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**MACROECONOMIC POLICY CYCLES UNDER  
ALTERNATIVE ELECTORAL STRUCTURES**

by

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# MACROECONOMIC POLICY CYCLES UNDER ALTERNATIVE ELECTORAL STRUCTURES

## ABSTRACT

This paper generalizes earlier work on political budget cycles to allow for the endogenous timing of elections by incumbents. In particular, it is shown that macroeconomic policy cycles are more pronounced in an electoral system with fixed-term elections than in one with endogenous elections. These findings are consistent with empirical evidence for some Parliamentary Democracies in the period after the Second World War. Moreover, these results show the sensitivity of economic performance to different political arrangements.

**KEYWORDS:** *Macroeconomic Policy, Elections, Electoral Timing, Political Budget Cycles.*

## I. INTRODUCTION:

A common practice in the macroeconomic literature is to model the government as a benevolent social planner who seeks to maximize consumer's welfare. In a rational expectations equilibrium, with no time inconsistency problems, it can be shown that optimal fiscal policy must obey the Ramsey smoothing principle under which distortions are spread over time and over states of nature.<sup>1</sup>

Yet, while the assumption of a benevolent social planner may be appropriate to a discussion of social optimality, it may conflict with the real world objectives of elected governments. Rather, one might suspect that in many countries, elected governments care not only about society's welfare but also about their *political survival*. Indeed, there is abundant empirical evidence that this is the case (Alesina (1988), and the references therein).<sup>2</sup>

Rogoff and Sibert (1988) and Rogoff (1987) develop a rational expectations model that addresses this dual interest of elected governments.<sup>3</sup> They argue that electoral cycles in certain macroeconomic variables—taxes, transfers, government expenditures, government investment, money supply—derive from temporal *information asymmetries* about the incumbent's competency in the provision of public goods (consumption and capital goods). Their model is consistent with evidence provided by Tufte (1979), and Alesina (1988) among others for a number of western countries.

Using a similar framework to that developed by Rogoff (1987) this paper presents an analysis of two electoral structures: *fixed-term* elections and *endogenous* elections. Under a fixed-term elections system, the incumbent faces elections every certain number of periods.

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<sup>1</sup>See for instance Lucas (1986).

<sup>2</sup>Indeed Alesina (1987) constructs a rational expectations theory of partisan Macroeconomic cycles. Alesina postulates that policymakers coming from different political parties follow macroeconomic policies to favor their constituencies (see also Hibbs (1977) and (1987)).

<sup>3</sup>Nordhaus (1975) provide the first formal model of political-business cycles. He postulated that any incumbent seeking reelection could stimulate the economy prior to elections in order to assure his electoral success. The model economy used by Nordhaus had a Phillips curve structure and economic agents with adaptive expectations. More recently, Ferejohn (1986), and Cukierman and Meltzer (1986) have also provided some interesting models of the incumbent's behavior.

Under an endogenous electoral system, the incumbent may call early elections before the end of his regular term.<sup>4</sup> It is shown that macroeconomic policy cycles are more pronounced in an electoral system with fixed-term elections than in one with endogenous elections. The intuition behind this result is that an early call of general elections is a non-distortionary signal about the incumbent's competency level. A low (competency)-type incumbent is less eager to call an early election than a high (competency)-type incumbent, because of his relatively low chances for re-election. Moreover, a low-type incumbent can improve his chances of being re-elected by waiting until the end of his term. Clearly calling early elections will not generally be sufficient to separate incumbents, since in the absence of other signals, low-type incumbents could simply pretend to be high-type incumbents by calling early elections. However, it is shown that the ability of competent incumbents to partially signal their type through early elections reduces (in a separating equilibrium) the amount of other policy distortions needed to separate themselves from incompetent incumbents.<sup>5</sup>

These results are important because they make sharp empirical predictions about the nature of political budget cycles and, in general, political business cycles in most Parliamentary Democracies. As can be seen in Table 1, a great number of Parliamentary Democracies allow for an early dissolution of the Parliament. Moreover, these predictions

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<sup>4</sup>In general, the Parliament may be dissolved under the following circumstances:

- (i) when the government hopes to strengthen its position by taking advantage of favorable conditions (social and economic), or when the Parliament is finishing its legal term.
- (ii) when there is a dispute between the Executive and Legislature. This situation happens, more frequently, with minority governments in fragmentary Parliamentary democracies.

Our analysis only covers the first case.

<sup>5</sup>Building upon Nordhaus' (1975) model, Frey and Schneider (1978), Chappel and Peel (1979), and Lachler (1982) have explored the effects of endogenous election dates on political business cycles. In particular, Chappel and Peel (1979) assume – as we do – that the timing of election is controlled by the government. In these circumstances, they find that policy generated cycles tend to be more regular and more pronounced than those suggested by Nordhaus in his original model. Clearly, these predictions do not agree with the empirical evidence of Parliamentary democracies. Moreover, the theoretical underpinnings of the model they use are very controversial. Rogoff (1987) presents strong arguments against this kind of models.



are grossly in agreement with some of the empirical findings reported in Terrones (1988). In particular, he finds strong evidence that the Liberal Democratic Party (LDP) of Japan has been using the timing of elections efficiently. The implication of this result is that the Japanese economy has not been greatly distorted by the incumbent's behavior.<sup>6</sup> Yet, further empirical work is necessary.

This paper is organized as follows: section II introduces the formal model; section III examines the model under the assumption of full information; section IV examines the model under the assumption of asymmetric information; section V discusses some empirical findings, and section VI concludes the paper.

## II. THE MODEL

This section presents preferences, technology, and electoral structure of the formal model, which is based on Rogoff's (1987) paper.

### (A) Preferences

There is a large but finite number,  $N$ , of voters.<sup>7</sup> All  $N$  voters are assumed to be identical, except that in any given period of time one of the voters is the leader. The representative voter's utility is time separable and is an increasing function of his consumption of private and public goods. There are two types of public goods: public consumption goods,  $G$ , and public investment goods,  $S$ . Voters also derive utility from their leader's leadership abilities. This is an exogenous stochastic characteristic that will often be referred to as the looks shock,  $\theta$ . The aim of introducing this uncertainty in voters preferences is to capture non-economic factors that might affect the electoral process.

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<sup>6</sup>Ito and Park (1988) provide similar evidence to that of Terrones. They find that the LDP party has been behaving "opportunisticly" and that economic booms were causing elections rather than the other way around.

<sup>7</sup>One alternative is to assume a continuum of voters. In this case the event that a particular voter be selected to be the leader is a measure zero event.

At any period of time, one of the voters is the leader of this society. Thus the leader has identical utility function as that of the representative voter. The only difference is that the leader derives *ego rents*,  $R$ , from being in office due to the national recognition and social status associated with that position.<sup>8</sup>

Formally, let superscript  $i$ ,  $i \in \{\ell, p\}$ , indicate whether the  $i^{\text{th}}$  voter is the leader ( $\ell$ ) or a private citizen ( $p$ ). Then, in each period  $t$ , voters' preferences are given by:

$$U_t^i = U(c_t, G_t) + V(S_t) + \theta_t + 1_{(i=\ell)} R \quad (1)$$

where

$c_t$  = private consumption

$G_t$  = government consumption good

$S_t$  = government investment good

$\theta_t$  = the leader's looks shock

$R$  = the leader's "ego rent"

$1_{(.)}$  = indicator function (which takes the value 1 if the term inside brackets is true, and 0 otherwise)

and where  $U: \mathbb{R}_+^2 \rightarrow \mathbb{R}$  and  $V: \mathbb{R}_+ \rightarrow \mathbb{R}$ , are increasing, twice continuous differentiable, and strictly concave functions that satisfy the usual Inada conditions and  $\lim_{S_t \rightarrow 0} V(S_t) = -\infty$ .

Finally, assume that  $c$  and  $G$  are *normal* goods.

Let  $T$  be the end of the representative voter's planning horizon. Then we can use (1) to define the voter's (incumbent's) intertemporal expected discounted utility,  $\Gamma$ , as of time  $t$ :

$$\Gamma_t^i = E\left\{\left(\sum_{s=t}^T \beta^{s-t} U_s^i\right) \mid I_t^i\right\} \quad (2)$$

$i \in \{\ell, p\}$ , where  $\beta \in (0, 1)$  is the representative voter's discount factor, and where  $E\{.\}$  is the expectation operator conditional on the  $i^{\text{th}}$  voter's information set  $I$  in period  $t$ .

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<sup>8</sup>The leader is assumed to receive no pecuniary benefit from leadership.

(B) Technology

In the economy, there is a nonstorable good ( $y$ ) that can be used as a private consumption good or as an input for the production of the two public goods. In each period, each voter gets an exogenous amount of the nonstorable good,  $\bar{y}$ , from which he must pay  $\tau_t$  as lump-sum taxes and may consume, or dispose of, the remainder, so that  $c_t^i \leq \bar{y} - \tau_t$ . Government revenues,  $N\tau_t$ , and the leader's *administrative competency*,  $\varepsilon_t$ , are combined to produce public goods under the technology:

$$G_t + K_{t+1} \leq N\tau_t + \varepsilon_t \quad (3)$$

where  $N\tau_t$  and  $\varepsilon_t$  are perfect substitutes in production, and where total public goods output is divided between the current period public consumption good,  $G_t$ , and the public capital good,  $K_{t+1}$ .  $G_t$  is nonstorable, and  $K_{t+1}$  is used in the production of next period's government investment good,  $S_{t+1}$ , under the following technology<sup>9</sup>

$$S_{t+1} \leq \psi K_{t+1} \quad (4)$$

where  $\psi$  is a positive constant and  $K_{t+1}$  is fully used up at the end of the productive process.

In any period  $t$ , there can be only one leader in this society and any voter is qualified to be this leader. Voters are distinguished by their level of competency in the production of public goods. Competency is a characteristic that evolves exogenously according to the MA(1) process:

$$\varepsilon_t^{ji} = \alpha_{t-1}^j + \alpha_t^i \quad (5)$$

where  $\{\alpha_t\}_t$  is an i.i.d. stochastic process defined on  $\Lambda = \{\alpha^l, \alpha^h\}$ , so that  $-\bar{y}/2 < \alpha^l < \alpha^h \ll \infty$ .<sup>1</sup>

Assume  $\rho = \text{Prob}\{\alpha_t = \alpha^h\}$ ,  $1-\rho = \text{Prob}\{\alpha_t = \alpha^l\}$ , and  $0 < \rho < 1$ . Finally,

$$\varepsilon_t^{ji} \in \mathcal{E} = \{\varepsilon^{ll}, \varepsilon^{lh} = \varepsilon^{hl}, \varepsilon^{hh}\}.$$

<sup>9</sup>Note, there is a one period lag between the time  $K_{t+1}$  is produced and  $S_{t+1}$  is consumed.

<sup>10</sup>This analysis can be extended to consider the case in which  $\alpha$  can take a continuum of values. Rogoff and Sibert (1988) and Ramey (1987) solve continuous versions of problems similar to the one in this

(C) Electoral Structures

Imagine a society coming to "democratic rule" with a constitution and a leader imposed on it. The constitution stipulates how elections are to take place. There are two features of the electoral process that are important for our purposes: 1) the number of times the incumbent is allowed to run for re-election and 2) the timing of elections. Throughout the paper, it is assumed that the incumbent can run for re-election as many times as he wishes. And with regard to the timing of elections two possibilities are considered:

- i) Fixed-Term Elections: Under this system, elections are called periodically every certain fixed number of years,  $n$ . The leader has no power to call a general election.
- ii) Endogenous Elections: In this system, the incumbent can choose the date of elections at any time previous to the end of his term in office. However, the constitution constrains the duration of any administration to a maximum number of years,  $n$ , after which the incumbent has to call a general election. If the incumbent calls an early election and wins, he does not have to call a new election for  $n$  years.

Additional assumptions about the electoral structure are as follows:

- (i) Assume  $T$  as the final year that the incumbent can be in power.<sup>11</sup>
- (ii) Assume that under both electoral regimes, the maximum number of years per term is two, i.e.  $n = 2$ . In the fixed-term case, elections are called every other period. In the endogenous elections case, elections may be called every year.

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paper.

<sup>11</sup>I.e. one can think that an hereditary monarchy takes control of all government policy, and that elections no longer take place.



- (iii) In each period in which there is an election, a voter other than the incumbent is selected at random from the  $N-1$  voters not in office to be the opposition candidate. Each voter has an infinitesimal probability  $1/(N-1)$  of being chosen.
- (iv) Every period, each voter experiences a looks shock,  $\theta_t$ , which is intended to reflect each voters' nonpecuniary talent (i.e. how well he would have performed in non-economic issues were he in office) as well as "rally round the flag" factors. In order to keep matters simple, assume  $\theta_t$  follows a MA(1) process:

$$\theta_t^i = q_{t-1}^i + q_t^i \quad (6)$$

where  $\{q_t^i\}_t$  is an i.i.d. stochastic process with bounded support on  $Q \subset \mathbb{R}$ . And  $i \in \{\ell, a\}$ . Finally, assume that  $q$ , an i.i.d. random variable defined as  $q = q_t^\ell - q_t^a$ , has c.d.f.  $F(q)$  and symmetric density function  $f(q)$  which are known to everybody. Clearly,  $q$  has bounded support on the real line.

### III. THE FULL INFORMATION CASE

In this section it is assumed that both the incumbent and voters observe the incumbent's latest competency shock,  $\alpha_t$ , at the start of time  $t$ . Then the full information equilibrium for the fixed-term and endogenous elections are determined.

#### (A) The Fixed-Term Case

The representative voter's problem, in this case, is very simple. If  $t$  is not an election year he has to decide how much of the private good to consume. Since  $y$  is nonstorable, and  $U(\cdot, G_t)$  is an increasing function in  $c_t$ , it is optimal for him to consume  $c_t = \bar{y} - \tau_t$ . If  $t$  is an election year, he also has to decide whether to vote for the incumbent ( $v = 1$ ) or for the

opposition candidate ( $v = 0$ ). Each voter votes for the candidate who provides him with the higher expected discounted utility:

$$v^* = \begin{cases} 1 & \text{if } \Gamma_{t+1}^{p,\ell} \geq \Gamma_{t+1}^{p,a} \\ 0 & \text{otherwise} \end{cases} \quad (7)$$

where  $\Gamma_{t+1}^{p,\ell}$  ( $\Gamma_{t+1}^{p,a}$ ) is the voter's ( $p$ ) expected discounted utility if the incumbent ( $\ell$ ) (opposition candidate,  $a$ ) wins conditional on the voter's information set. Clearly, voters are forward looking and their period  $t$  welfare is a "sunk-welfare" of having  $\ell$  as leader.

Before we continue with our analysis, let's introduce some notation. Let  $W_t^i = W_t^i(G_t, \tau_t, \varepsilon_t)$  be voter's (incumbent's) utility derived from the consumption of pecuniary goods (private and public) when either the incumbent, ( $\ell$ ), or the opposition candidate,  $a$ , is in office, so that

$$W_t^i(G_t, \tau_t, \varepsilon_t) = U(\bar{y} - \tau_t, G_t) + \beta V[\psi(N\tau_t + \varepsilon_t^i - G_t)] \quad (8)$$

$i \in \{\ell, a\}$ . Where  $\varepsilon_t^i$  is the incumbent's (opposition candidate's) period  $t$  competency level. Indeed, one should denote this variable as  $\varepsilon_t^{ji}$ ,<sup>12</sup> where  $j, i \in \{1, h\}$  and  $i \in \{\ell, a\}$ . In order to simplify notation, if  $\varepsilon_t^{j1}, \ell$  (or  $\varepsilon_t^{jh}, \ell$ ) for given  $j \in \{1, h\}$ , let's denote the incumbent as a "1 (h)-type incumbent". Similar notation will be used for the opposition candidate.<sup>12</sup>

After some simplifications,<sup>13</sup> one can write expression (7) as follows:

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<sup>12</sup>One can verify that for a given  $N\tau_t - G_t$ , a type  $h$  provides  $\psi(\varepsilon_t^{jh} - \varepsilon_t^{j1})$  more units of investment goods than a type  $l$  does. The welfare value of this difference is:

$$W_t(G_t, \tau_t, \varepsilon_t^{jh}) - W_t(G_t, \tau_t, \varepsilon_t^{j1}) = \beta \{V(\psi(N\tau_t + \varepsilon_t^{jh} - G_t)) - V(\psi(N\tau_t + \varepsilon_t^{j1} - G_t))\}.$$

<sup>13</sup>Given the stochastic structure of  $\varepsilon$  and  $\theta$ , it follows that

$$E\{(\beta^{s-t} [W_s^\ell(G_s, \tau_s, \varepsilon_s) + \theta_s^\ell]) | I_t^p\} = E\{(\beta^{s-t} [W_s^a(G_s, \tau_s, \varepsilon_s) + \theta_s^a]) | I_t^p\},$$

$\forall s \geq t+2$ . Moreover, since voters observe the incumbent's and opposition's candidate current looks shock prior to voting, it follows that

$$E\{(\theta_{t+1}^\ell - \theta_{t+1}^a) | I_t^p\} = q_t^\ell - q_t^a.$$

$$v^* = \begin{cases} 1 & \text{if } E\{(W_{t+1}^\ell - W_{t+1}^a) | I_t^p\} + q_t^\ell - q_t^a \geq 0 \\ 0 & \text{otherwise} \end{cases} \quad (9)$$

From this expression it is clear that an electoral outcome depends not only on economic but also on non-economic factors. Thus, a h-type incumbent can be defeated in an electoral process if his, time  $t$ , looks shock is sufficiently low compared with that of his adversary. Conversely, an l-type incumbent could be reelected if his looks shock is sufficiently high compared with those of the other candidate.

At the time the incumbent sets the values of  $G$ ,  $\tau$  and  $K$ , he does not know neither his looks shocks,  $q_t^\ell$ , nor the opposition candidate's looks shock,  $q_t^a$ . However, he knows the probability distribution of the difference of these random variables,  $q_t$ . Based on this information, a type  $i$  incumbent (i.e. one for which  $\alpha_i^i$ ) assesses his chances of being reelected, in period  $t$ , as follows:

$$\pi(i) = \text{Prob}(v^* = 1) = F(M_i) \quad (10)$$

where  $M_i = \{q_t | q_t \geq E[(W_{t+1}^a - W_{t+1}^\ell) | I_t^\ell]\}$

This expression is clearly independent of period- $t$  level of taxes, government investment, and government consumption.

Given preferences, technology, stochastic shocks, and voters' behavior, the incumbent's problem then simplifies to

$$\text{Max}_{\tau, G_t \in \mathcal{H}_t} W_t(G_t, \tau_t, \varepsilon_t^{ji}) = U(\bar{y} - \tau_t, G_t) + \beta V(\psi(N\tau_t + \varepsilon_t^{ji} - G_t)), \quad \forall t. \quad (11)$$

where  $\tau_t \in \mathcal{T}_t = \{\tau | -\varepsilon_t^{ji}/N < \tau < \bar{y}\}$   
 $G_t \in \mathcal{G}_t = \{G | 0 < G < N\bar{y} + \varepsilon_t^{ji}\}$  and  
 $\mathcal{H}_t = \mathcal{T}_t \times \mathcal{G}_t$

**Proposition 1:** There exists a unique decreasing function  $\tau^*(\epsilon_t): \mathcal{E} \rightarrow \mathbb{R}$ , and unique increasing function  $G^*(\epsilon_t): \mathcal{E} \rightarrow \mathbb{R}^+$ , such that  $\tau_t = \tau^*(\epsilon_t)$  and  $G_t = G^*(\epsilon_t)$ , attain (11).

**Proof:** This result is a direct consequence of the assumptions made about  $U(.,.)$  and  $V(.,.)$ , as well as from the compactness of  $\mathcal{K}_t$ . One can solve for  $\tau^*(\epsilon)$  and  $G^*(\epsilon)$  from the first order condition

$$\frac{N\beta V'[\psi(N\tau_t + \epsilon_t - G_t)]}{U_c(\tilde{y} - \tau_t, G_t)} = \frac{\beta V'[\psi(N\tau_t + \epsilon_t - G_t)]}{U_G(\bar{y} - \tau_t, G_t)}.$$

It is straightforward to determine that  $\Delta\tau^*/\Delta(\epsilon)$  is negative and  $\Delta G^*/\Delta\epsilon$  is positive.<sup>14//</sup>

The first order condition for the problem above, are the familiar Samuelsonian optimality conditions for the provision of two public goods. The left-hand-side expression is the sum of the voters' marginal rates of substitution between the public investment good and private consumption. The term in the right hand side is the rate of substitution between the public investment good and the public consumption good. Finally, both of these terms have to be equal to the marginal rate of substitution in production between the public investment good and the private consumption good ( $1/\psi$ ). Since the values of  $\tau^*$  and  $G^*$  that solve this problem are those that maximize voter's welfare, they are also the socially optimal levels for these variables. Thus we have

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<sup>14</sup>To find the sign of the derivatives, one makes use of the implicit function theorem. For instance, one can totally differentiate the following system

$$U_c(\bar{y} - \tau^*, G^*) = \beta\psi NV'(\psi(N\tau^* + \epsilon - G^*)), \text{ and}$$

$$U_G(\bar{y} - \tau^*, G^*) = \beta\psi V'(\psi(N\tau^* + \epsilon - G^*))$$

then we can use of normality assumption to sign the resulting Jacobian. Next one can solve for  $\Delta\tau^*/\Delta\epsilon$  and  $\Delta G^*/\Delta\epsilon$ . Once we have solve for  $\tau$  and  $G$ , we could find the optimal values of  $c$ ,  $K$  and  $S$ .



Proposition 2: In the full information case, no incumbent ever deviates from the socially optimal level<sup>15</sup> of taxes and public investment.

Next, define

$$W^*(\epsilon_t^{ji}) = U(\bar{y} - \tau^*(\epsilon_t^{ji}), G^*(\epsilon_t^{ji})) + \beta V[\psi(N\tau^*(\epsilon_t^{ji}) + \epsilon_t^{ji} - G^*(\epsilon_t^{ji}))] \quad (12)$$

as the level of social (voter's) welfare when a type  $i$  incumbent,  $i \in \{l, h\}$ , sets taxes and government consumption at their social optimal levels.  $W^*(\epsilon_t^{ji})$  is an increasing and strictly concave<sup>16</sup> function of  $\epsilon_t^{ji}$ . So that if  $\alpha_t^j$ ,  $j \in \{l, h\}$ , was observed at  $t$ , then the voter's expected welfare in period  $t+1$ , conditional on this observation, is

$$\Omega^j = E_i\{W^*(\epsilon_{t+1}^{ji})\} = \rho W^*(\epsilon_{t+1}^{jh}) + (1 - \rho)W^*(\epsilon_{t+1}^{jl}). \quad (13)$$

Conversely, if  $\alpha_t$  is not observed in period  $t$ , define

$$\Omega^o = E_j\{\Omega^j\} = \rho\Omega^h + (1 - \rho)\Omega^l \quad (14).$$

which is the voter's unconditional expected welfare. In general, this is the expected welfare that voters would obtain were the opposition candidate to win. Note that  $\Omega^h > \Omega^o > \Omega^l$ .

Using this notation, one can readily verify that  $0 < \pi(l) < 1/2 < \pi(h) < 1$ .

## (B) Endogenous Elections

In this section, the incumbent must also decide whether or not to call an "early election" in  $t$  (the first period of his term in office). The representative voter's problem is identical to the one studied in the previous section, so we focus here on the incumbent's problem.

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<sup>15</sup>Actually, "social optimality" in this context refers to the attainable social optimum given the electoral system. Of course, the global social optimum would require a "high  $\alpha$ " leader in all periods.

<sup>16</sup>Using the envelope theorem, one can verify that  $W^{*'}(\epsilon) = \beta V'(\psi(N\tau + \epsilon - G)) > 0$  and  $W^{*''}(\epsilon) = \beta V''(\psi(N\tau + \epsilon - G)) < 0$ .

The leader's problem can be treated as a "two-stage problem". In the first stage he determines the optimal levels of taxes, public consumption and public investment with early elections and without early elections. It was shown above (see Proposition 2) that in the full information case, no incumbent will ever deviate from the socially optimal levels of these variables whether there is an election or not.

In the second stage, the incumbent determines whether to call an early election or not, choosing the alternative that provides him with higher expected discounted utility. Let  $\delta$  be the election indicator ( $\delta = 1$  if there is an early election,  $\delta = 0$  if not). Then the  $i$ -type incumbent sets

$$\delta^* = \begin{cases} 1 & \text{if } \Gamma_{e,k}^{\ell}(\epsilon_t^{ji}) \geq \Gamma_{n,k}^{\ell}(\epsilon_t^{ji}) \\ 0 & \text{otherwise} \end{cases} \quad (15)$$

for  $j, i \in \{l, h\}$  and where the subscripts  $e$  and  $n$  indicate whether the incumbent calls an election or does not call an election respectively. Finally, the subscript  $k$  indicates the number of periods remaining before the end of the planning horizon, i.e.  $k = T - t$ .

In general, the incumbent's problem of whether or not to call an early election can be very complicated. However, one way to get around it is taking a finite  $T$  and then solve it by backward recursion. Note that  $t$  is the incumbent's first period in office and it is in this period when he has the flexibility of calling an early election or not. In Appendix 1, we solve the incumbent's problem for the last three periods ( $T$ ,  $T-1$  and  $T-2$ ) and show how this solution could be generalized to any other period. For our purposes, it would be enough to analyze the incumbent's problem as of period  $T-2$ .

In period  $T-2$ , an  $i$ -type incumbent chooses  $\delta$  as follows

$$\delta^* = \begin{cases} 1 & \text{if } \Gamma_{e,2}^{\ell,ji} > \Gamma_{n,2}^{\ell,ji} \\ 0 & \text{otherwise} \end{cases} \quad (16)$$

where:

$$\Gamma_{e,2}^{\ell,ji} = [R + W^*(\epsilon_{T-2}^{ji})] + \beta\{\pi(i)\Gamma_1^{\ell,i} + [1 - \pi(i)]\Gamma_1^{p,o}\} \quad (17)$$

is a type  $i$  incumbent's discounted welfare provided that he calls an early election at  $T-2$ . The first term, in the right hand side of this equation, is the welfare the incumbent obtains from being in office at  $T-2$ . The second term is the expected welfare of facing an election at  $T-2$ . There is a probability  $\pi(i)$  that the incumbent be reelected and a probability  $(1-\pi(i))$  that the incumbent be voted out of office. In the first case, the incumbent's expected welfare is  $\Gamma_1^{\ell,i}$ ; in the second case the incumbents expected welfare is  $\Gamma_1^{p,o}$  (this is so since the incumbent becomes a voter,  $p$ , as of period  $T-1$ , and the opposition candidate's type is unknown).

And where:

$$\Gamma_{n,2}^{\ell,ji} = [R + W^*(\epsilon_{T-2}^{ji})] + \beta\Gamma_{R,1}^{\ell,i} \quad (18)$$

is a type  $i$  incumbent's discounted welfare if he does not call an early election at  $T-2$ . The first term in the right hand side of this equation is the incumbent's welfare from being in office at  $T-2$ . The second term is the incumbent's expected welfare when he faces regular elections at  $T-1$ . See Appendix 1 for more details.

Expression (16), after some simplifications, tell us that a  $h$ -type incumbent would call for early elections only if the following is true

$$\pi(h)[\Gamma_1^{\ell,h} - \Gamma_1^{p,o}] > [\Gamma_{R,1}^{\ell,h} - \Gamma_1^{p,o}] \quad (19)$$

which is the same as

$$\pi(h) > \omega \equiv \{[\alpha + \mathcal{L}\pi(l)]/[\alpha + \mathcal{L}]\} \quad (20)$$

where  $\alpha = (R + \Omega^h - \Omega^o)$ ;  
 $\mathcal{L} = \beta(1 - \rho)(R + \Omega^l - \Omega^o)$ ;  
 and  $0 \leq \pi(l) < \pi(h) < 1$ .

A h-type incumbent calls an early elections, at  $T - 2$ , if and only if his assessment of his chances of winning an election are bigger than  $\omega$ . It is worthwhile to note the following facts about  $\omega$ :

- (i)  $1 > \omega > 1/2$ ; (i.e, the incumbent must have more than even chances of winning to risk calling an early election).
- (ii) The lower is the probability of drawing a high competency shock ( $\rho$ ) the lower is  $\omega$ . If a h-type incumbent waits until next period, there is a high probability he would draw a low  $\alpha$ . In this situation, his chances of getting reelected next period would not be as good as his chances at  $T - 2$ .
- (iii) The higher is the incumbent's ego rent, the lower is  $\omega$ .
- (iv) The higher the variance of  $q$ , the higher is  $\omega$ , (i.e. the greater the risk involved in an electoral process, the more conservative the h-type incumbent becomes).

A low-type incumbent does not call an early election because of his low chances of being re-elected,  $\pi(l) < 1/2 < \pi(h)$  makes it costly for him to call an early election.<sup>17</sup> Moreover, he increases his chances of being in office longer by waiting until next period. If he waits, his expected chances of winning the regular elections next period are  $\pi^* = [\rho\pi(h) + (1 - \rho)\pi(l)] > \pi(l)$ . This is so because there is a probability  $\rho$  that the incumbent becomes a h-type and probability  $(1 - \rho)$  that he continue being a l-type next period. Since the incumbent is risk neutral on  $R$ , it pays to wait. This logic holds regardless of how many periods there are until the end of electoral rule. Hence, we have the following proposition

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<sup>17</sup>Indeed, a l-type incumbent would call an early election if the following condition is true:

$$\pi(l)[\Gamma_1^{\ell,1} - \Gamma_1^{p,o}] > [\Gamma_{R,1}^{\ell,1} - \Gamma_1^{p,o}]$$

which requires  $\pi(l) > 1/2$ . Moreover, one can readily verify that for any period  $t$  the condition for a l-type incumbent to call an early election implies  $\pi(l) > 1/2$ . This condition is in contradiction with the fact that  $0 < \pi(l) < 1/2 < \pi(h)$ .



Proposition 3: In the full information case, no l-type incumbent would ever call an early election. In contrast, a h-type incumbent calls an early election if and only if  $\pi(h) \geq \omega$ .

From now on it would be assumed that this is the case.

#### IV. THE ASYMMETRIC INFORMATION CASE

In this section it is assumed that voters—as opposed to the leader—cannot contemporaneously observe the incumbent's latest competency shock  $\alpha_t$ ,<sup>18</sup> so that  $\alpha_t^i \notin I_t^P$ . The existence of this asymmetry in information leads to an interesting strategic signaling game between the incumbent and voters.

To avoid any confusion, we summarize the *sequence of events*. At the beginning of very period, "nature" determines the incumbent's competency shock  $\alpha_t$ . There is a probability  $p$  ( $1 - p$ ) that  $\alpha^h(\alpha^l)$  be chosen. The incumbent observes  $\alpha_t$ , at this point. And before observing any contemporaneous looks shock, he announces the level of taxes, and government consumption, and whether or not there will be an early election (in the case of endogenous elections). Looks shocks are observed after this policy announcement, but prior to end of the period. Voting, if any, occurs after voters have learned about the looks shocks. Early next period, voters can observe the values of  $\alpha_t$  and  $S_{t+1}$ , and the information cycle starts again (see Tables 2 and 3).

Even though voters observe  $\alpha_t$ , and  $S_{t+1}$  only until next period, they do observe the current levels of taxes ( $\tau_t$ ), government expenditures ( $G_t$ ), and whether or not the incumbent calls an early election,  $\delta_t$  (whenever applicable). Based on this information, and knowing the incumbent's maximization problem (which is common knowledge), voters make inferences

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<sup>18</sup>One can think that monitoring the incumbent is too costly for individual voters, and that no public watchdog group is strictly credible. In any case, as Rogoff argues, all that is necessary for our analysis to hold is that there be a sufficiently high percentage of voters that remain uninformed.

about the incumbent's competency level and next period public investment good. In sequential separating equilibria, voters correctly infer the values of these variables. Even so, the incumbent's policy may deviate from the "socially optimal" policy due to efforts of the incumbents to distinguish themselves.

Following Rogoff (1987),<sup>19</sup> first we define and characterize all sequential separating equilibrium. As it is common in this kind of literature we will find multiplicity of separating equilibria. Next, we use Moulin's (1981) sequential elimination of dominated strategies, we find a unique undominated separating equilibrium. Finally, we rule out any equilibrium in which different types of incumbents follow the same fiscal policy. With this purpose we use the intuitive criteria originally proposed by Cho and Kreps (1987).

The equilibrium under the *fixed-term* elections is discussed in Rogoff (1987). Therefore, the focus of the following analysis is on the *endogenous elections* case. However, for purposes of comparison some of Rogoff's results are reported without proof. Finally, for our purposes it would be enough to discuss what would happen in the last three periods: T, T-1 and T-2. Appendix 2 presents a discussion of the period T and T-1, below we present a discussion of period T-2.

At T-2, voters after observing  $\tau$ , G and  $\delta$  form beliefs about  $\alpha_{T-2}$ . In the formation of these beliefs, they use Bayesian rules which are discussed below. Define  $\hat{p}(\tau, G, \delta)$  as the probability voters assign to the event  $\{\alpha_{T-2} = \alpha^h\}$  conditional on  $\mathcal{I}_{T-2}^P$ . As in the full information case, the voters' problem is reduced to deciding which candidate to vote for. Voters with inferences  $\hat{p}(\tau, G, \delta)$  elect the candidate that provides them with the higher expected discounted utility. Let  $v(G, \tau, \delta)$  be voters' strategy, where  $v(.) \in \{0, 1\}$ . Thus, voters choose  $v(.)$  according to

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<sup>19</sup>See also Milgrom and Roberts (1986), and Bagwell and Ramey (1987), who follow this approach for characterizing an equilibrium in similar problems.

$$v^* = \begin{cases} 1 & \text{if } \hat{\rho}\Omega^h + (1 - \hat{\rho})\Omega^1 - \Omega^0 + q \geq 0. \\ 0 & \text{otherwise} \end{cases} \quad (21)$$

The incumbent knows  $\hat{\rho}(\tau, G, \delta)$ . In particular, he knows how this function changes when its arguments change. The incumbent, at the time he sets the values of  $\tau$ ,  $G$  and  $\delta$ , does not know the value of  $q$ , thus he does not know if he is going to be reelected or not. The incumbent's conjecture of his chances of reelection, based on his period  $T-2$  information set, is

$$\pi(\hat{\rho}(\tau, G, \delta)) = \text{Prob}(v^* = 1) = F(M^*) \quad (22)$$

where  $\pi: [0,1] \rightarrow [\pi(l), \pi(h)]$  and  $M^* = \{q_i \mid q_i \geq \Omega^0 - \hat{\rho}\Omega^h - (1 - \hat{\rho})\Omega^1\}$ .

From this expression it is clear that the incumbent has incentives to set  $\{\tau, G, \delta\}$  so that  $\hat{\rho} = 1$  and therefore  $\pi(\hat{\rho}) = \pi(h)$ . However, there is a loss in social welfare (and in the incumbent's welfare!) whenever suboptimal levels of  $\tau$  and  $G$  are used. This restrains the incumbent's departure the socially optimal levels of  $\tau$  and  $G$ . In contrast,  $\delta$  is a "cost free" action that the incumbent can use at discretion. So it is important to determine the conditions which an incumbent uses  $\delta$  and the implications for  $G$ ,  $\tau$ , and  $S$ .

A type  $i$  incumbent's program at  $T - 2$  is to choose  $\{\tau'', G'', \delta''\} \in$

$$\text{Arg max}_{\tau, G, \delta} Z(\tau, G, \delta, \hat{\rho}, \epsilon^{ji}) = \text{Max}_{\substack{\delta=1 \\ \delta=0}} \{ \Psi_{e,2}^\ell(\tau'', G''), \Psi_{n,2}^\ell(\tau'', G'') \} \quad (23)$$

where  $(\tau'', G'') \in \mathcal{C} = \mathcal{N} \cup \mathcal{M}$ , and where

$$\begin{aligned} \mathcal{N} = \{(\tau \cdot, G \cdot) \mid (\tau \cdot, G \cdot) \in \text{Arg max}_{\tau, G} \Psi_{e,2}^\ell(\tau, G) = R + W(\tau, G, \epsilon^{ji}) \\ + \beta \{ \pi(\hat{\rho}(\tau, G, 1))\Psi_1^{\ell, i} + [(1 - \pi(\hat{\rho}(\tau, G, 1)))]\Psi_1^{\rho, o} \} \end{aligned}$$

Likewise,

$$\mathcal{M} = \{(\tau \cdot, G \cdot) \mid (\tau \cdot, G \cdot) \in \text{Arg max}_{\tau, G} \Psi_{n,2}^\ell(\tau, G) = R + W(\tau, G, \epsilon^{ji}) + \beta \Psi_{R,1}^{\ell, i} \}$$

which are the programs a type  $i$  incumbent would solve if he calls (does not call) for an early election. Here  $\Psi_1^{\ell,i}$  ( $\Psi_1^{p,o}$ ) and  $\Psi_{R,1}^{\ell,i}$  are the incumbent's (voter's) equilibrium welfare at  $T-1$  conditional on the information he has as of period  $T-2$  (see Appendix 2 for more details).

### (A) Sequential Equilibrium

Roughly speaking, in a sequential equilibrium (Kreps and Wilson (1982)) the incumbent's (voter's) strategy profile give the choice to be made at each decision point as a function of his information set, as well as the voter's beliefs about the incumbent's competency. These beliefs must be Bayes consistent. More formally, let  $\{G^i, \tau^i, \delta^i\}$  be an strategy for the type  $i$  incumbent,  $i \in \{l, h\}$ , and  $\{v(\hat{\rho}(G^i, \tau^i, \delta^i))\}$  be a strategy for voters,  $v(.) \in \{0, 1\}$ . Then a *sequential equilibrium*—in pure strategies—is the pair  $\{[(G^i, \tau^i, \delta^i), v(\hat{\rho}(G^i, \tau^i, \delta^i))], \hat{\rho}(G^i, \tau^i, \delta^i)\}$ , such that: (i)  $[G^i, \tau^i, \delta^i]$  attains (23); (ii)  $v(\hat{\rho}(G^i, \tau^i, \delta^i))$  satisfies (21); and (iii) Agents' beliefs are Bayes—consistent, so that a) if  $[G^l, \tau^l, \delta^l] \neq [G^h, \tau^h, \delta^h]$  then  $\hat{\rho}(G^l, \tau^l, \delta^l) = 0$  and  $\hat{\rho}(G^h, \tau^h, \delta^h) = 1$ , and (b) if  $[G^l, \tau^l, \delta^l] = [G^h, \tau^h, \delta^h]$  then  $\hat{\rho}(G^i, \tau^i, \delta^i) = \rho$  for  $i \in \{l, h\}$ .

### (B) Separating Equilibrium

In a sequential separating equilibrium  $[G^l, \tau^l, \delta^l] \neq [G^h, \tau^h, \delta^h]$ . Thus, voters become *informed* about the incumbent's type before they vote by observing  $G, \tau$ , and  $\delta$ .

Proposition 4: In any separating equilibrium  $[G^l, \tau^l, \delta^l] = [G^*(\epsilon^{j1}), \tau^*(\epsilon^{j1}), 0]$ .

Proof: The proof is done by contradiction. Suppose  $[G^l, \tau^l, \delta^l] \neq [G^*(\epsilon^{j1}), \tau^*(\epsilon^{j1}), 0]$  is a separating equilibrium. Then the voters beliefs are such that  $\hat{\rho}(G^l, \tau^l, \delta^l) = 0$ . However,  $Z(G^l, \tau^l, \delta^l, 0, \epsilon^{j1}) < Z(G^*(\epsilon^{j1}), \tau^*(\epsilon^{j1}), 0, \hat{\rho}, \epsilon^{j1})$  so that (23) is not attained. Therefore  $[G^l, \tau^l, \delta^l]$  cannot be an equilibrium.<sup>20//</sup>

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<sup>20</sup>Note  $Z(G_t^l, \tau_t^l, 0, 0, \epsilon_t^{j1}) < Z(G_t^*(\epsilon_t^{j1}), \tau_t^*(\epsilon_t^{j1}), 0, \hat{\rho}, \epsilon_t^{j1})$  is trivially true. Moreover,



Out-of-equilibrium path beliefs in a sequential equilibrium are arbitrary. Thus, one can conveniently set  $\hat{\rho}(G, \tau, \delta) = 0 \quad \forall (G, \tau, \delta) \neq (G^h, \tau^h, \delta^h)$ . This implies that voters always think they have a low-type incumbent, unless they observe the equilibrium choices of a high-type incumbent. Therefore, a type-l incumbent attains (23) iff

$$Z(G^*(\epsilon^{jl}), \tau^*(\epsilon^{jl}), 0, 0, \epsilon^{jl}) \geq Z(G^h, \tau^h, 1, 1, \epsilon^{jl}). \quad (24)$$

The set of  $G$  and  $\tau$  that corresponds to this expression is

$$\mathcal{J} = \left\{ (G^h, \tau^h) \mid W(G^h, \tau^h, \epsilon^{jl}) \leq W^*(\epsilon^{jl}) - \mathcal{J}^l. \text{ Where } \mathcal{J}^l = \beta \{ \pi(h) [\Psi_1^{\ell, 1} - \Psi_1^{p, o}] - [\Psi_{R, 1}^{\ell, 1} - \Psi_1^{p, o}] \} > 0. \right\}$$

In figure 1(a)  $\mathcal{J}$  is represented by the area outside the ellipse with center at  $(G^*(\epsilon^{jl}), \tau^*(\epsilon^{jl}))$ . Similarly, a type h-incumbent attains (23) iff

$$Z(G^h, \tau^h, 1, 1, \epsilon^{jh}) \geq Z(G^*(\epsilon^h), \tau^*(\epsilon^h), 0, 0, \epsilon^{jh}). \quad (25)$$

The set that corresponds to this inequality is

$$\mathcal{K} = \left\{ (G^h, \tau^h) \mid W(G^h, \tau^h, \epsilon^{jh}) \geq W^*(\epsilon^{jh}) - \mathcal{J}^h. \text{ Where } \mathcal{J}^h = \beta \{ \pi(h) [\Psi_1^{\ell, h} - \Psi_1^{p, o}] - [\Psi_{R, 1}^{\ell, h} - \Psi_1^{p, o}] \} > 0. \right\}$$

$\mathcal{K}$ , in figure 1(b), is represented as all the points which are interior to the ellipse  $\mathcal{Y}^h$  with center  $(G^*(\epsilon^{jh}), \tau^*(\epsilon^{jh}))$ .<sup>21</sup>

Define  $\mathcal{O} = \{(G^h, \tau^h) \mid (24) \text{ and } (25) \text{ are true}\}$ . Then a separating equilibrium is given by:

$$\mathcal{S} = \{(G^i, \tau^i, \delta^i), i \in \{l, h\} \mid (G^l, \tau^l, \delta^l) = (G^*(\epsilon^{jl}), \tau^*(\epsilon^{jl}), 0), (G^h, \tau^h) \in \mathcal{O}, \text{ and } \delta^h = 1\}.$$

Next, we need to study the characteristics of  $\mathcal{O}$

**Proposition 5:**  $\mathcal{O}$  is a nonempty compact set in  $\mathbb{R}^2$ .

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$Z(G^l, \tau^l, 1, 0, \epsilon^{jl}) < Z(G^*(\epsilon^{jh}), \tau^*(\epsilon^{jh}), \hat{\rho}, \epsilon^{jl})$  is also true since  $\pi(l) < 1/2$ .

<sup>21</sup>One can easily verify that  $\pi(h) > \omega$  guarantees that  $\mathcal{J}^l$  and  $\mathcal{J}^h$  are both positive.

*Proof:*  $\mathcal{H}$  is a compact set in  $\mathbb{R}^2$ . The complement of  $\mathcal{H}$ ,  $\mathcal{H}^c$ , is a bounded open set also in  $\mathbb{R}^2$ . Then,  $\emptyset = \mathcal{H} - \mathcal{H}^c$  is empty if and only if  $\mathcal{H}$  is a subset of  $\mathcal{H}^c$ . But, this is impossible since  $\mathcal{H}^h > \mathcal{H}^l > 0$  and  $V''(\cdot) < 0$ . Finally,  $\emptyset \subset \mathcal{H}$  is compact since it is the difference of a compact set and an open set which are not disjoint. //

From this proposition, it is clear that there can be a multiplicity of separating equilibrium in which the values of  $G^h$  and  $\tau^h$  can be economically unintuitive. This situation is originated by the arbitrariness of the out-of-equilibrium beliefs. Using a refinement of sequential equilibrium proposed by Moulin (1981), one can reduce this myriad of equilibrium significantly.

### (C) Undominated Separating Equilibria

Here, we assume that voters are sophisticated enough that they do not believe an incumbent has played dominated strategies.

More formally,  $(G, \tau, \delta)$  is *dominated* for a type  $i$  incumbent,  $i \in \{l, h\}$ , iff

$$Z(G^*(\epsilon^{ji}), \tau^*(\epsilon^{ji}), 0, 0, \epsilon^{ji}) > Z(G, \tau, 1, 1, \epsilon^{ji}) \quad (26).$$

Clearly, for  $i=h$ , the locus of points that satisfies this inequality is  $\mathcal{H}^c$ . Likewise, for  $i=l$ , the locus of points that satisfies the inequality is  $\mathcal{H}$  with exclusion of the borders of the ellipse  $\mathcal{Y}^l$ . We rule out dominated equilibria by requiring  $\hat{\rho} = 1$  ( $\hat{\rho} = 0$ ) if expression (26) holds for  $l$  ( $h$ ), but not for  $h$  ( $l$ ), respectively. The sets of points that are dominated for  $l$ , but not for  $h$ , is  $\emptyset$ . In order to identify the undominated separating equilibrium  $(G^h, \tau^h)$ , the  $h$ -type incumbent solves the following program:

$$\begin{aligned} & \text{Max}_{(G, \tau) \in \emptyset} W(G, \tau, \epsilon^{jh}) \end{aligned} \quad (27)$$

Thus, we have the following proposition:

**Proposition 6:** In the endogenous election case, there is a unique undominated separating equilibrium in which a h type incumbent chooses

- (i)  $\tau_e^h = \tau^*(\epsilon^{jh})$  and  $G_e^h = G^*(\epsilon^{jh})$  if  $(\tau^*(\epsilon^{jh}), G^*(\epsilon^{jh})) \in \mathcal{O}$ , or
- (ii)  $\tau_e^h < \tau^*(\epsilon^{jh})$  and  $G_e^h > G^*(\epsilon^{jh})$  if  $(\tau^*(\epsilon^{jh}), G^*(\epsilon^{jh})) \notin \mathcal{O}$

**Proof:** Existence is assured by the continuity of  $W(.,., \epsilon^{jh})$  and compactness of  $\mathcal{O}$ .

Uniqueness is result of the concavity of  $U(.,.)$  and  $V(.)$  as well of the normality of  $c$  and  $G$ . If  $(\tau^*(\epsilon), G^*(\epsilon)) \in \mathcal{O}$  then the incumbent chooses his global maximum which is attained in his bliss point. In contrast, if  $(\tau^*(\epsilon), G^*(\epsilon)) \notin \mathcal{O}$  the incumbent chooses  $(G, \tau)$  to satisfy the following equations:

$$NU_G(\bar{y} - \tau, G) = U_c(\bar{y} - \tau, G) \quad (28)$$

$$Z(G, \tau, 1, 1, \epsilon^{jl}) = Z(G^*(\epsilon^{jl}), \tau^*(\epsilon^{jl}), 0, 0, \epsilon^{jl})$$

The second order condition is satisfied only when

$$\{U_c(\bar{y} - \tau^h, G^h) - \beta \psi N V'(\psi(N\tau^h + \epsilon^{jl} - G^h))\} < \{U_c(\bar{y} - \tau^h, G^h) - \beta \psi N V'(\psi(N\tau^h + \epsilon^{jh} - G^h))\} < 0$$

in which case  $\tau_e^h < \tau^*(\epsilon^{jh})$  and  $G_e^h < G^*(\epsilon^{jh})$ . //

Therefore, in an undominated separating equilibrium, if  $[G^*(\epsilon^{jh}), \tau^*(\epsilon^{jh})] \in \mathcal{O}$ , then calling an early election may be fully informative to voters. In this case, it is optimal for an h type incumbent to set his full information levels of taxes and government consumption. In contrast, if  $[G^*(\epsilon^{jh}), \tau^*(\epsilon^{jh})] \notin \mathcal{O}$ , then a h-type incumbent will set taxes (government consumption) below (above) their full information levels by an amount sufficient to distinguish himself as a high-type incumbent.

Note that the first order condition (28), which is identical to the Samuelsonian condition found from solving the full information problem (see proposition 1), allows us to solve  $\tau$  as a function of  $G$ ,  $\tau = \tau(G)$ , where  $\tau'(G) < 0$ . Define the "efficient signaling locus" as

$$\mathcal{V} = \{(G, \tau) \mid \tau = \tau(G), \text{ and } G = G^*(\epsilon), \text{ for any value of } \epsilon\}.$$

Then the solution for the unique undominated equilibrium  $(G_e^h, \tau_e^h)$  is the point of intersection between  $\mathcal{V}$  and the curve whose equation is  $W(G, \tau, \epsilon^{jl}) = W^*(\epsilon^{jl}) + \mathcal{X}^l$ . This is point  $e$  in figure (2a).

#### (D) Pooling Equilibria

In a separating equilibrium, voters become informed about the incumbent's latest competency shock. However, there may exist equilibria in which observing  $(G, \tau, \delta)$  does not provide any information about the incumbent's type. The elimination of dominated strategies does not rule out these pooling equilibria.

In a pooling equilibrium,  $(G^l, \tau^l, \delta^l) = (G^h, \tau^h, \delta^h)$  and  $\hat{\rho}(G^i, \tau^i, \delta^i) = \rho$ ,  $i \in \{l, h\}$ . In this case, voters can not distinguish the incumbent's type by observing  $(G^i, \tau^i, \delta^i)$ . This clearly happen if voters' beliefs are unsophisticated and do not take into account the incumbent's incentives. In order to rule out this kind of equilibria, Cho and Kreps (1987) have proposed the use of the intuitive refinement to the sequential equilibrium.

An equilibrium  $\{(G^l, \tau^l, \delta^l), (G^h, \tau^h, \delta^h)\}$  is unintuitive if there exists another strategy  $(G^+, \tau^+, \delta^+)$  such that for a type  $h$  incumbent the following is true:

$$Z(G^+, \tau^+, \delta^+, 1, \epsilon^{jh}) - Z(G^h, \tau^h, \delta^h, \hat{\rho}(G^h, \tau^h, \delta^h), \epsilon^{jh}) > 0.$$

In this case, the incumbent prefers  $(G^+, \tau^+, \delta^+)$  over  $(G^h, \tau^h, \delta^h)$  if by doing so he convinces voters of his true type. Conversely, for a type  $l$ -incumbent

$$Z(G^+, \tau^+, \delta^+, 1, \epsilon^{jl}) - Z(G^l, \tau^l, \delta^l, \hat{\rho}(G^l, \tau^l, \delta^l), \epsilon^{jl}) < 0.$$

Let  $(G^P, \tau^P, 1)$  be a pooling equilibria, and define



$$T^i(G, \tau) = Z(G, \tau, 1, 1, \epsilon^{ji}) - Z(G^P, \tau^P, 1, \hat{\rho}, \epsilon^{ji})$$

to be the gains (losses) that a type  $i$  incumbent obtains from deviating from the pooling equilibrium and playing strategy  $(G, \tau, 1)$ .  $T^i$  is a continuous function in  $G$  and  $\tau$ . And  $0 < \hat{\rho} < 1$ , implies that  $\pi(l) < \pi(\hat{\rho}) < \pi(h)$ . Thus,

Proposition 7: In the endogenous election case, all pooling equilibria are unintuitive.

Proof: Assume, without loss of generality, that  $(G^P, \tau^P) \notin \mathcal{V}$ . Then there is a pair  $(G', \tau(G'))$  in  $\mathcal{V}$ , which is located to the right of  $(G_e^h, \tau_e^h)$ , such that  $T^h(G', \tau(G')) = 0$ . This is so because  $Z(G, \tau, 1, 1, \epsilon^{jh})$  is continuous  $(G, \tau)$  and has a bliss point in  $(G^h, \tau^h)$ . Furthermore,

$$NU_G(\bar{y} - \tau(G'), G') = U_c(\bar{y} - \tau(G'), G')$$

and  $\pi(h) > \pi(\hat{\rho})$  imply  $\tau^P - G^P > \tau(G') - G'$ . But then  $T^l(G', \tau(G')) < 0$  since  $V'' < 0$ . Moreover,  $T^h$  is monotonic along  $\mathcal{V}$ , since  $Z(G, \tau, 1, 1, \epsilon^{jh})$  has this property. Then by continuity of  $T^i$ , there is a  $\tau > 0$ , so that  $T^h(G' - \tau, \tau(G' - \tau)) > 0$  and  $T^l(G' - \tau, \tau(G' - \tau)) < 0$ . Hence pooling equilibrium are unintuitive. //

#### (E) A Comparison of Equilibria Under Fixed And Endogenous Elections

Rogoff determines, for  $t = T - 2$ , the undominated separating equilibrium for the fixed-term election case. This is obtained from solving the following program:<sup>22</sup>

$$\begin{aligned} & \text{Max} && W(G, \tau, \epsilon^{jh}) \\ & (G, \tau) \in \mathcal{O}' \end{aligned}$$

where  $\mathcal{O}'$  is defined in Rogoff's paper. In particular the pair  $(G, \tau)$  that solves the program above can be found by solving the following equation:

$$W(G, \tau, \epsilon^{jl}) = W^*(\epsilon^{jl}) - \beta\{(\pi(h) - \pi(l))[(R + \Omega^1 - \Omega^0) + \beta R]\} \quad (32)$$

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<sup>22</sup>These expressions are not quite the same as those of Rogoff's. This is so because the model used in this paper is slightly different to the one used by him.

which yields the following:

*Proposition 8:* (Rogoff): In the fixed-term election case, there exist a unique undominated separating equilibrium in which  $\{\tau_r^l = \tau^*(\epsilon^{jl}), G_r^l = G^*(\epsilon^{jl})\}$  and  $\{\tau_r^h < \tau^*(\epsilon^h), G_r^h > G^*(\epsilon^h)\}$ .

Note that  $(G_r^h, \tau_r^h)$  is also found as the intersection between  $\mathcal{V}$  and the curve described by equation (32) to the right of  $(G^*(\epsilon^{jh}), \tau^*(\epsilon^{jh}))$ . See point  $r$  in picture 2 (b).

Because  $\beta\{(\pi(h) - \pi(l))[(R + \Omega^1 - \Omega^0) + \beta R]\} > \mathcal{X}^1$ , one can readily verify that  $\tau_r^h < \tau_e^h \leq \tau^*(\epsilon^{jh})$ , and  $G_r^h > G_e^h \leq G^*(\epsilon^{jh})$ .<sup>23</sup> Thus, on average, macroeconomic policy distortions are more acute with fixed election terms than with endogenous elections. This is shown graphically in figures 3 (a) and 3 (b). In figure 3 (a), economic policy is optimal with endogenous elections as opposed to the case with fixed elections. Since  $e$  coincides with the type  $h$ -incumbent's bliss point. In figure 3 (b), under both electoral structures there is suboptimal use of economic policy with signaling purposes, for this reason  $e$  and  $r$  are to the right of the  $h$  type incumbent's bliss point.

## V. SOME EMPIRICAL RESULTS

Recently, Ito and Park (1988) have conducted a causality test in order to determine whether elections cause economic booms or whether economic booms trigger elections in Japan during the post-war period. Their findings suggest that the causality goes from economic conditions to elections, or more precisely that the Japanese Government has acted opportunistically rather than manipulatively.

Terrones (1988) using a discrete choice model (one with forward looking incumbent and voters) finds evidence that a favorable evolution of those variables associated with the government performance (and with the incumbent's and voters' indirect utility) increases the

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<sup>23</sup>This is so since  $\pi(l) < 1/2$  and  $\pi(h) > \omega$ .

chances that a particular incumbent may call an early election. The relevant variables, in this model, turn out to be the permanent components of the output rate of growth and inflation rate (see Terrones (1988) for more details). For purposes of illustration, we report below some of the results obtained for the Japanese case.<sup>24</sup>

	constant	$g^P$	$g^T$	$\pi^P$	$\pi^T$	t	LLK
Probit	-7.375 (-3.02)	.083 (1.90)	.038 (1.03)	-.248 (-2.11)	-1.61 (-.80)	.63 (3.49)	-13.92
Logit	-12.99 (-2.78)	.142 (1.80)	.061 (.83)	-.44 (-2.07)	-3.10 (-.83)	1.09 (3.34)	-14.20

where: the dependent variable,  $\delta$ , takes value 1 (0) if an election is (not) held.

$g^P(g^T)$  is the permanent (transitory) component of the output rate of growth,

$\pi^P(\pi^T)$  is the permanent (transitory) component of the inflation rate.

t is the period since the last election, and

the values in parenthesis are the computed t-values.

Altogether, these results are in agreement with some of the predictions of the theoretical model although more empirical work is necessary.

## VI. CONCLUSIONS

Abundant empirical evidence indicates that political macroeconomic policy cycles are endemic to Western democracies.<sup>25</sup> Even so, there have been few theoretical attempts to understand the nature of these cycles. The analysis in this paper complements the political budget cycles literature by showing that the magnitude of these cycles is sensitive to the

<sup>24</sup>Terrones also studies the cases of Australia, Austria, Canada and United Kingdom. The data he uses is quarterly and it covers the 1957:1 to 1987:2 period.

<sup>25</sup>See for instance Alesina (1988), Borooah and Van der Ploeg (1983), Fair (1987), Haynes and Stone (1987), Hibbs (1987), Tabellini and La Via (1987), for some recent empirical studies on this issue.

different political arrangements of each society. In particular, our analysis suggest that political budget cycles in a democracy with endogenous elections (most of Parliamentary Democracies) are *less* pronounced and *less* regular than those one would observe in democracies with fixed term elections (most of Presidential Democracies). These predictions appear to be consistent with the empirical evidence reported in Terrones (1988) and in Ito and Park (1988), however further empirical work is necessary.

One interesting topic for further research is the study of the normative implications of a variety of electoral structures.<sup>26</sup> For instance, based on the results of this paper one may be tempted to infer that a society with an endogenous electoral system is better off than other society with fixed term elections. Indeed, this does not need to be case because there are two opposing forces at work. On the one hand, we have found that the amount of policy distortions in a system with endogenous elections is lower than a system with fixed-term elections. On the other hand, we have also found that early elections are, on average, more frequent than fixed-term elections. Thus, we can not clearly determine under which system a society is better off. Maybe, this is the reason why these two electoral systems coexists.

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<sup>26</sup>Earlier researchers of the Political Business Cycles literature have suggested several institutional changes to reduce the reach of these cycles. See for instance, Lindbeck (1976), and Tufte (1978) among others.



## APPENDIX 1:

Endogenous Elections: Full Information Case.

Let's start assuming that  $t = T$ . I.e., by looking at the end of democratic rule at which point no further elections are allowed. At  $t = T$ , the incumbent does not have discretion over  $\delta$ . However, he can still determine the levels of taxes, public consumption and public investment. In particular, he sets them at their socially optimal levels since there is no gain of doing otherwise. In these conditions, a type  $i$  incumbent's welfare as of period  $T$ , (i.e.  $k = 0$ ) is:

$$\Gamma_o^{\ell,ji} = R + W^*(\epsilon_T^{ji}) \quad (A1.1)$$

The incumbent's expected welfare before he learns his type,  $\alpha_T$ , and after observing  $\alpha_{T-1} = \alpha^j$  is

$$\Gamma_o^{\ell,j} = E_i \{ \Gamma_o^{\ell,ji} \} = R + \Omega^j. \quad (A1.2)$$

Finally, the the incumbent's unconditional expected welfare (i.e. when he knows neither  $\alpha_{T-1}$  nor  $\alpha_T$ ) is

$$\Gamma_o^{\ell,o} = E_j \{ \Gamma_o^{\ell,j} \} = R + \Omega^o. \quad (A1.3)$$

Similarly, we can compute the representative voter's welfare, as of period  $T$  for each of the three situations considered above ( $\Gamma_o^{\ell,ji}$ ,  $\Gamma_o^{\ell,j}$ , and  $\Gamma_o^{\ell,o}$ ). The incumbent's and representative voter's welfare are the same except for the ego rent terms that appears in the welfare of the first but not in the welfare of the second one.

Next, assume  $t = T - 1$ . The incumbent at  $T - 1$  is deciding whether or not to call an early election, given that he always (i.e. in particular at  $T - 1$  and  $T$ ) sets socially optimal levels of taxes, public consumption and public investment. If a  $i$ -type incumbent calls an early election then his expected discounted utility, for a given and known  $\alpha_{T-2}^j$ ,  $j \in \{l, h\}$ , is

$$\Gamma_{e,1}^{\ell,ji} = [W^*(\epsilon_{T-1}^{ji}) + R] + \beta \{ \pi(i) \Gamma_o^{\ell,i} + (1 - \pi(i)) \Gamma_o^{\ell,o} \} \quad (A1.4)$$

$i \in \{l, h\}$ , and the subscript  $(e,1)$  indicates that the incumbent calls for general elections in the next to last period. The first term on the right hand side of this expression is the utility the incumbent obtains from staying in office in period  $T - 1$ . The second term is the incumbent's next period discounted expected utility given that he called an early election in  $T - 1$ . There is a probability  $\pi(i)$  that he be re-elected and a probability  $(1 - \pi(i))$  that he be voted out of office (thus becoming another voter) as of period  $T$ .

In contrast, a  $i$ -type incumbent's expected discounted utility if he does not call an early election at  $T - 1$  is

$$\Gamma_{n,1}^{\ell,ji} = [W^*(\epsilon_{T-1}^{ji}) + R] + \beta [\Gamma_o^{\ell,i}] \quad (A1.5)$$

where the subscript  $(n,1)$  indicates that the incumbent does not call an early election in the next to last period.

Expression (A1.5) is the incumbent's expected utility when he stays in office up to the end of his two period term, which, in this case coincides with the end of democratic rule. The (i-type) incumbent sets

$$\delta^* = \begin{cases} 1 & \text{if } \Gamma_{e,1}^{\ell,ji} > \Gamma_{n,1}^{\ell,ji} \\ 0 & \text{otherwise} \end{cases} \quad (\text{A1.6})$$

it is easy to check that a h-type incumbent does not call an early election when  $t = T - 1$ . Similarly a l-type incumbent does not call an early election provided that  $R + \Omega^1 - \Omega^0 > 0$ . From now on we assume that this inequality holds, so that any incumbent always wants to stay in office.

Under these conditions, the type-i incumbent's welfare at  $T-1$  is given by

$$\Gamma_1^{\ell,ji} = R + W^*(\epsilon_{T-1}^{ji}) + \beta \Gamma_o^{\ell,i} \quad (\text{A1.7})$$

likewise, the incumbent's expected discounted welfare before he observes his type, but conditional on knowing  $\alpha_{T-2} = \alpha^j$ , is

$$\Gamma_1^{\ell,j} = E_i \{ \Gamma_1^{\ell,ji} \} = R + \Omega^j + \beta \Gamma_o^{\ell,o} \quad (\text{A1.8})$$

finally, the incumbent's unconditional expected discounted welfare is

$$\Gamma_1^{\ell,o} = E_j \{ \Gamma_1^{\ell,j} \} = R + \Omega^o + \beta \Gamma_o^{\ell,o}. \quad (\text{A1.9})$$

As in the previous case, we can define the representative voter's welfare by eliminating  $R$  and by substituting the superscript  $\ell$  by  $p$  in the above expressions.

On the other hand, if the incumbent has to face regular elections at  $T-1$  (i.e. he can not choose between e,n) then an i-type incumbent's welfare is

$$\Gamma_{R,1}^{\ell,ji} = R + W^*(\epsilon_{T-1}^{ji}) + \beta \{ \pi(i) \Gamma_o^{\ell,i} + [1-\pi(i)] \Gamma_o^{p,o} \} \quad (\text{A1.10})$$

the incumbent's expected discounted welfare before he observes his type, but conditional on knowing  $\alpha_{T-2} = \alpha^j$ , is

$$\begin{aligned} \Gamma_{R,1}^{\ell,j} = E_i \{ \Gamma_{R,1}^{\ell,ji} \} &= R + \Omega^j + \beta \rho \{ \pi(h) \Gamma_o^{\ell,h} + [1-\pi(h)] \Gamma_o^{p,o} \} \\ &+ \beta(1-\rho) \{ \pi(l) \Gamma_o^{\ell,l} + [1-\pi(l)] \Gamma_o^{p,o} \} \end{aligned} \quad (\text{A1.11})$$

similarly, the incumbent's unconditional expected discounted welfare is

$$\begin{aligned} \Gamma_{R,1}^{\ell,o} = E_i \{ \Gamma_{R,1}^{\ell,ji} \} &= R + \Omega^o + \beta \rho \{ \pi(h) \Gamma_o^{\ell,h} + [1-\pi(h)] \Gamma_o^{p,o} \} \\ &+ \beta(1-\rho) \{ \pi(l) \Gamma_o^{\ell,l} + [1-\pi(l)] \Gamma_o^{p,o} \} \end{aligned} \quad (\text{A1.12})$$

As before, the representative voter's welfare can be easily derived from the expressions above by eliminating

the ego rent terms and changing the superscript  $\ell$  by  $p$ .

Now let  $t = T - 2$ . Again the incumbent is deciding whether or not to call an election at  $T - 2$ . If he calls an election and wins, he stays in office until  $T$ . If he loses he spends the next two periods as a private citizen.<sup>27</sup> Hence, a  $i$ -type incumbent's expected discounted utility – if he calls an early election when there are two periods – to go is

$$\Gamma_{e,2}^{\ell,ji} = [R + W^*(\epsilon_{T-2}^{ji})] + \beta\{\pi(i)\Gamma_1^{\ell,i} + [1 - \pi(i)]\Gamma_1^{p,o}\}. \quad (A1.13)$$

Similarly if the incumbent does not call an election, he has to face general elections next period regardless of his type.<sup>28</sup> If he wins this regular election he stays in office until  $T$ . If he loses, he forfeits a sure period as leader and spends the final period as a private citizen. Thus, the  $i$ -type incumbent's expected discounted utility of not calling an early elections is

$$\Gamma_{n,2}^{\ell,ji} = [R + W^*(\epsilon_{T-2}^{ji})] + \beta\Gamma_{R,1}^{\ell,i}. \quad (A1.14)$$

Based on the results reported in the main text of this paper (see pages 12 and 13), one can compute an  $h$ -type incumbent's welfare – as of period  $T-2$  – to be:

$$\Gamma_2^{\ell,jh} = R + W^*(\epsilon_{T-2}^{jh}) + \beta\{\pi(h)\Gamma_1^{\ell,h} + (1-\pi(h))\Gamma_1^{p,o}\}$$

likewise a  $l$ -type incumbent's welfare is given by:

$$\Gamma_2^{\ell,jl} = [R + W^*(\epsilon_{T-2}^{jl})] + \beta\Gamma_{R,1}^{\ell,l} \quad (A1.15)$$

Thus, the incumbent's expected welfare before he learns his type, but after knowing  $\alpha_{T-3}$ , is given by:

$$\Gamma_2^{\ell,j} = E_i\{\Gamma_2^{\ell,ji}\} = [R + \Omega^j] + \beta\{\rho[\pi(h)\Gamma_1^{\ell,h} + (1-\pi(h))\Gamma_1^{p,o}] + (1-\rho)\Gamma_{R,1}^{\ell,l}\} \quad (A1.16)$$

The incumbent's (unconditional) expected welfare is given by

$$\Gamma_2^{\ell,o} = E_j\{\Gamma_2^{\ell,j}\} = [R + \Omega^o] + \beta\{\rho[\pi(h)\Gamma_1^{\ell,h} + (1-\pi(h))\Gamma_1^{p,o}] + (1-\rho)\Gamma_{R,1}^{\ell,l}\} \quad (A1.17)$$

Similarly, the representative voter's expected welfare can be easily computed from the expressions above (just eliminate the ego rent terms and substitute the superscript  $\ell$  by  $p$ )

If a  $i$ -type incumbent has to face *regular* elections at  $T-2$ , then his expected discounted welfare is

$$\Gamma_{R,2}^{\ell,ji} = R + W^*(\epsilon_{T-2}^{ji}) + \beta\{\pi(h)\Gamma_1^{\ell,i} + (1-\pi(h))\Gamma_1^{p,o}\} \quad (A1.18)$$

moreover, if the incumbent does not know his type then his expected discounted welfare, conditional on knowing  $\alpha_{T-3}$ , is

<sup>27</sup>Remember that the chances of being drawn as the opposition candidate are infinitesimal. Furthermore, the chances, once one got to be the opposition candidate, of being elected as the leader are also low.

<sup>28</sup>The incumbent's type does change from period to period, since every period "nature" draws a new competency shock. In this set-up it is quite possible that the incumbent be a high type today and a low type

$$\Gamma_{R,2}^{\ell,j} = E_i \{ \Gamma_{R,2}^{\ell,ji} \} = [R + \Omega^j] + \beta \{ \rho [\pi(h) \Gamma_1^{\ell,h} + (1-\pi(h)) \Gamma_1^{p,o}] + (1-\rho) [\pi(l) \Gamma_1^{\ell,l} + (1-\pi(l)) \Gamma_1^{p,o}] \} \quad (A1.19)$$

finally, the incumbent's unconditional expected discounted welfare is given by

$$\Gamma_{R,2}^{\ell,o} = E_j \{ \Gamma_{R,2}^{\ell,j} \} = [R + \Omega^o] + \beta \{ \rho [\pi(h) \Gamma_1^{\ell,h} + (1-\pi(h)) \Gamma_1^{p,o}] + (1-\rho) [\pi(l) \Gamma_1^{\ell,l} + (1-\pi(l)) \Gamma_1^{p,o}] \} \quad (A1.20)$$

As before, we can obtain the representative voter welfare from the expressions above by eliminating the ego rent terms and by substituting the superscript  $\ell$  by  $p$ .

Using this notation, it is simple to extend our analysis to any period  $t$  -i.e. when there are  $k = T-t$  periods to go- moreover, one can verify that if  $\pi(h) > \omega$ , then

$$\pi(h) [\Gamma_{k+1}^{\ell,h} - \Gamma_{k+1}^{p,o}] > [\Gamma_{k+1}^{\ell,h} - \Gamma_{k+1}^{i,o}] \quad (A1.21)$$

holds  $\forall k > 1$ .

## APPENDIX 2:

### Endogenous Elections: Asymmetric Information Case.

At  $T$ , the last period of democratic rule, no incumbent faces an election. Therefore, no incumbent has any incentive to deviate from the socially optimal levels of taxes and government expenditures. Thus, a  $i$ -type incumbent's welfare as of period  $T$ , (i.e.  $k = 0$ ) is:

$$\Psi_o^{\ell,ji} = R + W^* (\epsilon_T^{ji}) \quad (A2.1)$$

( $\Psi$  has the same meaning as  $\Gamma$  in the full information case). The incumbent's expected welfare before he learns his type,  $\alpha_T$ , but after observing  $\alpha_{T-1} = \alpha^j$ , is

$$\Psi_o^{\ell,j} = E_i \{ \Psi_o^{\ell,ji} \} = R + \Omega^j. \quad (A2.2)$$

Finally, the incumbent's unconditional expected welfare (i.e. when he knows neither  $\alpha_{T-1}$  nor  $\alpha_T$ ) is

$$\Psi_o^{\ell,o} = E_j \{ \Psi_o^{\ell,j} \} = R + \Omega^o. \quad (A2.3)$$

Similarly, we can compute the representative voter's welfare from the expressions above by eliminating the ego rent term ( $R$ ) and by changing the superscript  $\ell$  by  $p$ . (I.e. we obtain expressions for  $\Psi_o^{p,ji}$ ,  $\Psi_o^{p,j}$ , and  $\Psi_o^{p,o}$ )

At  $T-1$  we know, from the analysis of the full information case, that no incumbent calls an early election. At  $T-2$ , there is no information about  $\alpha_{T-1}$ , thus the incumbent's (equilibrium) expected discounted



welfare conditional on his information as of period  $T-2$  is:

$$\Psi_1^{\ell,j} = R + \Omega^j + \beta \Psi_0^{\ell,o} \quad (\text{A2.4})$$

similarly, if  $\alpha_{T-2}$  is not known then the incumbent's (equilibrium) expected discounted welfare is:

$$\Psi_1^{\ell,o} = E_j \{ \Psi_1^{\ell,j} \} = R + \Omega^o + \beta \Psi_0^{\ell,o}. \quad (\text{A2.5})$$

As before, we can define the voter's (equilibrium) expected discounted welfare for each of the cases considered above by simply excluding  $R$ , and changing the superscript  $\ell$  by  $p$ .

If a particular incumbent did not face an election (whether regular or early election) in period  $t = T - 2$ , then he must held general elections at  $T - 1$ . Let's put ourselves in this period and determine the incumbent's strategy. Note that the sequence of events has not changed. Thus at the beginning of this period, "nature" determines the incumbent's competency shock  $\alpha_{T-1}^i$ ,  $i \in \{l, h\}$ , which is observed by the incumbent but not by voters and so on. However,  $\delta$  is no longer a decision variable since elections are compulsory. The structure of this problem is almost similar to the one Rogoff solves in his (1987) paper, although there is a small change: there is only one more period (as opposed to two) before the end of democratic rule. Below, some of Rogoff's results (with the corresponding modifications) are reported without proof. The definitions of the different equilibrium concepts used in this Appendix can be found in Rogoff's 1987 paper (see also the main text of this paper for related definitions).

A type  $i$ -incumbent's maximization problem at  $T - 1$  is to choose  $(G', \tau')$  such that

$$\begin{aligned} (G', \tau') \in \underset{G, \tau}{\text{Arg max}} \ Z(G, \tau, \hat{\rho}(G, \tau), \epsilon^{ji}) &= [R + W(G, \tau, \epsilon^{ji})] \\ &+ \beta [\pi(\hat{\rho}(G, \tau)) \Psi_0^{\ell,i} + [1 - \pi(\hat{\rho}(G, \tau))] \Psi_0^{p,o}] \end{aligned} \quad (\text{A2.6})$$

where  $\pi(0) = \pi(l)$  and  $\pi(1) = \pi(h)$ . Thus we obtain the first result:

**Proposition A1:** In any sequential separating equilibrium  $[G_{T-1}^1, \tau_{T-1}^1] = [G^*(\epsilon_{T-1}^{j1}), \tau^*(\epsilon_{T-1}^{j1})]$ .

If the out of equilibrium beliefs are assumed so that  $\hat{\rho}(G, \tau) = 0$  for all  $(G, \tau) \neq (G^h, \tau^h)$ , then a  $l$ -type incumbent is attaining a maximum for (A2.6) iff

$$Z(G^*(\epsilon^{jl}), \tau^*(\epsilon^{jl}), 0, \epsilon^{jl}) - Z(G^h, \tau^h, 1, \epsilon^{jl}) \geq 0. \quad (\text{A2.7})$$

Similarly, a  $h$ -type incumbent is attaining a maximum iff

$$Z(G^h, \tau^h, 1, \epsilon^{jh}) - Z(G^*(\epsilon^{jh}), \tau^*(\epsilon^{jh}), 0, \epsilon^{jh}) \geq 0 \quad (\text{A2.8})$$

Define  $\mathcal{L} = \{(G^h, \tau^h) \mid (\text{A2.7}) \text{ and } (\text{A2.8}) \text{ hold}\}$ .  $\mathcal{L}$  is a nonempty compact set (see Rogoff for a proof).

In an undominated separating equilibrium, a type  $h$ -incumbent solves the following program:

$$\begin{aligned} & \text{Max}_{\{G, \tau\} \in \mathcal{Q}} W(G, \tau, \varepsilon^{jh}) \end{aligned} \quad (\text{A2.9})$$

Then

Proposition A2: There exists a unique undominated separating equilibrium in which taxes (government consumption) are set below (above) their social optimum level.

Indeed,  $\{G^h, \tau^h\}$  solve the following equation:

$$W(G^h, \tau^h, \varepsilon^{j1}) = W^*(\varepsilon^{j1}) - \beta [\pi(h) - \pi(l)] \{\Psi_o^{\ell,1} - \Psi_o^{p,o}\} \quad (\text{A2.10})$$

Let's us define

$$W'(\varepsilon^{jh}) = W(G^h, \tau^h, \varepsilon^{jh}), \quad (\text{A2.11})$$

and

$$W'(\varepsilon^{j1}) = W^*(\varepsilon^{j1}). \quad (\text{A2.12})$$

which are the (equilibrium) levels of welfare when a  $i$ -type is in office. Indeed, it is easy to show that

$$W'(\varepsilon^{jh}) = W(G^h, \tau^h, \varepsilon^{j1}) + \beta \{V(\psi(N\tau^h + \varepsilon^{jh} - G^h)) - V(\psi(N\tau^h + \varepsilon^{j1} - G^h))\} \quad (\text{A2.13})$$

Moreover, at  $t = T-2$ , there is no information about  $\alpha_{T-1}^i$ , so that the equilibrium expected welfare at  $T-1$  conditional on information at  $T-2$  is

$$\Omega' j = E_i \{W'(\varepsilon^{ji})\} = \rho W'(\varepsilon^{jh}) + (1 - \rho) W'(\varepsilon^{j1}). \quad (\text{A2.14})$$

The incumbent's (equilibrium) expected welfare is:

$$\Psi_{R,1}^{\ell,j} = R + \Omega' j + \beta \{ \rho [\pi(h) \Psi_o^{\ell,h} + (1 - \pi(h)) \Psi_o^{p,o}] + (1 - \rho) [\pi(l) \Psi_o^{\ell,1} + (1 - \pi(l)) \Psi_o^{p,o}] \} \quad (\text{A2.15})$$

Where  $\Psi_R$  corresponds to  $\Gamma_R$  in the full information case.

Similarly, if  $\alpha_{T-2}^j$  is not known then

$$\Omega' o = E_j \{\Omega' j\} = \rho \Omega' h + (1 - \rho) \Omega' l. \quad (\text{A2.16})$$

Thus, the incumbent's expected welfare is

$$\Psi_{R,1}^{\ell,o} = R + \Omega' o + \beta \{ \rho [\pi(h) \Psi_o^{\ell,h} + (1 - \pi(h)) \Psi_o^{p,o}] + (1 - \rho) [\pi(l) \Psi_o^{\ell,1} + (1 - \pi(l)) \Psi_o^{p,o}] \}. \quad (\text{A2.17})$$

Finally, we can easily find the representative consumer welfare for each of the cases above (just eliminate  $R$  from and change the superscript  $\ell$  by  $p$  for each of the expressions above).

Table 1

PARLIAMENTARY DEMOCRACIES:<sup>29</sup>

Country	Parliament/Houses	Term of Office (years)	Early dissolution
Australia	Parliament/Senate	6	—
	House of Representatives <sup>+</sup>	3	y
Austria	Parliament/Federal Council	5 or 6	—
	National Council <sup>+</sup>	4	y*
Canada	Parliament/Senate	until retirement	—
	House of Commons <sup>+</sup>	5	y
Denmark	Folketing <sup>+</sup>	4	y
France	Parliament/Senate	9	—
	National Assembly <sup>+</sup>	5	y
Germany (Federal Republic)	Parliament/Federal Council	Variable	—
	Federal Diet <sup>+</sup>	4	y*
India	Parliament/Council of States	6	—
	House of the People <sup>+</sup>	5	y
Ireland	The Oireachtas/Senate	5	—
	Dail <sup>+</sup>	5	y
Italy	Parliament/Senate	5	y
	Chamber of Deputies	5	y
Japan	Diet/House of Councillors	6	—
	House of Representatives <sup>+</sup>	4	y
New Zealand	House of Representatives <sup>+</sup>	3	y
Portugal	Assembly of the Republic <sup>+</sup>	4	y
St. Vincent	House of Assembly <sup>+</sup>	5	y*
Solomon Islands	National Parliament <sup>+</sup>	4	y
Spain	General Courts/Senate	4	y
	Congress of Deputies <sup>+</sup>	4	y
Sweden	Parliament <sup>+</sup>	3	y*
United Kingdom	Parliament/House of Lords	Continuous	—
	House of Commons <sup>+</sup>	5	y
Vanuatu	Parliament <sup>+</sup>	4	y
Zimbabwe	Parliament/Senate	5	y
	House of Assembly <sup>+</sup>	5	y

Source: *Parliaments of the World: A Comparative Reference Compendium* (1986) (Tables 1, 39 and 46).

<sup>+</sup> House that influence the appointment of the Government.

\* Early dissolution of Parliament/House is possible only under very specific conditions.

<sup>29</sup>We include only those cases in which: (1) the Parliament influence the composition of the executive (directly or indirectly), and (2) the Parliament may be subject to early dissolution.

Table 2

### THE SEQUENCE OF EVENTS WITH FIXED-TERM ELECTIONS

INCUMBENT		VOTERS		Winner of election takes office	
Observes $\alpha_t$		Observe $\tau_r G_r S_r \alpha_{t-1},$			
		$q_t$		Next election	
Sets $\tau_r G_r K_{t+1}$		Vote		at t + 2.	
				Events repeat as in t	
		ELECTION			
PERIOD t				PERIOD t + 1	

Table 3

### THE SEQUENCE OF EVENTS WITH ENDOGENOUS ELECTIONS

INCUMBENT	VOTERS	*	Winner of election takes office.	*
Observes $\alpha_t$	Observe $\tau_t G_t S_t \alpha_{t-1}$	*	Next regular	*
	$q_t$	*	election at t+2	*
Sets $\tau_t, G_t, K_{t+1}$	Vote	*	Events repeat as	*
		*	in t.	*
		*	Incumbent has	*
		*	option of calling	*
		*	an early election.	*
		*		*
	ELECTION	*	.....	*
		*	'EARLY ELECTION'	*
		*	.....	*
PERIOD t		*	PERIOD t + 1	*



## NOTATION:

$c$	$\equiv$	private consumption good
$G$	$\equiv$	public consumption good
$I$	$\equiv$	information set
$K$	$\equiv$	public capital good
$\ell$	$\equiv$	incumbent
$N$	$\equiv$	population size
$a$	$\equiv$	opposition candidate
$p$	$\equiv$	representative voter
$q$	$\equiv$	Looks shock
$R$	$\equiv$	incumbent's ego rent
$S$	$\equiv$	public investment good
$T$	$\equiv$	end of planning horizon
$\bar{y}$	$\equiv$	voter's endowment of the nonstorable good.
$W$	$\equiv$	consumer's welfare derived from the consumption of pecuniary goods
$k$	$\equiv$	number of periods to go, i.e. $k = T - t$ .
$\alpha$	$\equiv$	competency shock
$\beta$	$\equiv$	discount factor
$\delta$	$\equiv$	indicates whether the incumbent calls an early election or not
$\varepsilon$	$\equiv$	competency level
$\theta$	$\equiv$	looks level
$\psi$	$\equiv$	technological parameter.
$\rho$	$\equiv$	probability of drawing a high competency shock
$\hat{\rho}$	$\equiv$	probability voters assign to the event $\{\alpha = \alpha^h\}$ .
$\Gamma$	$\equiv$	expected discounted utility with no policy distortions (i.e. under full information.)
$\Psi$	$\equiv$	expected discounted utility with policy distortions (i.e. under asymmetric information).
$\pi$	$\equiv$	incumbent's assessment of the probability of being re-elected
$\tau$	$\equiv$	lump-sum taxes
$\Omega^i$	$\equiv$	consumer's expected welfare conditional on knowing $\alpha_{t-1} = \alpha_{t-1}^i$ .
$\Omega^0$	$\equiv$	consumer's expected welfare when neither $\alpha_{t-1}$ nor $\alpha_t$ are known.
$\Omega'^i$	$\equiv$	consumer's expected welfare when a type- $i$ incumbent faces elections at $T-1$ .
$h$	$\equiv$	high type, i.e. $\alpha = \alpha^h$ .
$l$	$\equiv$	low type, i.e. $\alpha = \alpha^l$ .
$e$	$\equiv$	early election.
$n$	$\equiv$	no early election.
$R$	$\equiv$	forced election.

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