Political Budget Cycles, Information and Development*

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Abstract

Recent evidence has established the following facts about Political Budget Cycles (PBCs): (i) PBCs mostly occur in developing countries and are financed with debt; (ii) PBCs have little correlation with incumbents' reelection probabilities in developing countries, and (iii) PBCs are negatively correlated with incumbents' reelection probabilities in developed countries. This paper presents first a full characterization of the sequential equilibria of a dynamic game of elections with asymmetric information. The game nests previous theoretical analyses on PBCs and has an equilibrium capable of matching fact (ii). In such equilibrium outcome PBCs arise exclusively from the behavior of unproductive incumbents who attempt to mimic competent governments by issuing hidden debt. Then I introduce a set of costly signals regarding incumbent performance and show that relatively rich voters acquire more informative signals. This ensuing information asymmetry of voters across income levels is shown to generate facts (i) and (iii). I finally discuss possible long term effects of initial unproductive politicians in office.

Keywords: Political Budget Cycles; Hidden action; Impermanent types; Costly information.
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1 Introduction

Since the cornerstone work of Downs (1957) there has been an extensive inquiry on the relationship between politicians and economic aggregates, summarized for instance in Drazen (2000) and Persson and Tabellini (2000). A salient feature of this line of research has been the study of the link between fiscal policy and elections, where a regular pattern has been established. In effect, starting with the book by Tufte (1978), and continuing with the sweeping, more rigorous empirical work by Blais and Nadeau (1992), Brender (2003), Brender and Drazen (2005) and Schuknecht (2000), it has been determined that government spending increases during election years in a systematic way across countries, a regularity coined with the term Political Budget Cycle (PBC).

The landmark theoretical appraisal of this phenomenon given by Rogoff (1990) characterizes PBCs as the equilibrium outcome of a signalling game between politicians and voters. In his formulation, office-seeking politicians have different, privately known skills which evolve with time, but present some persistence. Voters, in turn, use public information—taxes and government spending—to infer types and thus select the best candidate. In the unique separating equilibrium that Rogoff obtains, only productive incumbents increase public spending in election years, and hence the political budget cycle is a welfare-enhancing phenomenon because it reflects efficient signaling by the most able politicians. Additionally, unproductive politicians are always removed from office unless voters have an intrinsic, bold taste for them.[1] Finally, a key assumption underlying his analysis is that, apart from tax revenue, which is publicly observed, skills are the only determinant of the amount of public good that a politician may produce.

Recent empirical studies, however, have bestowed new information on political budget cycles. In particular, the panel evidence from Shi and Svensson (2006) and Brender and Drazen (2008) suggests three facts: (*i*) political budget cycles occur mostly in developing

[1] In the model voters have random preferences (McFadden (1974)) and thus voting is probabilistic (Coughlin (1982)).

countries and are financed with debt; (*ii*) in developing countries, election year increases in public spending do not hurt the incumbent politician's reelection prospects, and (*iii*) in developed countries, election year increases in public spending do hurt the incumbent's reelection prospects.

This evidence is unattained by Rogoff's equilibrium in the following aspects. First, the fact that rich-country voters punish rather than reward those politicians who generate PBCs suggests that voters may perceive that increases in election-year spending are caused by unproductive incumbents attempting to mimic efficient outcomes. In other words, the evidence seems to point toward a moral hazard perspective of PBCs stemming from the behavior of office-seeking, unproductive politicians. Secondly, the fact voters in low-income countries show lesser disapproval of PBCs, suggests the presence of more information in developed countries, which would allow the detection of hidden debt more easily. This informational channel, in turn, would explain the empirical erosion of political budget cycles in relatively richer countries.

The purpose of this paper is to build a model capable of matching the evidence (*i*)—(*iii*) described above, and then use such model to ask what type of politician is behind election-year increases in government spending. For this task I borrow unrestrainedly from Rogoff's original insights, namely politicians differing in productivity and asymmetric information between voters and incumbents. I introduce two main ingredients. First, apart from privately observe their productivity, office holders have the possibility of hidden borrowing; that is, incumbents may borrow abroad and such move is only observed by voters with a lag. This feature allows the separation of government spending from public good outcomes, and plays a key role in the empirical match of the model. Second, voters may buy a costly signal of varying precision that is correlated with politician's hidden action. This information market enables rich voters to afford accurate information regarding incumbent's performance.

I present a full characterization of the set of sequential equilibria of the game I build. The key determinants behind these equilibria are two parameters: nonpecuniary *ego* rents of

politicians and the likelihood that unproductive politicians become productive. For certain thresholds I obtain three ensuing equilibriums: one in which there are no PBCs, another that corresponds to Rogoff's outcome, and finally an equilibrium where only unproductive politicians generate political budget cycles.

The main thrust from the paper, however, stems from the third equilibrium obtained. I show that for parameter values supported by the work of Besley (2005), Caselli and Morelli (2004), Mattozzi and Merlo (2008), and Messner and Polborn (2004), such equilibrium is capable of matching the facts (*i*)—(*iii*). In this equilibrium outcome, unproductive incumbents end up using debt to mimic the public spending standard of productive politicians. In such case, when voters face a increase of public goods in election years, they cannot distinguish what type of politician is actually in office and thereby randomize at the polls, which generates fact (*iii*). This result still holds when voters may acquire informative signals, but as voters get richer and therefore improve their monitoring over incumbents, the PBC end up disappearing and any election-year increase in spending is punished by voters at the polls, which resembles facts (*i*)–(*ii*).

In the third equilibrium that I characterize then, I infer that political budget cycles are far from reflecting efficient signalling, and instead may be harmful. As long as voters cannot afford the cost of precise information, in which case they are not able to figure out incumbent's type, it is very likely that after elections they will face both interest payments and, more importantly, an unproductive politician again in office. I discuss possible long term effects of unproductive incumbents in economies on early stages of development.

The rest of the paper is organized as follows: in § 2 I briefly review the literature on political budget cycles. In § 3 I lay out the game with no information market and characterize its equilibrium set. In § 4 I introduce an information market to study the transition of political budget cycles along income path documented in the data. Finally, in § 5 I present some final remarks.

2 Literature

Rogoff (1990) is the landmark theoretical work on political political budget cycles, a line of research initiated with the empirical work by Tufte (1978) and then studied with the subsequent work by Blais and Nadeau (1992), Brender (2003), Brender and Drazen (2005), Brender and Drazen (2008), Schuknecht (2000) and Shi and Svensson (2006). There are different explanations, however, for the relationship between budget deficits and elections. Brender and Drazen (2005) argue a new democracies effect: voters of young democracies are not familiarized with elections, and thence subject to manipulation by opportunistic incumbents. Saporiti and Streb (2008) relate PBCs to separation of powers and the role of legislature. Drazen and Eslava (2010) and Brender and Drazen (2013) document that instead of changes in level, elections go along with modifications in the composition of government spending.

Apart from Rogoff (1990), my work is closely related to Shi and Svensson (2006) and Alt and Lassen (2006). The former established empirically that PBCs mainly occur in developing countries, and both papers study the reasons behind such regularity. The authors argue that since corruption is higher and there are fewer voters with access to information in poorer countries, it follows that opportunistic governments have ample space to issue debt and manipulate voters' expectation regarding incumbent's ability. They use a career-concerns model (Holmström (1999)) where an exogenous fraction of the population cannot observe debt and politicians set policy before they learn their productivity. They obtain a PBC, where each politician, regardless from his type, will increase debt in election years and will face a 50% probability of reelection.

While I share their heuristic argument that information is the channel behind fact (*i*) in § 1, we have three stark differences. First, I model information as an endogenously determined, equilibrium object along the lines of Amir and Lazzati (2011), Martinelli (2006) and Persico (2000). Second, building from Besley (2005), Caselli and Morelli (2004), Mattozzi and Merlo (2008), and Messner and Polborn (2004), I make explicit the point that

politicians do not behave equally, in particular, since political and market skills correlate positively, incumbents may have heterogenous preferences for keeping office. Finally, I state that politicians set policy having private information, which is demonstrably an important ingredient in this area or research (v.gr. Ferejohn (1986)).

Starting from these building blocks I am able to characterize clearly the relationship between political budget cycles, quality of information and income, and also make more transparent the transition of the equilibria as income increases. Moreover, I also take into account voters' response to make it consistent with the data, which was not considered by previous work. Finally, and more importantly, my setup enables the comparison with Rogoff's claim regarding the efficiency of PBCs, which is the core issue behind this strand of literature.

The idea that underlies my analysis is the possible endogenous erosion of moral hazard as economies develop, and idea that has been studied in a different context by Acemoglu and Zilibotti (1999). The conclusion of my analysis is related to Acemoglu, Egorov, and Sonin (2010) and Caselli and Morelli (2004) regarding possible explanations for the endogenous persistence of bad politicians in office. Following Banks and Sundaram (1998), however, I completely shut down the adverse selection of the model and I just consider that the unique tool of voters to provide incentives is given by the reelection decision.

This paper is also related to the empirical and theoretical literature on transparency and economic policy across countries, a sample given by Alesina et al. (1999), Gavazza and Lizzeri (2009), Hameed (2005), Islam (2006), Kopits and Craig (1998) and Kaufmann, Kraay, and Mastruzzi (2010). Finally, my work is consistent with the experimental literature on the impact of information on the quality of choice by voters in developing countries, which is summarized by Pande (2011).

3 Model

Consider the following environment: there is a set of politicians P with measure one, where a fraction $\rho \in (0,1)$ of them are productive, i.e. have associated a number $\overline{\theta} \in \mathbb{R}_+$, while the rest are associated with $\underline{\theta}$, where $0 < \underline{\theta} < \overline{\theta} \leq 1$. In each of the periods $t = 1, 2, 3$, a voter is endowed with $y \in R_+$ units of a consumption good, which may also be transformed into a public good through a linear technology which is under the control of a politician. In order to finance the provision of such public good there is an exogenously fixed tax rate $\tau \in [0,1]$ on voter's endowment. Additionally, it is also possible for the politician to borrow some extra units of the consumption good abroad at an interest rate $r > 0$.

In this environment the following dynamic game of imperfect information between a single voter v and a randomly selected politician $p \in P$ ensues. Denote this game by Γ. Each $t \in \{1,2,3\}$, the politician chooses an action $a_t^p \in A_p = \{b, 0\}$, where $b \equiv (\overline{\theta} - \underline{\theta})\tau y/\underline{\theta} > 0$ is the feasible amount of debt that p may issue abroad.[2] On the other hand, v may keep or fire the incumbent politician at the beginning of the last period, that is, v chooses the action $a_t^v \in A_v(t)$, where

$$A_v(t) = \begin{cases} \{k\} & \text{if } t = 1, 2, \\ \{k, f\} & \text{if } t = 3. \end{cases}$$

There are two sources of asymmetric information: First, p's action is observed by v after one period lag. Additionally, p's productivity $\theta_t \in \Theta = \{\overline{\theta}, \underline{\theta}\}$ is private information. Moreover, as in Phelan (2006), a politician's type may change. Formally, the following Markov process is assumed for the productivity sequence $\{\theta_t\}$, where the state $\overline{\theta}$ is assumed absorbing for the sake of simplicity

$$\Pr(\theta_{t+1} = \overline{\theta} | \theta_t = \underline{\theta}) = \varepsilon \in (0,1).$$

[2] In Rogoff's model politicians choose taxes and spending over compact, convex spaces. While p's action space here is simpler, it has the advantage of not centering the analysis on out-of-equilibrium beliefs as Rogoff does by using the framework of Bagwell and Ramey (1988) and Cho and Kreps (1987).

Each pair $(a_t^p, \theta_t) \in A_p \times \Theta$ together with the endowment y, the tax rate τ and the interest payments $(1+r)a_{t-1}^p$, determines the publicly observed amount of public good g_t as follows

$$g_t \equiv g(a_t^p, \theta_t; a_{t-1}^p) = \theta_t \left(\tau y + a_t^p - (1+r)a_{t-1}^p\right).$$

Both the voter and the incumbent politician derive utility from the consumption of the public good. The incumbent, in addition, gets nonpecuniary rents $e(\theta_t) \in \mathbb{R}_+$ from holding office. For simplicity, I assume that v's endowment is fully taxed, i.e. $\tau \equiv 1$. In this case, stage rewards are given by[3]

$$\begin{aligned} u_t^p &\equiv u^p(a_t^p, a_t^v, \theta_t; a_{t-1}^p) = g_t + e(\theta_t) I_{\{a_t^v = k\}}, \\ u_t^v &\equiv u^v(a_t^p, a_t^v, \theta_t; a_{t-1}^p) = g_t, \end{aligned}$$

There are two kinds of histories in this game: private and public. A private history $h_p^t = (a_1^p, \ldots, a_t^p, \theta_1, \ldots, \theta_t) \in H_p^t$ keeps track of the incumbent politician's actions and type. A public history of events, in turn, is a sequence $h^t = (a_1^p, \ldots, a_t^p, g_1, \ldots, g_t) \in H^t$, where $H \equiv \bigcup_t H^t$. Such public histories are used by v to assess the probability of having a productive incumbent in office. That is, v's beliefs regarding p's type are a sequence

$$\mu = \{\mu_t\}_{t=1}^3, \quad \mu_t : H \to \Delta(\Theta), \quad \mu_t = (\pi_t, 1-\pi_t),$$

where $\pi_t(h^{t-1}) = \Pr(\theta_t = \overline{\theta} \,|\, h^{t-1})$ is the posterior probability of facing a productive politician. Since there is a fraction $\rho \in (0,1)$ of productive politicians in P, it follows that $\pi_1 \equiv \rho$.

A strategy for p in this game is a function σ^p specifying the probability of borrowing $\sigma_t^p(h_p^{t-1}, \theta_t) \in [0,1]$ for each t, h_p^{t-1}, θ_t. A strategy for v, instead, is a function σ^v specifying the probability of reelection $\sigma_t^v(h^{t-1}) \in [0,1]$ for each t, h^{t-1}. A profile of strategies $\sigma = (\sigma^p, \sigma^v) \in \Sigma$ induces payoffs

[3] In § 4.2 I discuss the role of τ on the information acquisition decision of the voter.

$$U_\iota(\sigma) = E^{\sigma,\mu} \sum_{t=1}^{3} u_t^\iota, \quad \iota \in \{p, v\},$$

where $E^{\sigma,\mu}$ denotes the expectation operator given the assessment $(\sigma, \mu) \in \Sigma \times \Delta(\Theta)^3$.

The following assumptions are in force throughout the paper[4]

$$\rho > \varepsilon. \tag{1}$$

$$\underline{\theta} > \chi\, \overline{\theta}. \tag{2}$$

Assumption 1 states that it is more likely to pick a productive politician randomly selecting from P than expect a productivity jump by an unproductive politician throughout his tenure. Hence, if types were observable by voters, they would dismiss unproductive incumbents. Assumption 2, in turn, prevents the productivity gap between politicians of different types from being *too* wide. Under this assumption, if the voter confronts an scenario in which he faces a public history possibly caused by an unproductive politician, it may be still sequentially rational for him to respond to such history with a positive probability of reelection.

I begin the study of this game with the following definition that simplifies notation.

Definition 1. *A public history $h^{t-1} \in H$ is revealing if $\pi_t(h^{t-1}) \in \{0, 1\}\, \forall \sigma^p$.*

The first result of the analysis is that there is a unique history $h^2 \in H$ that inhibits v from certainly inferring p's type before the election. That history is precisely a relatively higher public good production right before the election.

[4]The parameter $\chi \in (0, 1)$ is given by

$$\chi \equiv \max\left\{\frac{1+r}{2-\rho}, \frac{(1+r)(1-\varepsilon)(\rho-\varepsilon)}{(2+r)(1-\varepsilon)(\rho-\varepsilon)-\varepsilon(1-\rho)}\right\}.$$

Lemma 1. *Every public history* $h^2 = (a_1^p, g_1, g_2) \neq (0, \underline{\theta}y, \overline{\theta}y)$ *is revealing.*

Proof. Since A_p and Θ are finite, debt has one-period maturity, and $\overline{\theta}$ is an absorbing state, it follows by construction that there is a finite set of histories possibly faced by v at the end of $t = 2$. If v faces $h^2 \in \underline{H} = \{ (0, \underline{\theta}y, \underline{\theta}y) , (b, \overline{\theta}y, \underline{\theta}y - \underline{\theta}(1+r)b) , (b, \overline{\theta}y, \overline{\theta}y - \underline{\theta}(1+r)b) \}$, then $\pi_3(h^2) = 0$, as each g_2 embedded in this set of histories is strictly less than what a $\overline{\theta}$–type would produce. On the other hand, if $h^2 \in \overline{H} = \{ h^2 \in \underline{H}^c : h^2 \neq (0, \underline{\theta}y, \overline{\theta}y) \}$ it follows that $\pi_3(h^2) = 1$ because each second-period public good outcome arising from these histories is infeasible for the $\underline{\theta}$–type. Finally, if $h^2 = (0, \underline{\theta}y, \overline{\theta}y)$, and since $\overline{\theta}y = g(0, \overline{\theta}; 0) = g(b, \underline{\theta}; 0)$, then v cannot distinguish whether this history is the result of a productivity shock according to the Markov process followed by θ_t or the consequence of unobserved borrowing, and therefore, because of Bayesian consistency, any $\sigma_2^p(h^1, \theta_2) > 0$ induces beliefs $\mu_3(h^2)$ that lie in the interior of $\Delta(\Theta)$. □

By Lemma 1 then, we can express the set of public histories possibly faced by the voter before the election as the partition $\overline{H} \bigcup \underline{H} \bigcup \{(0, \underline{\theta}y, \overline{\theta}y) \}$, where $\overline{H}$ corresponds to histories that reveal the presence of a productive incumbent, and histories in $\underline{H}$ reveal an unproductive type in office.

Consider now the following partition of the space of nonpecuniary rents of politicians: $(e(\overline{\theta}), e(\underline{\theta})) \in \mathbb{R}^2_+ = A \bigcup B \bigcup C$, where

$$
\begin{aligned}
A =& \{ (e(\overline{\theta}), e(\underline{\theta})) \in \mathbb{R}^2_+ : e(\overline{\theta}) < \overline{e},\ \varepsilon e(\overline{\theta}) + (1-\varepsilon) e(\underline{\theta}) < \underline{e} \},\\
B =& \{ (e(\overline{\theta}), e(\underline{\theta})) \in \mathbb{R}^2_+ : e(\overline{\theta}) \geq \overline{e}\ \forall\, e(\underline{\theta}) \},\\
C =& \{ (e(\overline{\theta}), e(\underline{\theta})) \in \mathbb{R}^2_+ : e(\overline{\theta}) < \overline{e},\ \varepsilon e(\overline{\theta}) + (1-\varepsilon) e(\underline{\theta}) \geq \underline{e} \},
\end{aligned}
$$

and the thresholds $\underline{e}$, $\overline{e}$ are defined by

$$
\begin{aligned}
\underline{e} &= (\overline{\theta} - \underline{\theta})(y - (1+r)b),\\
\overline{e} &= r\overline{\theta}b - (1-\rho)(\overline{\theta} - \underline{\theta})y.
\end{aligned}
$$

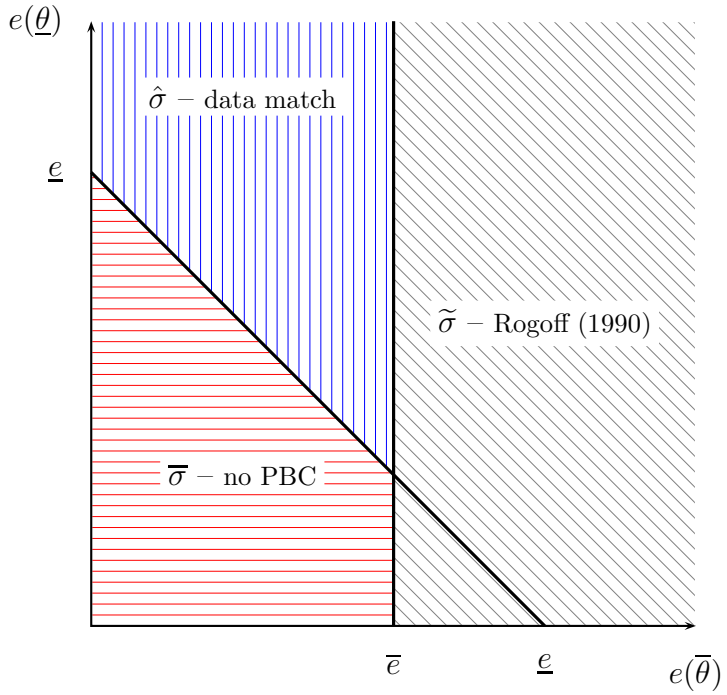
The number $\underline{e}$ reflects the amount of ego rents that makes a $\underline{\theta}$–type indifferent between facing a low production of public goods after being reelected or enjoy a high amount of public goods as a citizen ousted from office; that is $\underline{e} + g(0, \underline{\theta}; b) = g(0, \overline{\theta}; b)$. The number $\overline{e}$ on the other hand, indicates the amount of ego rents that exactly compensate a $\overline{\theta}$–type from the interest payments he would face as a reelected incumbent after election-year borrowing.

One particular area deserves special attention. The set of nonpecuniary rents C reflects that elections are high-stake tests for unproductive politicians only. Its rationale builds from the work of Caselli and Morelli (2004), which puts forward the argument that market and political skills are positively correlated, and then productive politicians may disregard the perks of holding office because they may opt to higher rents in the private sector, a point also illustrated by Besley (2005). Additionally, highly productive politicians may be willing to pursue spells in public office in the first place as a showcase to make their skills publicly known, as Mattozzi and Merlo (2008) point out. This reasoning finds support in the evidence of Diermeier, Keane, and Merlo (2005) who use data of the U.S. Congress and find that reelections increase future market wages of politicians in a substantial manner.

As I describe and prove in propositions 1–4, the thresholds of nonpecuniary rents $\overline{e}$ and $\underline{e}$—and the corresponding partition (A, B, C)—give rise to different equilibrium outcomes: one that features no PBCs, one that captures Rogoff's (1990) equilibrium, and finally an equilibrium based on rents belonging to C that matches of evidence described in § 1. These equilibria are shown in Figure 1.

The strategy profile $\overline{\sigma}$ corresponds to a sequential equilibrium of Γ where no politician ever borrows, because nonpecuniary rents in the set A are not enough to compensate incumbents for interest payments in the case of the $\overline{\theta}$–type, or lower future public goods in the case of the $\underline{\theta}$–type.

Figure 1: Equilibrium strategies as a function of rents



Proposition 1. *If* $(e(\overline{\theta}), e(\underline{\theta})) \in A$*, then* $\overline{\sigma}$ *is the unique sequential equilibrium of* Γ*, where*

$$\overline{\sigma}_t^p(h_p^{t-1}, \theta_t) = 0 \quad \forall\, t,\, h_p^{t-1},\, \theta_t.$$

$$\overline{\sigma}_3^v(h^2) = \begin{cases} 0 & \text{if } h^2 \in \underline{H}, \\ 1 & \text{if } h^2 \in \overline{H} \bigcup \{(0, \underline{\theta} y, \overline{\theta} y)\}. \end{cases}$$

Proof. Consider v's strategy. Under Assumption 1, it is optimal for v to fire the incumbent after observing public histories $h^2 \in \underline{H}$ and reelect in the case that $h^2 \in \overline{H}$. Since the incumbent will never borrow under $\overline{\sigma}^p$, v is sure to be facing a $\overline{\theta}$–type if observes $h^2 = (0, \underline{\theta} y, \overline{\theta} y)$. Thus, $\overline{\sigma}^v$ is optimal. On the other hand, since $(e(\overline{\theta}), e(\underline{\theta})) \in A$ it is never profitable for the incumbent to borrow before the election, regardless of his type. In effect, in the case of the $\overline{\theta}$–type, since $\overline{\sigma}^v$ awards reelection after $h^2 \in \overline{H} \bigcup \{(0, \underline{\theta} y, \overline{\theta} y)\}$, productive incumbents may avoid interest payments and still be reelected with probability one.

In the case of the $\underline{\theta}$–type, if he borrows he gets for sure ego rents $\varepsilon e(\overline{\theta}) + (1-\varepsilon)e(\underline{\theta})$, but since he also faces interest payments and $(e(\overline{\theta}), e(\underline{\theta})) \in A$, it follows that $a_2^p = b$ is strictly dominated by zero borrowing. The optimality of no borrowing in the first period follows from the same logic as in $t = 2$ for the both types.

Concerning uniqueness, suppose there is another equilibrium $\overline{\sigma}'$. In the case of the voter, under Assumption 1, $\overline{\sigma}_3^v{}'(h^2) = \overline{\sigma}_3^v(h^2)\ \forall\, h^2 \in \underline{H} \bigcup \overline{H}$. If $h^2 = (0, \underline{\theta}y, \overline{\theta}y)$, then—under $(e(\overline{\theta}), e(\underline{\theta})) \in A$—there is no optimal strategy $\overline{\sigma}^{p\,\prime}$ specifying a positive probability of borrowing, and then it is also the case that $\overline{\sigma}_3^v{}'(h^2) = \overline{\sigma}_3^v(h^2)$ for $h^2 = (0, \underline{\theta}y, \overline{\theta}y)$. Suppose finally that $\overline{\sigma}^{p\,\prime} \neq \overline{\sigma}^p$. This implies that borrowing is optimal for some type under some history of events, but then it must be the case that ego rents compensate an incumbent after election-year borrowing, which contradicts the fact that $(e(\overline{\theta}), e(\underline{\theta})) \in A$. Hence $\overline{\sigma}' = \overline{\sigma}$. □

The strategy profile $\widetilde{\sigma}$ in Figure 1 captures the essence of Rogoff's (1990) equilibrium. In this case, the $\overline{\theta}$–type increases election-year spending to separate himself from the unproductive type. As the $\underline{\theta}$–type foresees separation, he decides not to borrow and so avoid interest payments after being fired. This equilibrium is sustained by the decision of the voter of conceding reelection only to histories in $\overline{H}$, which encourages the $\overline{\theta}$–type to borrow and is consistent with the fact that such type gets sufficient ego rents to make up for interest payments after reelection.

Proposition 2. *If* $(e(\overline{\theta}), e(\underline{\theta})) \in B$ *then* $\widetilde{\sigma}$ *is the unique sequential equilibrium of* Γ*, where*

$$\widetilde{\sigma}_t^p(h_p^{t-1}, \theta_t) = \begin{cases} 0 & \text{if } t = 1 \ \forall \, \theta_1, \\ 0 & \text{if } \theta_2 = \underline{\theta}, h_p^1 = (a_1^p, \underline{\theta}) \ \forall \, a_1^p, \\ 0 & \text{if } \theta_2 = \overline{\theta}, h_p^1 = (a_1^p, \overline{\theta}) \ \forall \, a_1^p, \\ 1 & \text{if } \theta_2 = \overline{\theta}, h_p^1 = (a_1^p, \underline{\theta}) \ \forall \, a_1^p. \end{cases}$$

$$\widetilde{\sigma}_3^v(h^2) = \begin{cases} 0 & \text{if } h^2 \in \underline{H} \bigcup \{(0, \underline{\theta}y, \overline{\theta}y)\}, \\ 1 & \text{if } h^2 \in \overline{H}. \end{cases}$$

Proof. Consider v's strategy. Since $\overline{\theta}$ is absorbing, it is optimal for v to reelect incumbents after public histories $h^2 \in \overline{H}$. Under Assumption 1, instead, it is optimal for v to fire incumbents when observing $h^2 \in \underline{H}$. Now consider $h^2 = (0, \underline{\theta}y, \overline{\theta}y)$. Such history is feasible for any type, but under $\widetilde{\sigma}^p$ it can be only the result of an unproductive incumbent. In this case, v's action prescribed by $\widetilde{\sigma}^v$, $a_3^v = f$, is optimal.

Now consider p's strategy. In the first period no incumbent is willing to borrow: if $\theta_1 = \overline{\theta}$, then no extra borrowing is necessary for such incumbent to reveal his type, and if $\theta_1 = \underline{\theta}$, then such politician prefers not to face interest payments because he will be ousted from office anyways. If $h_p^1 = (a_1^p, \underline{\theta})$ and $\theta_2 = \overline{\theta}$, then p's expected utility is given by

$$E^{\widetilde{\sigma}} \sum_{t=2}^{3} u_t^p = \begin{cases} \overline{\theta}y + (\rho\overline{\theta} + (1-\rho)\underline{\theta})y & \text{if } a_2^p = 0, \\ \overline{\theta}(y+b) + \overline{\theta}(y - (1+r)b) + e(\overline{\theta}) & \text{if } a_2^p = b. \end{cases}$$

Since $e(\overline{\theta}) \geq \overline{e}$ it follows that $\widetilde{\sigma}_2^p(h_p^1, \overline{\theta}) = 1$ is optimal. If $\theta_2 = \underline{\theta}$ after $h_p^1 = (a_1^p, \underline{\theta})$, since $\widetilde{\sigma}^v(h^2) = 0$ after $h^2 = (0, \underline{\theta}y, \overline{\theta}y)$, if follows that it is optimal for p not to borrow as $\widetilde{\sigma}^p$ indicates. Finally, since a productive-born type automatically generates public histories $h^2 \in \overline{H}$, it is optimal for him to set $a_1^p = 0$. Uniqueness follows from the same steps in Proposition 1 under $(e(\overline{\theta}), e(\underline{\theta})) \in B$. □

Now, consider the strategy profile $\hat{\sigma} = (\hat{\sigma}^p, \hat{\sigma}^v)$, defined as follows

$$\hat{\sigma}_t^p(h_p^{t-1}, \theta_t) = \begin{cases} 0 & \text{if } t = 1 \,\forall\, \theta_1, \\ 0 & \text{if } \theta_2 = \overline{\theta} \,\forall\, h_p^1, \\ 0 & \text{if } \theta_2 = \underline{\theta}, h_p^1 = (b, \underline{\theta}), \\ \hat{\lambda}_p & \text{if } \theta_2 = \underline{\theta}, h_p^1 = (0, \overline{\theta}). \end{cases}$$

$$\hat{\sigma}_3^v(h^2) = \begin{cases} 0 & \text{if } h^2 \in \underline{H}, \\ 1 & \text{if } h^2 \in \overline{H}, \\ \hat{\lambda}_v & \text{if } h^2 = (0, \underline{\theta}y, \overline{\theta}y), \end{cases}$$

where

$$\hat{\lambda}_p = \frac{\varepsilon(1-\rho)y}{(1-\varepsilon)(\rho-\varepsilon)(y-R)} \in (0,1), \tag{3}$$

$$\hat{\lambda}_v = \frac{(\,\rho\overline{\theta} + (1-\rho)\underline{\theta}\,)R - (\overline{\theta} - \underline{\theta})y}{(1-\varepsilon)X - (\overline{\theta} - \underline{\theta})(\rho-\varepsilon)(y-R)} \in (0,1). \tag{4}$$

This strategy profile establishes one the one hand that productive politicians never borrow, and the other that all of those unproductive-born incumbents that keep their type borrow right before elections. In other words, $\hat{\sigma}^p$ induces a political budget cycle that is exclusively generated by unproductive politicians. In the case of the voter, $\hat{\sigma}^v$ calls for re-election of productive incumbents in the event in which v may infer types, that is, in the case in which $h^2 \in \underline{H} \bigcup \overline{H}$. If the voter, however, faces the non-revealing public history $h^2 = (0, \underline{\theta}y, \overline{\theta}y)$, then $\hat{\sigma}^v$ prescribes randomization at the polls. As the following result shows, if the possibility that an unproductive politician becomes productive is sufficiently unlikely, then the strategy profile $\hat{\sigma}$ actually corresponds to equilibrium behavior.

Proposition 3. *If* $(e(\overline{\theta}), e(\underline{\theta})) \in C$ *then* $\exists\, \overline{\varepsilon} > 0 : \ \forall\, \varepsilon \in (0, \overline{\varepsilon}),\ (\hat{\sigma}, \hat{\mu})$ *is a sequential equilibrium of* Γ.

Proof. Consider first v's strategy. If $h^2 \in \underline{H}$, Lemma 1 implies $\hat{\pi}_3(h^2) = \Pr(\theta_2 = \overline{\theta} \,|\, h^2) = 0$, and then Assumption 1 entails that it is optimal for v playing the pure strategy $a_3^v = f$, because it is more likely to select a $\overline{\theta}$–type from a new draw than expect a productivity switch of the incumbent. If $h^2 \in \overline{H}$, then $\hat{\pi}_3(h^3) = 1$, and since $\overline{\theta}$ is an absorbing state, it follows that setting $a_3^v = k$ is the best response by v. When v faces the unique non-revealing history $h^2 = (0, \underline{\theta}y, \overline{\theta}y)$, his expected utility is

$$E^{\hat{\sigma},\hat{\mu}} u_3^v = \begin{cases} \hat{\pi}_3 \overline{\theta} y + (1 - \hat{\pi}_3) E_\varepsilon \theta (y - (1+r)b) & \text{if } a_3^v = k, \\ \hat{\pi}_3 E_\rho \theta y + (1 - \hat{\pi}_3) E_\rho \theta (y - (1+r)b) & \text{if } a_3^v = f, \end{cases} \tag{5}$$

where $E_j \theta \equiv j\overline{\theta} + (1-j)\underline{\theta}$, $j = \rho\,, \varepsilon$. Bayesian consistency of beliefs $\hat{\mu}_3(h^2) = (\hat{\pi}_3, 1 - \hat{\pi}_3) \in \Delta(\Theta)$ requires

$$\hat{\pi}_3 = \frac{\varepsilon}{\varepsilon + (1-\varepsilon)\hat{\lambda}_p},$$

and then, given (3), v ends up indifferent between keeping or firing the incumbent, and therefore randomization is a sequentially rational move after h^2. Hence, given $\hat{\mu}$, $\hat{\sigma}^v$ is optimal.

On p's side, if $\theta_t = \overline{\theta}$, it follows that borrowing in any period is a strictly dominated strategy. In effect, given that $\overline{\theta}$ is an absorbing state, $e(\overline{\theta}) = 0$, and $r > 0$, each time the $\overline{\theta}$–type borrows his payoff is reduced by $rb > 0$, and therefore $\hat{\sigma}_t^p(h_p^{t-1}, \overline{\theta}) = 0$ is a best response, regardless of the evolution of the game. If $\theta_1 = \underline{\theta}$, $\hat{\sigma}^p$ calls for $a_1^p = 0$. If p deviates nonetheless, according to Lemma 1, he generates revealing histories that will drive him with probability one to be either fired or reelected, depending on his second-period type. The value of the deviation

$a_1^p = b$ by the $\underline{\theta}$–type is then[5]

$$\Delta(\varepsilon) \equiv \Lambda(\overline{\theta} - \underline{\theta}) - \left\{ \left(\varepsilon\overline{\theta} + (1-\varepsilon)\underline{\theta}\right)(1+r)b + (1-\varepsilon)^2 \hat{\lambda}_v X \right\}.$$

The first term on the RHS represents the expected benefit of the deviation, while the term in curly brackets represents its expected cost. Since $\varepsilon e(\overline{\theta}) + (1-\varepsilon)e(\underline{\theta}) > \underline{e}$, it follows from Assumption (2) that $\lim_{\varepsilon \to 0} \Delta(\varepsilon) < 0$, and since $\Delta : (0,1) \to \mathbb{R}$ is a continuous function, then there exists a neighborhood $N_{\overline{\varepsilon}}(0)$ such that $\Delta(\varepsilon) < 0$ for each $\varepsilon \in (0, \overline{\varepsilon})$. Roughly speaking, since the $\underline{\theta}$–type at $t = 1$ foresees that it is very likely that he will keep his type during the next term, and that he does not lose to much g if reelected ($\underline{\theta} > \chi\,\overline{\theta}$), then his best response is borrowing just before the election to try to get the political rent X. In the event, however, in which a $\underline{\theta}$–type borrows in the first period and does not change his type, his best response at $t = 2$ is not borrowing, because under Lemma 1 he will be dismissed, and in such contingency he prefers to avoid interest payments at $t = 3$.

Finally, if a $\underline{\theta}$–type followed $\hat{\sigma}^p$ in the first period and also keeps his type for the second period, then—given (4)—p is indifferent between borrowing or not, and thus willing to randomize during $t = 2$. Hence $\hat{\sigma}^p$ is optimal and consequently $(\hat{\sigma}, \hat{\mu})$ is a sequential equilibrium. □

Proposition 4. *For $(e(\overline{\theta}), e(\underline{\theta})) \in C$ and $\varepsilon \in (0, \overline{\varepsilon})$, $(\hat{\sigma}, \hat{\mu})$ is unique.*

Proof. Suppose there is another sequential equilibrium $(\sigma, \mu) \in \Sigma \times \Delta(\Theta)^3$. Consider σ^v first. By Lemma 1, if $h^2 \in \underline{H} \bigcup \overline{H}$, then v plays pure strategies because he knows which θ_2–type is actually facing. If $h^2 \in \underline{H}$, then Assumption 1 implies $\sigma_3^v(h^2) = 0$, and if $h^2 \in \overline{H}$, then $\sigma_3^v(h^2) = 1$, because $\overline{\theta}$ is absorbing.

Now assume that v faces $h^2 = (0, \underline{\theta}y, \overline{\theta}y)$ instead. Suppose that $\sigma_3^v(h^2)$ calls for the pure

[5] Where

$$\Lambda \equiv \left\{ y + \varepsilon(1-\hat{\lambda}_v)(1-\rho)y + (1-\varepsilon)\hat{\lambda}_v(\rho-\varepsilon)(y - \hat{\lambda}_p(1+r)b) + (1-\varepsilon)\hat{\lambda}_p(E_\rho\theta(1+r) - \underline{\theta})\frac{y}{\underline{\theta}} \right\}.$$

strategy $a_3^v = f$. In this case, a $\underline{\theta}$–type would prefer not borrow so as to avoid interest payments when thrown out of office. Therefore, $h^2 = (0, \underline{\theta}y, \overline{\theta}y)$ would be the result of a productivity shock, and then, since v would be facing unequivocally a $\overline{\theta}$–type, $a_3^v = f$ is not optimal. If $\sigma_3^v(h^2)$ requires $a_3^v = k$ instead, then—since $\varepsilon e(\overline{\theta}) + (1-\varepsilon)e(\underline{\theta}) \geq \underline{e}$—a productive type plays $a_2^p = b$ with probability one. Hence, according to Bayes' rule, the probability that v faces a $\overline{\theta}$–type—given that a $\overline{\theta}$-type does not borrow—is $\pi_3(h^2) = \varepsilon$. Under this beliefs, and $(e(\overline{\theta}), e(\underline{\theta})) \in C$, the optimal strategy for v is $a_3^v = f$. As a result σ^v must involve a mixed strategy, but then v must be indifferent between keeping or firing p, and the only way this happens is when $\sigma_2^p((0, \underline{\theta}y), \underline{\theta})$ equals $\hat{\lambda}_p$.

On p's side, if $\theta_t = \overline{\theta}$, then σ^p must specify no borrowing for each t, as it is the case of $\hat{\sigma}^p$, because $r > 0$, $\overline{\theta}$ absorbing, and $e(\overline{\theta}) = 0$, imply that each loan cuts p's payoff by $rb > 0$.

If a $\underline{\theta}$–type borrows in the first period then he induces revealing histories that trigger pure-strategy responses by v, which in turn will induce no borrowing in the second period by p, regardless of his type. Since $\sigma_2^p((0, \underline{\theta}y), \underline{\theta}) = \hat{\lambda}_p$, it follows that p's expected gain of playing $a_1^p = b$ instead of $a_1^p = 0$ is given by $\Delta(\epsilon)$, possibly for a different $\hat{\lambda}_v$. But even if the probability of reelection is different, (2) implies $\Delta(\overline{\varepsilon}) < 0$, so $a_1^p = b$ is not optimal.

Finally, suppose σ^p calls for the pure strategy $a_2^p = b$ for a $\underline{\theta}$–type. After the history $h^1 = (0, \underline{\theta}y)$, the strategy $\sigma_2^p(h^1, \underline{\theta}) = 1$ induces beliefs $\pi_3(h^1, \overline{\theta}y) = \varepsilon$, that in turn force v to play the pure strategy $a_3^v = f$, which thereby breaks the optimality of setting $a_2^p = b$ with probability one. On the contrary, if $\sigma_2^p(h^1, \underline{\theta}) = 0$, then Bayes' rule implies $\pi_3(h^1, \overline{\theta}y) = 1$, and therefore v plays the pure strategy $a_3^v = k$, but this move again contradicts the optimality of the pure strategy $a_2^p = 0$. Consequently, $\sigma_2^p(h^1, \underline{\theta})$ must comprise a mixed strategy, which is only the case when p is indifferent, and that occurs exclusively when $\sigma_2^p(h^1, \underline{\theta}) = \hat{\lambda}_v$. In sum, $(\sigma, \mu) = (\hat{\sigma}, \hat{\mu})$. □

3.1 Multiple Elections

As it is hitherto formulated, the game Γ depicts a one-shot election, but it can be equivalently considered as a single piece from an infinite-horizon endowment economy with elections every other period, where there is a term limit on incumbent reelection. Hence, every time that a fresh incumbent jumps into office the game Γ ensues.

Consider the evidence that could be generated by the sequential equilibrium profile $\hat{\sigma}$. There are three possible combinations of types before an election, and each of those give rise to different equilibrium actions specified by $\hat{\sigma}$. In the case of permanently unproductive incumbents $(\theta_1, \theta_2) = (\underline{\theta}, \underline{\theta})$—which sum $(1-\rho)(1-\varepsilon)$—they increase spending with probability $\hat{\lambda}_p$ before the election, say from 1 to 2, and this generates an amount of public goods $(g_1, g_2) = (\underline{g}, \overline{g})$, where $\overline{g}$ denotes a high amount of public goods. In Table 1 I show spending, output and probability of reelections generated by the equilibrium $\hat{\sigma}$.

Table 1: Empirical evidence induced by $\hat{\sigma}$.

Types	Quantity	Spending	Output	Prob. re-election
$(\underline{\theta}, \underline{\theta})$	$(1-\rho)(1-\varepsilon)$	$\hat{\lambda}_p$: (1,2)	$(\underline{g}, \overline{g})$	$\hat{\lambda}_v$
		$(1-\hat{\lambda}_p)$: (1,1)	$(\underline{g}, \underline{g})$	0
$(\underline{\theta}, \overline{\theta})$	$(1-\rho)\varepsilon$	(1,1)	$(\underline{g}, \overline{g})$	$\hat{\lambda}_v$
$(\overline{\theta}, \overline{\theta})$	ρ	(1,1)	$(\overline{g}, \overline{g})$	1

If an econometrician observes data from Table 1 and runs a probit regression between reelections and government spending, he would obtain that the probability of reelection for incumbents conditional on flat spending, that is, without political budget cycles, is given by

$$\Pr(\text{ re-election } \mid \text{ spending (1,1) }) = \frac{\hat{\lambda}_v(1-\rho)\varepsilon + \rho}{(1-\rho)(1-\varepsilon)(1-\hat{\lambda}_p) + (1-\rho)\varepsilon + \rho}. \tag{6}$$

In the following table I show that for parameter values satisfying Assumptions 1–2 and rents $(e(\overline{\theta}), e(\underline{\theta})) \in C$, the equilibrium $\hat{\sigma}$ matches fact (*iii*) in § 1, i.e. an incumbent that generates a political budget cycle may face the same probability of reelection as if spending had been flat. This is a result for developing countries because—as § 4 will show—I am still implicitly assuming that additional information regarding incumbents is unaffordable for the voter, a fact that is associated with developing countries.

The intuition behind the result in Table 2 lies in the different information sets between the voter and the econometrician. Suppose that there was a low amount of public good in $t = 1$. Now, when the voter attends the polls, he merely knows the current amount of public goods g_2. If before the election there is a higher amount of public goods, the voter does not know whether spending increased—i.e. a PBC occured—or there was a productivity improvement, and thus randomizes according to (4). This is not the case for econometrician, who is capable of incorporating information regarding spending in his regressions and therefore automatically spots election-year extra spending to calculate (6).

Table 2: Calibration.

Parameters	$\overline{\theta}$	$\underline{\theta}$	ε	ρ	y	τ	r
	1	0.7	0.15	0.4	1.15	1	0.1
Results	Pr(re-election | spending (1,1)) $=$ $\hat{\lambda}_v = 0.79$						

4 Information Acquisition

The main thrust of the evidence uncovered by Brender and Drazen (2005, 2008) and Shi and Svensson (2006) is that political budget cycles do not occur evenly across countries. In particular, Shi and Svensson (2006) and Brender and Drazen (2008) draw a complimentary picture: on the one hand Shi and Svensson (2006) argue that political budget cycles belong mostly to developing countries, and on the other Brender and Drazen (2008) shows that the probability of reelection for an incumbent of a less developed country is not affected by PBCs; it is in developed countries where incumbents are punished at the polls if they increase fiscal deficits in election years.

This evidence is at odds with voter's response of Rogoff's equilibrium. In effect, if the random part of voter's utility in such formulation is left aside, then the political budget cycle is accompanied by assured reelection for the incumbent, but this fact is not supported by the data (Brender and Drazen (2008)). The evidence does suggest, in turn, that as countries get richer they tend to monitor more closely the performance of incumbents. This vision is also embraced by the experimental evidence summarized by Pande (2011), which shows that poor-country voters struggle to select able incumbents because they cannot afford information. Furthermore, when they are exogenously endowed with the relevant information they, for instance, remove corrupt incumbents from office.

4.1 Exogenous Signals

From now on I assume that $(e(\overline{\theta}), e(\underline{\theta})) \in C$. Building from all of these insights and from the work of Persico (2000); Martinelli (2006) and Amir and Lazzati (2011), I modify the game of the previous section by giving v the possibility of getting partially informed regarding p's hidden action, so as to investigate the fate of the political budget cycle and voter's equilibrium behavior as more information is accessed.

Suppose that after the history $h^1 = (0, \underline{\theta}y)$—i.e. a public record of low first-period public good—player v has the option of buying a signal that conveys information about p's second-period action at some cost. Since a_2^p is privately known, v appraises p's action as a random variable $\widetilde{a} \in A_p$. Let the signal s be a A_p-valued random variable and, as in Martinelli (2006), assume

$$\Pr(s(\eta) = \omega \,|\, \widetilde{a} = \omega) = \frac{1}{2} + \eta, \quad \omega \in A_p,\, \eta \in [0, 0.5]\,.$$

In other words, the signal s is right with probability $0.5 + \eta$, and hence the parameter η determines the precision of $s(\eta)$. The cost of such accuracy is given by a linear function $C : [0, \frac{1}{2}] \to \mathbb{R}_+$, where $C(0) = 0$.

In this modified environment thus, the history $h^1 = (0, \underline{\theta}y)$ induces a subgame where player v must decide the precision of the signal $s(\eta)$ before making his choice $a_3^v \in \{k, f\}$, and consequently player p must take into account such choice of η when deciding his own action a_2^p.

For example, in the extreme case in which hidden borrowing is perfectly detected by the signal, player p prefers not borrow before the election so as to avoid interest payments under a certain dismissal arising from Assumption 1.

Suppose first that v is publicly and exogenously endowed with $\eta \in (0, \frac{1}{2})$. Then, in the subgame after $h^1 = (0, \underline{\theta}y)$ and after observing $s(\eta) \in \{0, b\}$, a strategy for v is a probability of reelection $\phi^v : \{0, b\} \to [0, 1]$, and a strategy for p is a probability of borrowing $\phi^p(\eta, \cdot\,) : \Theta \to [0, 1]$. Consider the strategy profile $\phi = (\phi^p, \phi^v) \in \Phi$, defined by

$$\phi^p(\eta, \theta_2) = \begin{cases} 0 & \text{if } \theta_2 = \overline{\theta}, \\ \lambda_p(\eta) & \text{if } \theta_2 = \underline{\theta}. \end{cases}$$

$$\phi^v(s(\eta)) = \begin{cases} 0 & \text{if } s(\eta) = b, \\ \lambda_v(\eta) & \text{if } s(\eta) = 0, \end{cases}$$

where $\lambda_p(\eta)\,, \lambda_v(\eta) \in (0,1)$ are given by

$$\lambda_p(\eta) = \frac{(\frac{1}{2}+\eta)(1-\rho)y}{(1-\varepsilon)\left(\,(\frac{1}{2}+\eta)(1-\rho)y + (\frac{1}{2}+\eta)(\rho-\varepsilon)(y-(1+r)b)\,\right)}, \tag{7}$$

$$\lambda_v(\eta) = \frac{E_\rho\theta y - (\overline{\theta}-\underline{\theta})y}{(\frac{1}{2}-\eta)(E_\varepsilon\theta(y-(1+r)b) + \varepsilon e(\overline{\theta}) + (1-\varepsilon)e(\underline{\theta}))}. \tag{8}$$

The strategy profile ϕ resembles its no-information counterpart of Proposition 3. Now an unproductive incumbent still attempts to generate a budget cycle, but voter behavior is slightly different: v randomizes only if the signal he gets indicates that p is not borrowing. As the following result shows, the profile ϕ conforms to equilibrium behavior and more importantly, there is a threshold of quality of information such that after that point voter's monitoring over the incumbent is sufficiently tight to deter any election-year spending, which causes the elimination of PBCs.

Proposition 5. $\exists\ \overline{\eta} < \frac{1}{2}:$ *for each* $\eta \in (0,\overline{\eta})$, ϕ *is a Bayesian equilibrium of the subgame after* $h^1 = (0, \underline{\theta}y)$.

Proof. Consider p's strategy. As in the case of no information acquisition by v, the optimal strategy of a $\overline{\theta}$–type is $a_2^p = 0$ because his payoff is certainly reduced by $rb > 0$ each time he borrows. In the case of the $\underline{\theta}$–type, however, his expected utility of borrowing is given by

$$E^{\phi,s}\sum_{t=2}^{3} u_t^p \;=\; \overline{\theta}y + \left(\frac{1}{2}-\eta\right)\lambda_v(\eta)\left(\,E_\varepsilon\theta(y-(1+r)b) + e(\overline{\theta}) + (1-\varepsilon)e(\underline{\theta})\,\right),$$

while if $a_2^p = 0$, p gets $\underline{\theta}y + E_\rho\theta y$. When v randomizes with probability $\lambda_v(\eta)$ after observing $s(\eta) = 0$, then p is indifferent and prone to randomize as ϕ^p describes. This only works for a maximal amount $\overline{\eta}$, after which the expected utility of borrowing is strictly lower than setting $a_2^p = 0$.

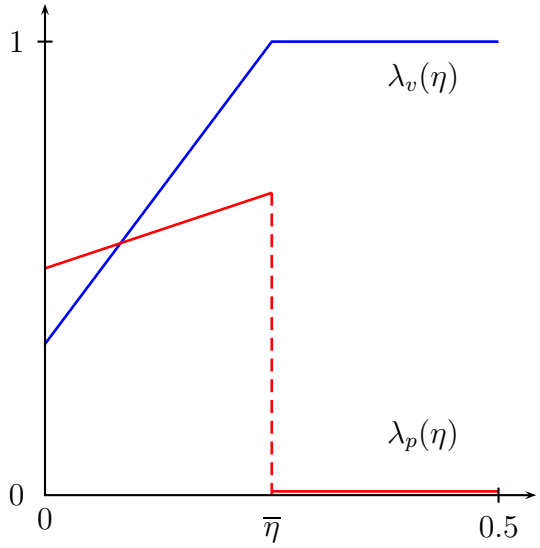
Now consider ϕ^v, and suppose first that $s(\eta) = 0$. In this case, v's posterior beliefs are given by

$$\Pr(\widetilde{a} = 0|s(\eta) = 0) = \frac{(\frac{1}{2} + \eta)\,(\,\varepsilon + (1-\varepsilon)(1-\lambda_p(\eta))\,)}{(\frac{1}{2} + \eta)\,(\,\varepsilon + (1-\varepsilon)(1-\lambda_p(\eta))\,) + (\frac{1}{2} - \eta)(1-\varepsilon)\lambda_p(\eta)}.$$

From equation (5), v is indifferent if $\Pr(\widetilde{a} = 0|s(\eta) = 0)(1-\rho)y = \Pr(\widetilde{a} = b|s(\eta) = 0)(\rho - \varepsilon)(y - R)$, and this is actually the case when p borrows with probability $\lambda_p(\eta)$. Therefore randomization after $s(\eta) = 0$ is optimal for v. On the other hand, if $s(\eta) = b$, then $v's$ posterior beliefs make $a^v = k$ a strictly dominated strategy for each signal quality, and thus it is optimal for v to fire p with probability one, as ϕ^v describes. The uniqueness of ϕ follows from the proof of Proposition 4. □

Figure 2 shows the probabilities of borrowing by the $\underline{\theta}$–type and the probability of re-election after $s(\eta) = 0$. When the voter is endowed with a quality of information $\eta \geq \overline{\eta}$, the unproductive politician is deterred from borrowing and thus any increase in election-year public goods arise from productivity shows. In this case political budget cycles no longer surge in equilibrium.

Figure 2: Equilibrium profiles as a function of η.



By Lemma 1, the history $h^1 = (0, \underline{\theta}y)$ is the only contingency of the game Γ in which v would use $s(\eta)$. If we incorporate the presence of the—still exogenously given—signal into the strategy profile σ of Proposition 3, we may define $\varphi = (\varphi^p, \varphi^v) \in \Sigma$, where

$$\varphi_t^p(\eta, h_p^{t-1}, \theta_t) = \begin{cases} 0 & \text{if } \theta_t = \overline{\theta}\,\forall\, t, h_p^{t-1} \text{ or } \theta_1 = \underline{\theta}, \\ 0 & \text{if } (h_p^1, \theta_2) = (\,(b, \underline{\theta})\,, \underline{\theta}), \\ \lambda_p(\eta) & \text{if } (h_p^1, \theta_2) = (\,(0, \underline{\theta})\,, \underline{\theta}). \end{cases}$$

$$\varphi_3^v(s(\eta), h^2) = \begin{cases} 0 & \text{if } h^2 \in \underline{H},\, \forall\, s(\eta) \\ 1 & \text{if } h^2 \in \overline{H},\, \forall\, s(\eta) \\ 0 & \text{if } h^2 = (0, \underline{\theta}y, \overline{\theta}y) \text{ and } s(\eta) = b, \\ \lambda_v(\eta) & \text{if } h^2 = (0, \underline{\theta}y, \overline{\theta}y) \text{ and } s(\eta) = 0. \end{cases}$$

The difference between σ and φ lies in $\lambda_\iota(\eta),\ \iota \in \{p, v\}$, and in the use of information by v and its corresponding effect on p's action. Denote $\Gamma(\eta)$ the game where v is endowed with a signal of precision η. The following result shows that a political budget cycle is still an equilibrium outcome even in the presence of informed voters.

Proposition 6. *For each $\eta \in (0, \overline{\eta})$, φ is the unique sequential equilibrium of $\Gamma(\eta)$.*

Proof. The result follows from Propositions 3–5. □

4.2 Endogenous Information

Until now it has been assumed that v is endowed with $s(\eta)$. The exercise, therefore, has been the theoretical counterpart of the studies for developing countries summarized by Pande (2011), where voters are exogenously provided with information regarding politicians' record and where it is also documented that better choices easily follow from higher η.

Since the book of Downs (1957)—and the more recent results of Martinelli (2006)—however, it has been established that non-pivotal voters optimally decide gather no information if they must pay for it. Even if the value of information is positive, once voters take into account the chance of affecting election outcome, they prefer not to buy info at all, or an arbitrarily small amount in the case that garbled info is freely available (Martinelli (2006)).

Building from the work of Harsanyi (1980, 1992), the analysis by Feddersen and Sandroni (2006a,b) shows that a fraction of non-pivotal voters still optimally pay for information out of a sense of civic duty. While in the two-player game $\Gamma(\eta)$ the voter is pivotal by construction, a positive demand for information is still the case even if $v \in [0,1]$ when the *ethical* motive is introduced.

Suppose v must decide the quality of the signal to use after $h^1 = (0, \underline{\theta} y)$. The expected benefit for the voter from buying a signal with precision $\eta \in (0, \frac{1}{2})$ is given by

$$\Pi(\eta;\tau) = \sum_{\omega \in A_p} \sum_{\widetilde{a} \in A_p} \left(g(0,\theta_3;\widetilde{a},\tau) I_{\{a_v^*\}} \Pr(\widetilde{a}|s(\eta)) \Pr(s(\eta)=\omega) \right),$$

where $\Pr(s(\eta))$ is the prior probability of gazing $s(\eta) = \omega$, $\Pr(\widetilde{a}|s(\eta))$ represents posterior beliefs after each value of $s(\eta) = 0$, and a_v^* represents optimal action for the voter in each contingency. This whole expression depends on τ: the higher the tax rate, the higher the difference of the public good outcomes between different types of incumbents.

The amount of information endogenously determined by v therefore, is the solution to the following program

$$\eta(y) \in \arg\max_{\eta \in [0,\frac{1}{2}]} \Pi(\eta;\tau) - C(\eta).$$

Proposition 7. *$\eta(y)$ is monotone increasing.*

Proof. Since $\Pi : \left(0, \frac{1}{2}\right) \times [0,1] \to \mathbb{R}$ is twice continuously differentiable, by theorem 4 and 6 of Milgrom and Shannon (1994), we just need to check whether Π has increasing differences

in $(\eta;\tau)$. In effect, since $\partial\lambda_p(\eta)/\partial y = 0$, it follows that

$$\frac{\partial^2\Pi(\eta;y)}{\partial\eta\partial y} = (\overline{\theta} - E_\varepsilon\theta(1-R'))\Big(q'(\eta)(\widehat{\pi}(\eta) - \widetilde{\pi}(\eta)) + q(\eta)\widehat{\pi}'(\eta)\Big),$$

where $q'(\eta)$ represents the prior probability of gazing $s(\eta) = 0$, $\widehat{\pi} = \Pr(\widetilde{a} = 0|s(\eta) = 0)$, and $\widetilde{\pi} = \Pr(\widetilde{a} = 0|s(\eta) = b)$. By Assumption (2), $1 - R' > 0$, and since $\varepsilon \in (0, \overline{\varepsilon})$, it follows that $\widehat{\pi}(\eta) > \widetilde{\pi}(\eta)$, and thus Π has increasing differences. The result follows from the monotonicity theorem in Milgrom and Shannon (1994). □

Propositions 6 and 7 establish that sufficiently rich economies are eventually free of political budget cycles, because voters are allowed to get arbitrarily well informed regarding incumbent performance. The map of this result into actual economies, however, is more subtle. Suppose that $\tau < 1$, so v derives utility from $c = (1-\tau)y - C(\eta)$ units of the consumption good. Since the after-election g is a random variable, it follows from Persico (2000) that the higher the share of the public good in the consumption bundle, the better informed that v gets, because they have more resources at stake.

The evidence of Persson and Tabellini (2003) shows that government spending is higher in economies that are both richer and with a higher fraction of population over 65 years. Since the latter fact is also positively related with income, the evidence, in sum, shows that richer countries have higher g, and then voters of those countries invest more resources in monitoring incumbents.

4.3 Data Match

As in § 3.1, we can obtain the predictions of $\Gamma(\eta)$ regarding spending, output and probability of reelections generated by the equilibrium φ. These data are shown in Table 3.

Table 3: Evidence from the model.

Signal	Type	Spending		Prob. re-election
$\eta \leq \overline{\eta}$	$(\underline{\theta}, \underline{\theta})$	$\lambda_p(\eta)$:	(1,2)	$\left(\frac{1}{2} - \eta\right) \lambda_v(\eta)$
		$1 - \lambda_p(\eta)$:	(1,1)	0
	$(\underline{\theta}, \overline{\theta})$		(1,1)	$\left(\frac{1}{2} + \eta\right) \lambda_v(\eta)$
	$(\overline{\theta}, \overline{\theta})$		(1,1)	1
$\eta > \overline{\eta}$	$(\underline{\theta}, \underline{\theta})$	(1,1)		0
	$(\underline{\theta}, \overline{\theta})$	(1,1)		1
	$(\overline{\theta}, \overline{\theta})$	(1,1)		1

The conspicuous feature of Table 3 is that PBCs no longer arise in economies with information sufficiently high quality. In other words, there is no variation in spending.

In the data there actually is variation in spending, which implies that to map the equilibrium outcome φ into the data, it must be the case that the set of Developed Countries (DC) is given by

$$\text{DC} = \{\ j\ : \eta_j \geq \overline{\eta} - \delta\ \}, \qquad \text{where } \delta > 0.$$

Let q be the fraction of developed countries below the threshold $\overline{\eta}$, that is

$$q \equiv \frac{|\,\{\ j\ :\ j \in \text{DC}\,,\ \ \eta_j < \overline{\eta}\ \}\,|}{|\,\text{DC}\,|}.$$

When an econometrician runs a probit regression between reelection and spending taking into account only Less Developed Countries (LDCs), i.e. countries with $\eta \leq \overline{\eta}$, he obtains the following probability of reelection conditional on flat spending

$$\Pr(\text{ re-elec } |(1,1)) = \frac{(0.5+\eta)\lambda_v(\eta)(1-\rho)\varepsilon + \rho}{(1-\rho)(1-\varepsilon)(1-\lambda_p(\eta)) + (1-\rho)\varepsilon + \rho} \equiv \Phi.$$

And thus we can put together the evidence for DCs and LDCs as in Table 4.

Table 4: Match with evidence.

Statistic	LDC		DC
Pr(PBC)	$(1-\rho)(1-\varepsilon)\lambda_p(\eta)$	$>$	$q(1-\rho)(1-\varepsilon)\lambda_p(\eta)$
Pr(re-elec | PBC)	$\left(\frac{1}{2}-\eta\right)\lambda_v(\eta)$		$q\left(\frac{1}{2}-\eta\right)\lambda_v(\eta)$
	$\wr$		$\wedge$
Pr(re-elec | PBC)	Φ		$q\Phi+(1-q)(\rho+(1-\rho)\varepsilon)$

Table 4 summarizes the results of the paper. It shows that political budget cycles are more likely to occur in LCDs, and since such outcome comes from the equilibrium φ, it follows that such PBCs are caused by hidden borrowing by unproductive politicians. As Table 2 shows, we can calibrate the parameters of the game to make the probabilities of reelection under PBC and flat spending equal, as § 3.1 describes. Finally, in developed countries, since all of those politicians that generate more public goods in election years are reelected, we obtain that the small fraction q of politicians that generate PBCs in those countries are punished at the polls. This features match evidence (i)–(iii) in § 1.

5 Conclusion

I develop a simple dynamic game of imperfect information that is capable of encompassing previous analyses on PBCs and matching recent panel data. The main thrust of the analysis is that in the unique data-matching equilibrium, increases in election-year government spending are exclusively caused by unproductive incumbents, which portraits dismal perspective on PBCs, i.e. they are far from reflecting efficient signalling by productive incumbents. Information acquisition has a key role in the scarce presence of PBCs in developed countries.

A straightforward, relevant avenue of research is considering the case in which public

goods help promote private investment (v.gr. Jones, Manuelli, and Rossi (1993)). In such case, economies with unskilled politicians in office in the first place may become stagnant because voters may only afford inexpensive, noisy information regarding incumbents, which translates into sloppy choices at the polls, and ensuing low future output, which affords again only garbled information. In sum, there is the possibility of economic stagnation due to the endogenous, permanent presence of *bad* politicians in office.

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