000).
accounted for, there is essentially no relationship. Many of these studies suffer from a failure to allow for non-stationarity. Other authors estimate cost functions, which is a more satisfactory approach, embodying more economic theory. Examples include Lynde and Richmond (1992, 1993a, 1993b) and Nadiri and Mamuneas (1996). Recently, Demetriades and Mamuneas [2000] have studied the effects of public capital in 12 OECD economies by estimating a system of equations derived from an intertemporal profit maximisation framework; they find positive effects (see also their paper for a good survey of the literature). Some of the estimates in these papers seem to be implausibly large. This is especially true when one does not take full account of the financing constraints associated with the government budget constraint.

We therefore believe that the general consensus is that the effect of government investment on growth is far from being well measured and understood. As we argued in the main text, it is not clear which components of expenditures can be treated as productive or unproductive. Given these problems, we side-step the composition issue, and look for effects on economic outcomes.
### TABLE 1
UK Growth 1971q2 – 1997q1

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coef.</th>
<th>t-ratio</th>
<th>Coef.</th>
<th>t-ratio</th>
<th>Coef.</th>
<th>t-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Uncorrected 71q2-97q4</td>
<td>Dummies and Newey-West corrected 71q2-97q4</td>
<td>Newey-West corrected 79q3-97q4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Growth(-1)</td>
<td>0.17</td>
<td>1.88</td>
<td>0.16</td>
<td>2.40</td>
<td>0.15</td>
<td>1.57</td>
</tr>
<tr>
<td>Growth(-2)</td>
<td>0.15</td>
<td>1.66</td>
<td>0.17</td>
<td>1.59</td>
<td>0.32</td>
<td>3.25</td>
</tr>
<tr>
<td>Growth(-3)</td>
<td>0.35</td>
<td>3.80</td>
<td>0.26</td>
<td>3.57</td>
<td>0.36</td>
<td>5.25</td>
</tr>
<tr>
<td>Demand(-1)</td>
<td>-0.30</td>
<td>-4.86</td>
<td>-0.31</td>
<td>-5.46</td>
<td>-0.26</td>
<td>-4.20</td>
</tr>
<tr>
<td>Change(logit) (-2)</td>
<td>0.0128</td>
<td>1.87</td>
<td>0.0100</td>
<td>1.85</td>
<td>0.0110</td>
<td>1.96</td>
</tr>
<tr>
<td>Constant</td>
<td>0.0016</td>
<td>1.30</td>
<td>0.0012</td>
<td>1.03</td>
<td>0.00036</td>
<td>0.35</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.236</td>
<td>0.484</td>
<td></td>
<td></td>
<td></td>
<td>0.518</td>
</tr>
</tbody>
</table>

### TABLE 2
UK HP-Filtered Output and Lead 1971q2 – 1997q1

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>t-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output(-1)</td>
<td>0.863</td>
<td>8.978</td>
</tr>
<tr>
<td>Output(-2)</td>
<td>-0.026</td>
<td>-0.204</td>
</tr>
<tr>
<td>Output(-3)</td>
<td>0.203</td>
<td>1.576</td>
</tr>
<tr>
<td>Output(-4)</td>
<td>-0.282</td>
<td>-2.904</td>
</tr>
<tr>
<td>Change(logit) (-2)</td>
<td>0.012</td>
<td>1.777</td>
</tr>
<tr>
<td>Constant</td>
<td>0.000</td>
<td>-0.030</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.236</td>
<td></td>
</tr>
</tbody>
</table>
TABLE 3

Panel (fixed effects) estimates of government duration on growth, decennial estimates, 1960 – 1990

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>t-Statistic</th>
<th>Coefficient</th>
<th>t-Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Duration</strong></td>
<td>6.27E-06</td>
<td>1.327853</td>
<td>9.59E-06</td>
<td>2.190703</td>
</tr>
<tr>
<td>1970s Dummy</td>
<td>-0.02042</td>
<td>-13.588</td>
<td>-0.022903</td>
<td>-24.76636</td>
</tr>
<tr>
<td>1980s Dummy</td>
<td>-0.02387</td>
<td>-15.2113</td>
<td>-0.022903</td>
<td>-</td>
</tr>
<tr>
<td><strong>Fixed Effects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AUS—C</td>
<td>0.025919</td>
<td>0.024317</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AUT—C</td>
<td>0.042775</td>
<td>0.040366</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BEL—C</td>
<td>0.038357</td>
<td>0.036753</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAN—C</td>
<td>0.027677</td>
<td>0.025157</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEN—C</td>
<td>0.03012</td>
<td>0.028610</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FIN—C</td>
<td>0.043138</td>
<td>0.041970</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FRA—C</td>
<td>0.040277</td>
<td>0.039362</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GER—C</td>
<td>0.037187</td>
<td>0.035514</td>
<td></td>
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</tr>
<tr>
<td>ICE—C</td>
<td>0.033017</td>
<td>0.030720</td>
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<tr>
<td>IRE—C</td>
<td>0.045386</td>
<td>0.042768</td>
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<tr>
<td>ISR—C</td>
<td>0.042316</td>
<td>0.041138</td>
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<td>ITA—C</td>
<td>0.048862</td>
<td>0.048275</td>
<td></td>
<td></td>
</tr>
<tr>
<td>JAP—C</td>
<td>0.06436</td>
<td>0.063045</td>
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REFERENCES


