Political Budget Cycles in a Fiscal Federation:

The Effect of Partisan Voluntary Transfers

Ivan F. S. Ferreira
Brazilian Central Bank and University of Brasilia

Mauricio S. Bugarin[1]
University of Illinois and University of Brasilia

Abstract

This article first presents an econometric study suggesting that intergovernmental transfers to Brazilian municipalities are strongly partisan motivated. In light of that stylized fact, it develops an extension to Rogoff (1990)'s model to analyze the effect of partisan motivated transfers into sub-national electoral and fiscal equilibria. The main finding is that important partisan transfers may undo the positive selection aspect of political budget cycles. Indeed, partisan transfers may, on one hand, eliminate the political budget cycle, solving a moral hazard problem, but, on the other hand, they may retain an incompetent incumbent in office, bringing about an adverse selection problem.

JEL Classification: D72, H77, C72.

Keywords: Fiscal federalism, partisan transfers, Political budget cycles

1. Introduction

Economists have long been interested in the relationship between economic performance and electoral success. As early as 1944, Kerr (1944) presented a preliminary study suggesting that favorable economic conditions were positively correlated with republican vote in the United States. Thereafter, several econometric and theoretical papers have focused on better understand this relationship between economics and politics. For instance, Kramer (1971) analyzes American voting behavior between 1896 and 1964, and concludes that a reduction by 10% in per *capita* income leads to a loss of almost 5% in the congressional votes of the President's party. Furthermore, that article suggests that economic cycles explain about 50% of the variance of legislative voting.

Given the importance voters seem to confer to economic performance when taking their ballot, incumbents have a clear incentive to seek growth in electoral times in order to obtain the corresponding political bonus.

[1] Please send all correspondence to Mauricio Bugarin, Economics Department, University of Illinois at Urbana-Champaign, 330 Wohlers Hall, 1206 S. Sixth Street, Champaign, Illinois 61820. Telephone: 1-217-3659756. E-mail: bugarin@uiuc.edu.

The seminal paper that has tried to formally explain that behavior is Nordhaus (1975), which sets the expression "Political Business Cycle". According to that study, the Executive incumbent increases money supply prior to electoral years in order to increase production, thus reducing unemployment. As a consequence, voters reelect the incumbent, seemingly ignoring that the incumbent's present policy will redound in increased prices and reduced employment in the near future.

Nordhaus' argument may be questioned in light of rational expectations since voters appear to be constantly deluded by the incumbent, despite the limited effect that the increase in money supply brings to economic growth in the medium-run. A refinement of that theory is the "Political Budget Cycle" approach developed by Rogoff (1990). Rogoff focuses the incumbent's strategy on fiscal policy. According to that article, voters have incomplete information about the Executive incumbent's administrative competence, which gives a competent incumbent an incentive to bias pre-election fiscal policy in order to signal his competence, thereby enhancing the probability of reelection.

That study's main conclusion is that, although political budget cycles cause a distortion in fiscal policy, they also constitute an effective mechanism for information updating about the incumbent's administrative competence, allowing voters to reelect only the most competent politicians. Therefore, Rogoff (1990)'s model reconciles the documented political business cycles literature with the rational choice approach to political economy. Moreover, it derives the political budget cycle as a second-best equilibrium in view of the asymmetric information that exists between voters and their elected representatives. In other words, the political budget cycle is a compromise whereby voters give up some electoral control, the moral hazard part of voters' concern, in order to gain in the quality of elected officials, the adverse selection part of their electoral concern.

However, the political budget cycle literature tends to concentrate on the fiscal policy choices of a unitary government, disregarding the intergovernmental relations that are the basis of a fiscal federation. Therefore, one may ask how the intricate systems of transfers between different governments in a federation may affect the budget cycle equilibrium in lower levels of governments, such as state and city governments. The main purpose of this article is to explore the effect of voluntary transfers from higher levels of government on the electoral and economic equilibrium at lower level governments.

The first part of this article, section 2, explores data from Brazilian municipalities, and concludes that there is strong evidence that voluntary transfers from state governments to municipalities are partisan motivated, i.e. a municipality is more likely to receive voluntary transfers from the state government if the city mayor and the governor belong to the same party. After establishing the stylized fact that voluntary transfers tend to be highly partisan motivated, the rest of the paper tries to characterize the potential effect of such transfers on the political equilibrium. More specifically, one wants to determine to what extent partisan transfers affect the political budget cycle and the second best property of allowing voters to choose the most competent politician, which was highlighted in Rogoff (1990).

Section 3 extends the basic model in Rogoff (1990) in order to include two levels of government with staggered elections for state and city governments. Section 4 solves the electoral game in the simple case where there is perfect information about the competence of the incumbent politician. The main result is that even under complete information, partisan transfers may constitute a friction strong enough to change people's behavior, in such a way that voters may prefer to reelect an incompetent mayor that belongs to the governor's party rather than switching to a more competent politician that belongs to a different party. Alternatively, voters may prefer not to reelect a competent incumbent in order to replace him with a less competent politician from the governor's political party.

Section 5 extends those results to the context of incomplete information about the true competence of the incumbent. In this case, political budget cycles may arise in equilibrium and, in fact, may be magnified in comparison to Rogoff (1990)'s model, due to the fact that belonging to the governor's party increases the incumbent mayor fiscal policy distortion capabilities. Therefore, the moral hazard cost of the political budget cycle may be increased by the existence of voluntary transfers.

Moreover, when transfers are important enough they may totally offset any signaling concerns so that no political budget cycles will arise in equilibrium. In that case voters will choose the candidate that belongs to the governor's party, regardless of administrative competence. Therefore, there is no moral hazard cost associated to electoral competition, as voters and politicians' fiscal policy goals are aligned, but there may be severe adverse selection with a less competent incumbent being successively reelected.

The main message of this study, discussed in section 6, is that intergovernamental voluntary transfers are not innocuous technical issues but have important implications to subnational political equilibria and should, therefore, be carefully regulated in order to avoid its inefficiency effect on incumbent selection.

2. Case Study: Partisan Transfers in the Brazilian Fiscal Federation

Rogoff (1990) study focuses on a government whose revenues are fully collected from its constituents, such that incumbents have both the bonus and the onus of taxation and public service production. However, most countries are organized as fiscal federations with intricate systems of intergovernmental transfers. When centering attention to the lowest hierarchical level of government in a federation, it is not uncommon to find that important shares of local revenues come from transfers from the upper level governments. In this section we study the specific case of Brazil.

The political and administrative organization of the Brazilian Federative Republic comprises the Union, the States and the Municipalities, all of them autonomous according to Brazilian Constitution. The Constitution establishes which taxes might be collected by each level of government, as well as mandatory transfers from upper levels to the lower levels of government. Table 1 shows the total amount of revenue collected by each government level in Brazil as well as final revenues net of out-transfers from year 2000 to year 2004. The notation R$ refers to *Reals*, the Brazilian currency, in current values. The data confirms that local governments are strongly dependent on higher governments' transfers. Indeed, municipalities' collected tax revenue typically corresponds to only one fourth of their total revenue.

Moreover, Table 2 shows the relative participation of voluntary transfers in total transfers from the Union to the states and municipalities from 1995 to 2000, according to Prado (2001), in thousands of reals in year 2000 values. One notices that not only the participation of voluntary transfers is significant in terms of total transfers, but it also has increased steadily from 18% to above 30% during the period. One important component of non-constitutional transfers refers to costs of maintaining the integrated national public health system, the SUS. Although these transfers are not constitutional, an important part of them is regulated by detailed legislation. Therefore, one could argue such expenditure is not voluntary transfer. The last two columns of that table adjusts for the SUS transfers and finds a lower relative participation of voluntary transfers, but still significant at 12.3% of total transfers on average.

Table 1: Tax Revenues and Total Revenues in the Brazilian Federation, years 2000-2003

			2000			2001			2002			2003		
			R$ million	% nation's revenue	**% local revenue**	R$ million	% nation's revenue	**% local revenue**	R$ million	% nation's revenue	**% local revenue**	R$ million	% nation's revenue	**% local revenue**
Union		Federal revenue	247420	69.14	100.0	280197	68.92	100.0	334325	69.91	100.0	376694	69.4	100.0
	–	Transfers to States	26793	7.49	10.8	30007	7.38	10.7	36060	7.54	10.8	37842	6.97	10.0
	–	Transfers to municiplities	18041	5.04	7.3	20477	5.04	7.3	25412	5.31	7.6	26813	4.94	7.1
	=	Net revenue	202586	56.62	81.9	229713	56.5	82.0	272853	57.05	81.6	312039	57.49	82.8
States		States' revenue	94216	26.33	100.0	108066	26.58	100.0	123683	25.86	100.0	142284	26.22	100.0
	–	Transfers to municipalities	29253	8.18	31.0	33568	8.26	31.1	37802	7.9	30.6	43272	7.97	30.4
	+	Transfers from Union	26793	7.49	28.4	30007	7.38	27.8	36060	7.54	29.2	37842	6.97	26.6
	=	Net revenue	91755	25.64	97.4	104505	25.7	96.7	121941	25.5	98.6	136854	25.21	96.2
Municipalities		muncipalities' revenue	16195	4.53	**100.0**	18302	4.5	**100.0**	20244	4.23	**100.0**	23774	4.38	**100.0**
	+	Transfers from States	29253	8.18	**180.6**	33568	8.26	**183.4**	37802	7.9	**186.7**	43272	7.97	**182.0**
	+	Transfers from Union	18041	5.04	**111.4**	20477	5.04	**111.9**	25412	5.31	**125.5**	26813	4.94	**112.8**
	=	Total local revenue	63488	17.74	**392.0**	72347	17.79	**395.3**	83458	17.45	**412.3**	93860	17.29	**394.8**
Total			357830	100		406565	100		478252	100		542753	100	

Source: Ministry of Finance – Secretariat of Federal Revenue

Table 2: Relative Participation of Voluntary Transfers on Total Transfers from the Union to States and Municipalities

Year	Constitutional transfers (CT)	Voluntary transfers (VT)	Relative participation (VT/CT)*100	SUS adjusted voluntary transfers (AVT)	SUS adjusted relative participation (AVT/CT)*100
1995	28327821.1	5092844.6	18.0		
1996	29650069.8	7547512.2	25.5		
1997	32144420.8	9503988.5	29.6	3995817.96	12.4
1998	36475624.6	13656605.2	37.4	6539343.12	17.9
1999	38190488.7	11877611.5	31.1	3164650.32	8.3
2000	37296296.9	13477239.2	36.1	3937132.06	10.6

Source: Prado (2001), Table 3.2

A second important characteristic of Brazilian political system is that all Executive mandates last four years. However, while the elections for Federal and the State governments are concomitant, they are staggered by municipal elections in the higher government's midterm. Thus, there are elections in Brazil every two years, once for President and State governors, then, two years later, for municipality mayors. Both the importance of higher-level government transfers to local finances and the staggered elections may motivate higher level incumbents to political use of voluntary transfers favoring mayors that belong to their respective parties. This section presents an econometric study aiming at determining if there is indeed evidence of such partisan motivation. Our tests centers on total transfers to municipalities. Partisan motivations are modeled as dummy variables which equal one whenever the mayor and the state governor (respectively the mayor and the President) belong to the same political party, and zero otherwise. The hypothesis being tested is that transfers are higher in municipalities whose mayors are aligned to the executive incumbents in the upper levels of the federation.

The data combine local government's budget figures from 1998 to 2004 (at current prices), available at the National Treasury website[2]; electoral information from 1996 to 2004, available at several Brazilian Regional Electoral Courts[3] websites; and also estimated population available at the IBGE[4] website.

Our sample consists of 1414 municipalities. The sample excluded all municipalities for which we could not find either detailed electoral or fiscal information. One important caveat about studies involving Brazilian municipalities is that there has been a great increase in their number especially since the new 1988 Federal Constitution, which brought about unintended fiscal incentives for the division of large municipalities into smaller ones. Therefore, a decision has to be made about how to handle new municipalities. This study decided on excluding all municipalities that changed size during the 1996-2004 period.[5]

---

[2] Data up to 1999 were downloaded on October 28th, 2005; from 2000 to 2003, on April 2nd, 2005; and 2004 on September 2nd, 2005. All from "Finanças do Brasil – Receitas e Despesas dos Municípios" at www.stn.fazenda.gov.br .

[3] See, for instance, www.tre-rs.gov.br, www.tre-pe.gov.br, www.tre-sp.gov.br, www.tre-pr.gov.br, and others. The only exception was Bahia's electoral data as of 1996, found at http://pfldabahia.org.br/mun_pref_96.asp.

[4] The Brazilian Government Insitute of Geography an Statistics, website: http://www.ibge.gov.br/.

[5] The number of municipalities has increased from 3951 in 1970 to 5.507 in 2000, to 5568 in 2005. See http://www.cnm.org.br

We regress total transfers from the Union and the States to the municipalities on an intercept, mandatory transfers, tax revenue, population of the municipality, a time trend, and two variables intended to measure political identification between the mayor and the state governor and between the mayor and the president. Therefore, we perform a panel data regression with fixed effects[6] for the following model.

$$Transf_{it} = \alpha_1 + \alpha_2 TMand_{i,t} + \alpha_3 RT_{i,t} + \alpha_4 POP_{i,t} + \alpha_5 Year_t + \alpha_6 [D_{S_{i,t}} * POP_{i,t}] + \alpha_7 [D_{P_{i,t}} * POP_{i,t}] + \varepsilon_{i,t}$$

In the above expression, the *i,t* subscripts indicate observations drawn from municipality *i* at period *t*. The dependent variable *Transf* denotes the natural log of total transfer[7] revenues. The explanatory variable *TMand* is the natural log of mandatory transfer[8] revenues; *RT* represents the natural log of tax revenues; *POP* refers to the natural log of population; *Year* is a time-trend variable; D_S is a dummy variable, which is equal to one whenever the state governor and the mayor belong to the same political party and zero otherwise; and D_P is another dummy variable, which assumes unitary value whenever the President and the mayor belong to the same political party. We use variables D_S*POP* and D_P*POP* rather than simply the dummies because one expects that the partisan effect, if it exists, should be proportional to the population size.

The main purpose of the regression is to check the sign and the significance of the variables D_S*POP* and D_P*POP*. A positive and significant coefficient suggests that municipalities whose mayors are political allies of the state governor or the President, respectively, receive, on average, additional transfer revenues compared to other municipalities. The results are presented in Table 3.

Table 3: Testing Partisan Transfers in Brazil[9]

[6] The Hausman test rejected the null hypothesis of random effects.

[7] Total transfers are considered as the sum of current and capital transfers received from state and Federal governments.

[8] In this paper, we consider as mandatory transfers the difference between current transfers (both, from states and Federal governments to local governments) and other current transfers (both, from states and Federal government). The result does not correspond exactly to all mandatory transfers, but it is a reasonably good proxy since it include the main Constitutional transfers. FPM, ICMS cote, FUNDEF, and others are example of mandatory transfers included in our proxy.

[9] The regression provides the fixed-effect estimator, also known as within estimator. The robust option was specified in order to have a covariance matrix robust to heteroskedasticity.

$Transf_{i,t}$	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf. Interval]	
$TMand_{i,t}$	**0.7622**	0.008	90.93	**0.00**	0.746	0.779
$RT_{i,t}$	-0.0016	0.002	-0.66	0.51	-0.006	0.003
$POP_{i,t}$	**0.1017**	0.016	6.36	**0.00**	0.070	0.133
$Year_t$	**0.0137**	0.001	11.03	**0.00**	0.011	0.016
$D_S.POP_{i,t}$	**0.0013**	0.000	4.47	**0.00**	0.001	0.002
$D_P.POP_{i,t}$	0.0002	0.000	0.53	0.60	-0.001	0.001
α_1	**2.7592**	0.184	14.98	**0.00**	2.398	3.120

Number of obs:	9888
Number of groups:	1414
R-sq (within):	0.898
F(6,8468) =	12413

The econometric tests produce two important results. First, it shows a positive correlation between political alignment of mayors and governors and the transfers received by local governments, which can be observed by the sign and the significance of the variable, D_S*POP. This result asks for an extended model in order to study political budget cycles in fiscal federations, such as the Brazilian, that takes into account partisan transfers. This is done in the rest of the paper.

Second, the study indicates no significant effect of political alignment between the mayor and the President on the transfers received by the municipality. This result suggests that the state may be the main channel thru which partisan transfers take place.

Given that Brazilian municipalities are very heterogeneous we ran a new regression using cluster and factorial analysis based upon social and economic development indicators, in order to check the robustness of the above result. The analysis consists of two steps. First all Brazilian cities were grouped into 10 clusters in order to maximize homogeneity of municipalities within each cluster and maximize heterogeneity among clusters. Then a panel data regression with fixed effects similar to the one presented above was performed. The new results confirmed the presence of partisan motivated transfers from states to cities in a number of clusters that accounts to 62% of all Brazilian municipalities in our dataset. The output of that regression is presented in the appendix. More detailed information can be obtained from the authors upon request.

These findings instigate the main question we want to shed light on: What are the consequences of partisan transfers on the electoral equilibrium in a fiscal federation? To answer this second question, Section 3 extends Rogoff (1990)'s model in order to encompass intergovernmental transfers and staggered elections.

3. A Model of Political Budget Cycle Model in a Fiscal Federation

The present model extends Rogoff (1990) in order to include the stylized facts found in the previous econometric analysis. First, there are two levels of government, the state and the municipality governments, with staggered elections. Second, there are partisan transfers from the state to the municipal government.

3.1. Basic Hypothesis

The economy is composed by a great number of ex-ante identical agents acting as voters and as politicians (just two candidates in every election). Both types of agents are utility maximizers. A representative voter maximizes the expected utility function, $E_t(\Gamma_t)$, where E_t denotes the voter's expectation operator at period t and Γ_t represents the present value of his utility at period t, which is modeled according to equation (1)

$$\Gamma_t = \sum_{s=t}^{T} \beta^{s-t}\left[U(c_s, g_s) + V(k_s) + q_s\right] \tag{1}$$

In the above expression, β is the time discount factor of representative citizen (β<1); T is the time horizon that might be finite or infinite; c represents consumption of a private good; g stands for the per capita consumption of a public good that is contemporary produced and consumed; and k corresponds to the per capita investment in a second public good, which consumption is only realized one period after investment is completed. Therefore, the amount k_s represents investments that were make in period $s-1$. Public schools, hospitals, libraries, bridges, roads, are all examples of investments that have this property of requiring time in order for agents to be able to derive utility from its consumption. The important property associated with this long-term investment is that voters only verify the amount k_s, which was made in period $s-1$, in period s. This brings about an informational asymmetry between the incumbent, who decides on fiscal policy today, and voters, who have to wait until tomorrow in order to verify this component of today's policy

Function $U(c,g)$ measures voter's contemporary utility of consumption of private good, c, and public good g. Public good g is produced exclusively by the municipal government. Function $V(k)$ measures voter's utility of consumption of public good k, which is assumed to be additively separable from the other consumptions. U e V are strictly concave and strictly increasing functions in all arguments, and satisfy: $\lim_{k\to 0} V(k) = -\infty$; for all $c \geq 0$, $\lim_{g\to 0} U_g(c,g) = +\infty$ and $\lim_{g\to\infty} U_g(c,g) = 0$; and for all $g \geq 0$, $\lim_{c\to 0} U_c(c,g) = +\infty$ and $\lim_{c\to\infty} U_c(c,g) = 0$ [10]. Furthermore, we assume that all three goods c, g and k are normal goods in the usual sense, i.e., if a voter's income increases, she will find it optimal to increase (production and) consumption of all three goods.

The term q_s is a random shock that can take on negative as well as positive values with expected value equal to zero. This shock is observed by voters at the end of period $s-1$ and lasts the entire s period. This could represent an appearance shock reflecting the popularity of the incumbent in each one of the considered periods $(s = t, \ldots, T)$. We shall suppose q_s independent for all period $t \neq s$ and identically distributed on $[-\bar{q}, \bar{q}]$, with cumulative distribution function G. A positive value of q_s implies that the representative voter has a bias in favor of the incumbent leader, whereas a negative value implies a bias in favor of the opponent.

3.2. Technology

In the beginning of each period, each voter receives y units of a non-storable good, which might be privately consumed or used as tax payment, τ_t, which is modeled as *lump-sum*. Therefore, an individuals' budget constrain is given by equation (2):

$$c_t = y - \tau_t \tag{2}$$

Taxes are used to produce public goods. In addition to taxes the production of such goods requires the input of the incumbent mayor, whose administrative competence is represented by a random variable ε. The production function of public goods is given by equation (3):

---

[10] U_c e U_g measure the marginal utility in consuming one additional unit of private good (c) and public good (g), respectively.

$$g_t + k_{t+1} = \tau_t + \varepsilon_t + F_t \tag{3}$$

The left hand side of equation (3) represents the uses of resources as defined by the incumbent. The total revenue is spent in order to produce the two kinds of public goods: the good g_t, which is produced and consumed in the same period, *t*; and k_{t+1}, which corresponds to the public good which is invested in t and has a one year maturity term.

The right hand side of equation (3) shows municipality revenue. Variable τ_t represents tax revenue. Variable F_t represents the amount of per capita transfers received by local government. The present model postulates that these transfers follow the expression below:

$$F_t = a + bD_t \tag{4}$$

In expression (4), the parameter a ($a \geq 0$) represents per capita mandatory transfers and bD_t represents per capita voluntary transfers. Dummy D_t is equal to one if the mayor and the state governor belong to the same political party, and zero otherwise; b is the increment in transfers (F) which dues to partisan motives ($b \geq 0$), according to the econometric test in section 2.

Any agent may become an incumbent. In any period *t*, individuals have different administrative competence. The potential (total) competence of individual *i* evolutes according to a MA(1) process:

$$\varepsilon_t^i = \alpha_t^i + \alpha_{t-1}^i \tag{5}$$

In the above expression, α_t^i represents a competence shock of individual *i* in period *t*. These shocks are identically distributed and independent among individuals and also in time; we assume they take either the value α^H or α^L with $\alpha^H > \alpha^L > 0$, according to the distribution probability $\rho = \text{Prob}\,[\alpha = \alpha^H]$ and $1 - \rho = \text{Prob}\,[\alpha = \alpha^L]$.

Note that the higher ε, the more competent is the incumbent. A competent incumbent can, according to (3), provide greater amounts of public goods (either *g*, or *k*, or both) with the same amount of taxes and transfers. Alternatively, he can provide the same amount of public goods collecting lesser taxes (considering the same amount of transfers). On the other hand, a small value for ε means that the incumbent is incompetent and the previous argument is inverted. In this paper we define a competent incumbent *in period t* (or a type H), as: $\varepsilon^H = \alpha_{t-1} + \alpha^H$; and an incompetent incumbent (or a type L), as $\varepsilon^L = \alpha_{t-1} + \alpha^L$.

3.3. The incumbent's utility function

Incumbent I's utility function has two components. The first component represents his utility as common citizen, consuming private and public goods and services and paying taxes; the second part represents the rents he receives by being an incumbent. Hence, the incumbent's expected utility at time t is given by the expression below:

$$E_t^I(\Gamma_t) + \sum_{s=t}^{T} \beta^{s-t} X \pi_{s,t} \tag{6}$$

In expression (6), I represents the incumbent; Γ_t is given by equation (1), where one should drop the term q_s, since the incumbent is immune to any popularity shock about himself; E_t^I denotes the incumbent's expectations based on the information available in period t; $\pi_{s,t}$ is the incumbent's estimation, in t, of the probability of still being an incumbent in period s; and X represents his ego rent.

We shall interpret (6) as the incumbent putting some weight on the social welfare (in which he is included as a member) and some weight on the profits he receive by holding office.

3.4. The structure of elections

Local government elections are held every four years. At the end of the second year there are state government elections. To simplify we are considering a federalist structure with only these two levels of government, ignoring the role of the federal government. This simplification is supported by the econometric analysis for Brazil in which partisan identity between the President and the meyor did not seem to affect significantly intergovernmental transfers.

There are no term limits. An incumbent's opponent is randomly chosen among the voters. Ex ante, all the individuals are equal. Hence the voter's unique information about the opponent is his ex ante probability of being competent (type H), ρ.

There are two political parties. If the incumbent mayor and the state governor belong to the same party, the opponent belongs to the opposition party. On the other hand, if the mayor and the governor belong to opposing parties, the opponent candidate belongs to the governor's party. This information is previously known to the voters.

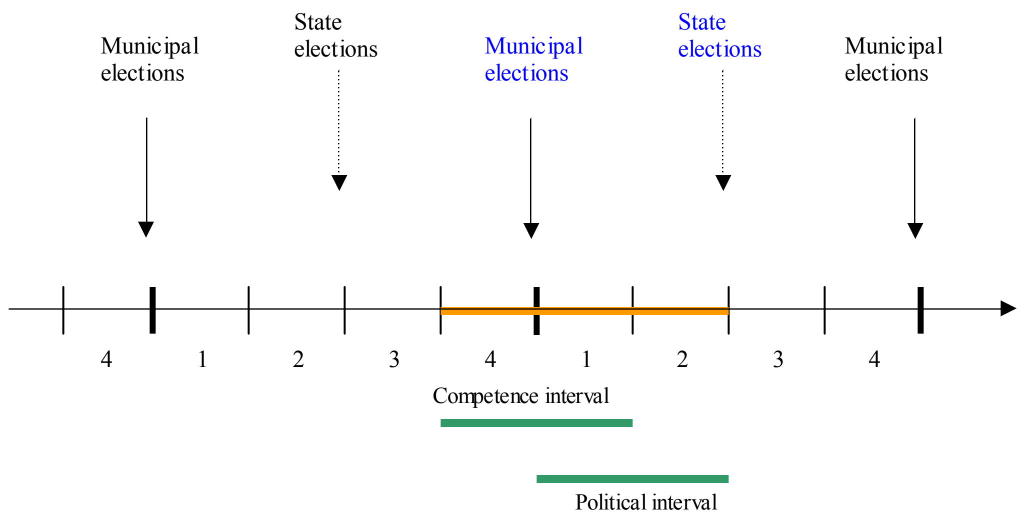
This study focuses on the election for municipal mayors. Therefore, we simplify state elections by assuming that the governor and his opponent have the same probability of winning the state electoral dispute.

The choice available to municipal voters at each election is either to reelect the incumbent or to elect the opponent candidate as mayor for the next four year term.

3.5. Timeline and informational structure

In every period, t=1,2,3,4 corresponding respectively to the first, second, third and final year of the term, the incumbent observes α_t and receives F_t from the state government. Then, the incumbent selects fiscal policy τ_t , g_t , k_{t+1} . Voters observe τ_t , g_t , k_t , F_t , deduce α_{t-1} according (3) and (5) and make inferences about α_t. At the end of the fourth year (t=4) the appearance shock q_{t+1} is realized, which will affect voters' utility the following year. Then voters check the political alignment between the candidates and the governor and vote. Notice that a shock $q_{t+1}>0$ is favorable to the incumbent, whereas a shock $q_{t+1}<0$ favors the opponent. Figure 1 illustrates the time trend described above.

Figure 1: Timeline



Note that, as the competence of the incumbent follows a MA(1) process, the relevant period for voters to analyze competence is only the municipal election's year and year that follows. Indeed, as α_t is identically distributed, the assessment about the probability of having a high ε_{t+2} is the same whatever the candidate that wins the elections. Therefore, the time interval that is relevant for the adverse selection concern of voters includes the last year of a mayor term and the first year after elections.

On the other hand, as municipalities receive transfers from state governments, partisan factor are relevant in this model. If t is a municipal elections' year, then voters anticipate that up to period t+2 the candidate aligned with the governor will receive additional resources. However, as the present governor term finishes in t+2, and both state candidates have the same probability of winning the next election, in t+3 both candidates to mayor have the same expected transfers. Hence the two years that follow municipal elections are relevant to voters' analysis.

Voters observe τ_t, F_t and g_t contemporaneously and use these information to make inference about k_{t+1} and the competence shock α_t. However, they cannot be sure about these inferences up to the following period. In t+1, when investment shows up, voters will be able to determine α_t for sure. Thus the incumbent leader has a temporary informational advantage over the voters.

Upon voting, the representative voter compares his expected utility with each candidate, then votes. The binary variable ν will be one if he votes for the incumbent leader and zero otherwise. Hence the decision of the representative voter in election year t is:

$$\begin{aligned} &\nu = 1, \quad \text{if} \quad E_t\,(\Gamma_{t+1}) \geq E_t\,(\Gamma^P_{t+1}) \\ &\nu = 0, \quad \text{otherwise} \end{aligned} \tag{7}$$

In the above expression, $E_t\,(\Gamma_{t+1})$ represents voter's expectation, in t, about the present value, in t+1, of his utility keeping the current mayor in government according to the current available information; elected mayor for the next four year term.

The following section solves the electoral game in the special case where voters can observe the incumbent's type α_t in period t, so that there is complete information.

4. Electoral equilibrium under complete information

Suppose, first, that there is no asymmetric information between voters and the incumbent, that is, voters observe the competence of the incumbent, α_t, before voting at the end of period t. In this situation, pre-electoral politics does not change voters' expectations about post-electoral competence. According to (6) the incumbent solve the following problem:

$$\underset{\{\tau_s\}_{s=t}^{T},\{c_s\}_{s=t}^{T},\{g_s\}_{s=t}^{T},\{k_s\}_{s=t+1}^{T}}{Max} E_t^I(\Gamma_t) + \sum_{s=t}^{T} \beta^{s-t} X\pi_{s,t}$$

Notice that, in this rational expectations model, when voting at the end of period t, voters care only about their utility from periods t+1 on. Therefore, four variables are relevant to voters' choice. First, given that competence follows a MA(1) process with ε_t=α_{t+1}+α_t, the competence shock in period t, α_t, matters. Moreover, the appearance shock of the incumbent, q_{t+1}, which will impact the utility of the voter in the first year of the next term also matters. Finally, voter care about the amount of voluntary transfers that the each municipality candidate will obtain from the state government in the first and second year of the mayor's term, bD_{t+1} and bD_{t+2}. Because all four variables are independent of the decisions made by the incumbent mayor, there is nothing he can do in terms of fiscal policy in order to enhance his chances of winning the election. Therefore, $\pi_{s,t}$ is exogenous and, maximizing the above utility results equivalent to maximizing only its first term. To put it differently, the incumbent maximizes the total welfare of the representative citizen.

Given the non-storage production technology, solving the original dynamic problem is equivalent to solving a sequence of static problems in which the incumbent maximizes his utility in each period, from t to T:

$$\begin{aligned} &\underset{\tau_t,\, c_t, g_t, k_{t+1}}{Max}\; U(c_t, g_t) + \beta.V(k_{t+1}), \quad \forall t \\ &\text{s.t. } c_t = y - \tau_t,\;\; g_t + k_{t+1} = \tau_t + \varepsilon_t + F_t,\;\; k_{t+1}, c_t, g_t \geq 0 \end{aligned} \tag{8}$$

Substituting the two initial restrictions into the objective function and using notation $W(g_t, \tau_t, \varepsilon_t, F_t) \equiv U(c_t, g_t) + \beta.V(k_{t+1})$, we can rewrite the problem in a more convenient way:

$$\begin{aligned} &\underset{\tau, g}{Max}\, W(g, \tau, \varepsilon, F) \equiv U(y-\tau, g) + \beta.V(\tau + \varepsilon + F - g) \\ &\qquad \text{s.t. } g \geq 0,\, y - \tau \geq 0,\, \tau + \varepsilon + F - g \geq 0 \end{aligned} \tag{9}$$

Given the assumptions on the utility function, the solution of this problem is interior and the first order conditions lead to the following results:

$$U_c(y-\tau,g) = \beta V'(\tau+\varepsilon+F-g) \tag{10}$$

$$U_c(y-\tau,g)=U_g(y-\tau,g) \tag{11}$$

Equation (10) equalizes the marginal utility of consuming private good (c) with the marginal utility of the investment public good (k), discount by the time factor β, due to the maturity period of the investment. Equation (11) equalizes the marginal utilities of contemporaneous consumption of the private good (c) and the public good (g).

Since $U(.)$ and $V(.)$ are strictly concave functions, for each value of F and ε, there is a unique solution $g^*(\varepsilon,F)$ and $\tau^*(\varepsilon,F)$ that satisfy simultaneously (10) and (11). Define $W^*(\varepsilon,F)=W^*(g^*(\varepsilon,F),\tau^*(\varepsilon,F),\varepsilon,F)$. It is straight forward to check that this function is strictly increasing on the arguments ε and F. Moreover, $c^*(\varepsilon,F)$, $g^*(\varepsilon,F)$ and $k^*(\varepsilon,F)$ will also be strictly increasing in both arguments, due to the hypothesis that all goods are normal. Hence, by (2) and (3), $\tau^*(\varepsilon,F)$ is strictly decreasing in both arguments. Also, it follows directly from the mayor's budget constraint that if $\varepsilon+F=\varepsilon'+F'$ then $W^*(\varepsilon,F)=W^*(\varepsilon',F')$. Therefore, we additionally use the simplified notation $w^*(\varepsilon+F)=W^*(\varepsilon,F)$ later in the text.

Consider now voters' electoral decision. Due to the fact that, in election year t, voters are indifferent between the incumbent and its challenger two years ahead, from (7) a representative voter will reelect the incumbent ($\nu=1$) if and only if:

$$E_t[W^*(\varepsilon_{t+1},F_{t+1})]+\beta E_t[W^*(\varepsilon_{t+2},F_{t+2})]+q_{t+1} \geq E_t[(W^*(\varepsilon^P_{t+1},F^P_{t+1})]+\beta E_t[(W^*(\varepsilon^P_{t+2},F^P_{t+2})] \tag{12}$$

The left hand side of equation (12) expresses voter's expected utility in period t for the next two periods, with the reelection of the incumbent, and the right hand side of (12) presents the corresponding expected utility with the opponent being elected. Furthermore, F_t refers to the amount of transfers received by the current mayor, $F_t = a+bD_t$ where D_t is a dummy variable which takes value one when the mayor and the state governor belong to the same political party. The variables $F^P_t = a+bD^P_t$ and D^P_t have the same meaning as F_t and D_t, but they refer to the challenger.

Define Ω^{I,D_t} as the expected utility of a representative voter at year t for the next two periods, as a function of the competence shock and of the political bias, keeping the current mayor (of competence $I=L,H$) in office (respectively, Ω^{P,D_t^P} if the opponent wins the election), without considering the appearance shock. If voters directly observe α_t before the elections, the first two summands of the left hand side of (12) can be calculated for each possible value of α_t.

a) If the mayor and the state governor belong to the same political party, then $D_t = 1$; hence $F_{t+1} = F_{t+2} = a + b$ and, for $I=L,H$,

$$\begin{aligned}\Omega^{I,1} &= \{E_t[W^*(\varepsilon_{t+1}, F_{t+1})] + \beta E_t[W^*(\varepsilon_{t+2}, F_{t+2})] \mid \alpha_t = \alpha^I; D_t = 1\} = \\ &= \rho w^*(\alpha^I + \alpha^H + a + b) + (1-\rho) w^*(\alpha^I + \alpha^L + a + b) + \beta[\rho^2 w^*(2\alpha^H + a + b) + \\ &+ 2\rho(1-\rho) w^*(\alpha^H + \alpha^L + a + b) + (1-\rho)^2 w^*(2\alpha^L + a + b)]\end{aligned} \tag{13}$$

b) If the mayor and the state governor belong to opposing parties, then $D_t = 0$, $F_{t+1} = F_{t+2} = a$ and, for $I=L,H$,

$$\begin{aligned}\Omega^{I,0} &= \{E_t[W^*(\varepsilon_{t+1}, F_{t+1})] + \beta E_t[W^*(\varepsilon_{t+2}, F_{t+2})] \mid \alpha_t = \alpha^I; D_t = 0\} = \\ &= \rho w^*(\alpha^I + \alpha^H + a) + (1-\rho) w^*(\alpha^I + \alpha^L + a) + \beta[\rho^2 w^*(2\alpha^H + a) + \\ &+ 2\rho(1-\rho) w^*(\alpha^H + \alpha^L + a) + (1-\rho)^2 w^*(2\alpha^L + a)]\end{aligned} \tag{14}$$

Since the opponent is not in office, voters do not observe his competence shock, α_t. However, they know its distribution. Hence, the two first summands in the right hand side of (12) can be calculated as follows.

a) If the opponent does not belong to the state governor's party $(D_t^P = 0)$ then $F_{t+1}^P = F_{t+2}^P = a$ and,

$$\begin{aligned}\Omega^{P,0} &= \{E_t[W^*(\varepsilon_{t+1}^P, F_{t+1}^P)] + \beta E_t[W^*(\varepsilon_{t+2}^P, F_{t+2}^P)] \mid D_t^P = 0\} = \\ &= [1+\beta]\{\rho^2 w^*(2\alpha^H + a) + 2\rho(1-\rho) w^*(\alpha^H + \alpha^L + a) + (1-\rho)^2 w^*(2\alpha^L + a)\}\end{aligned} \tag{15}$$

b) If the opponent and the state governor are political allies $(D_t^P = 1)$ then $F_{t+1}^P = F_{t+2}^P = a + b$ and,

$$\begin{aligned}\Omega^{P,1} &= \{E_t[W^*(\varepsilon_{t+1}^P, F_{t+1}^P)] + \beta E_t[W^*(\varepsilon_{t+2}^P, F_{t+2}^P)] \mid D_t^P = 1\} = \\ &= [1+\beta]\{\rho^2 w^*(2\alpha^H + a + b) + 2\rho(1-\rho) w^*(\alpha^H + \alpha^L + a + b) + -\rho)^2 w^*(2\alpha^L + a + b)\}\end{aligned} \tag{16}$$

Clearly, for all $\rho \in (0,1)$ and $b>0$, we have $\Omega^{H,1} > \Omega^{H,0} > \Omega^{P,0} > \Omega^{L,0}$. Moreover, it's clear that $\Omega^{H,1}$ and $\Omega^{L,0}$ represent the highest and the lowest expected utility, respectively, among all possible combination of competence shock and political interference[11]. The challenge here is to find how the inequality $\Omega^{P,1} > \Omega^{L,1} > \Omega^{L,0}$ fits into the above sequence of four inequalities. For instance, we don't know the relation between $\Omega^{H,0}$ and $\Omega^{P,1}$. In other words, is it better to reelect a competent incumbent, though not aligned with the governor or to elect a challenger with unknown competence, but politically aligned with the governor? Similarly, it's not clear what is the relation between $\Omega^{L,1}$ (utility associated with the reelection of an incompetent incumbent but supported by the governor) and $\Omega^{P,0}$ (utility associated with the election of the opponent with unknown competence, hence with a higher expected competence, but without financial support from the governor). The ordering will depend on three factors: the amount of voluntary transfer, b; the probability of the competence shock to be of type H, ρ; and the difference of type H and type L competence shocks. Proposition 1 below present sufficient conditions for the voluntary transfers to play a decisive role in the electoral outcome.

***PROPOSITION* 1.**

(i) *Suppose parameters b, α^H, α^L and ρ are such that the following condition is satisfied.*

$$\begin{gathered}\rho^2 w^*(2\alpha^H + a + b) + 2\rho(1-\rho)w^*(\alpha^H + \alpha^L + a + b) + (1-\rho)^2 w^*(2\alpha^L + a + b) \geq \\ \rho w^*(2\alpha^H + a) + (1-\rho)w^*(\alpha^H + \alpha^L + a)\end{gathered} \tag{17}$$

Then, $\Omega^{P,1} > \Omega^{H,0}$. Therefore, a challenger that belongs to the governor's political party is expected to beat, in the electoral race, the competent incumbent (type H) that belongs to a different party.

(ii) *Alternatively, suppose parameters b, α^H, α^L and ρ are such that condition* (18) *is satisfied.*

$$\begin{gathered}\rho w^*(\alpha^L + \alpha^H + a + b) + (1-\rho)w^*(2\alpha^L + a + b) \geq \\ \rho^2 w^*(2\alpha^H + a) + 2\rho(1-\rho)w^*(\alpha^H + \alpha^L + a) + (1-\rho)^2 w^*(2\alpha^L + a)\end{gathered} \tag{18}$$

Then, $\Omega^{L,1} > \Omega^{P,0}$. Therefore, an incompetent incumbent (type L) that belongs to the governor's political party is expected to beat, in the electoral race, the opponent with higher expected competence but with no partisan transfers from the governor.

---

[11] $\Omega^{H,1}$ corresponds to the situation in which the incumbent is competent and belongs to the same political party of state governor and thus receives voluntary transfers. $\Omega^{L,0}$ corresponds to the opposite situation in which the incumbent has low competence and does not receive any voluntary transfers from state governor.

(iii) *Suppose partisan transfers b exceed the competence differential* $\alpha^H - \alpha^L$ *, i.e.,* $b \geq \alpha^H - \alpha^L$*. Then* $\Omega^{P,1} > \Omega^{H,0}$ *and* $\Omega^{L,1} > \Omega^{P,0}$*, regardless of the probability distribution of the competence shock. In that case, the governor will always determine the outcome of the elections, in expected terms.*

In particular, the higher the partisan transfers b and the lower the competence differential $\alpha^H - \alpha^L$*, the more likely the governor will play a decisive role on the determining the electoral outcome.*

Proof: See appendix.

Conditions (17) and (18) express the trade-off between administrative competence and political alignment: if partisan transfers are high enough compared to the possible competence loss, then voters will elect the politician that belong to the governor's party, unless a significant popularity shock changes that preference.

Proposition 1 highlights how important may be the role of governors in municipal elections. In fact, depending on the amount of transfers, a governor might indeed reverse the property of selecting the candidate with the highest administrative competence, which is the main result in Rogoff (1990). In fact, if conditions (17) and (18) are satisfied, then the entire electoral process itself looses significance, as the partisan effect totally dominates the competence effect and one expects the governor's candidate to systematically win the race.

It is noteworthy in that case that the election of a candidate with lower administrative competence is fully rational under the strict point of view of voters' behavior, since the winner may collect more revenue from the state, which offsets his lower administrative ability in managing municipal resources. However, if voters could continue receiving the state transfers regardless of the political party of the elected mayor, then voters would be better off by electing the more efficient candidate. Therefore, although optimal given the actual restriction on transfers, the equilibrium is socially inefficient. That result is stated in the corollary below.

COROLLARY. *Suppose parameters b,* α^H*,* α^L *and* ρ *are such that condition* (17) or (18) is *fulfilled. Then, the partisan-transfers equilibrium is a second best solution to voters.*

Proof: It is sufficient to compare with the situation in which the municipality receives transfers regardless of partisan alignment, in which case the most competent candidate is elected, increasing voters' welfare.

5. The Electoral Equilibrium under Asymmetric Information

Suppose now voters do not observe the competence shock α_t in period t. Also, suppose the game has finite horizon, i.e., T is finite. The game starts in period $t=T-4$, which is the last period voters take their ballots. On this election year the incumbent observes α_t, receives transfers F_t and chooses fiscal policy τ_t, g_t and k_{t+1}. Voters observe τ_t, g_t, k_t and F_t and derive α_{t-1}. Hence, voters form beliefs about the contemporary competence shock α_t based on their observations. Denote by $\hat{\rho}(g_t, \tau_t, F_t)$ voters' belief that the incumbent's competence is high ($\alpha_t = \alpha^H$). By the end of the electoral year, the appearance shock q_{t+1} is realized and voters take their ballot. Notice that as in the case of complete information, a positive shock $q_{t+1} > 0$ favors the incumbent whereas a negative shock favors the opponent.

The elected mayor holds office during the next four years and then the game finishes. Therefore, there are no further municipal elections in the remaining four years. Similarly to the electoral year, for each of the remaining periods $t=T-3$, $T-2$, $T-1$, T, the incumbent observes α_t, receives transfers F_t and chooses fiscal policy τ_t, g_t and k_{t+1}. Period $t=T-2$ represents the last year state elections year. In period $T-4$, mayor and voters alike estimate that both parties have the same probability of winning the state government in period $T-2$. Therefore, considering that the effect of a contemporary competence shock only lasts until next period, one may totally ignore the game after period $T-2$.

Figure 2 presents the extensive form of this game. The lower half of the game tree represents a generic realization of the appearance shock[12] q. The upper half presents an alternative realization of the appearance shock q'. The left hand side of the figure reflects a competence shock $\alpha_{T-4} = \alpha^H$ whereas the right hand side presents the lower competence shock $\alpha_{T-4} = \alpha^L$. The dotted curves indicate the existence of infinitely many possible choices to

[12] In fact, voters are represented by the median voter with respect to the realization of the appearance shock q. However, we maintain hereafter the term more intuitive and shorter term "voters".

the incumbent or to the opponent, only one of which is explicitly presented in the game tree. Therefore, while nodes t_0, t_1 and t_1' correspond to unique decision nodes, nodes t_2 to t_{12} and t_2' to t_{12}' represent infinite possible sequences to the game beginning with the initial incumbent's choice. The term k_+ reflects the fact that investment decisions have a maturing period of one year. As usual, the dotted horizontal lines correspond to information sets for the voters.

Let $\Gamma_{s,t}^j = \beta^{s-t}[U(c_s^j, g_s^j) + V(k_s^j) + q_s]$ represent the present value (in t) of voter's utility in period s when the incumbent $(j = I)$ or the opponent $(j = P)$ wins the election. Then, according to a previous comment, $E[\Gamma_{T-1,T-4}^I] = E[\Gamma_{T-1,T-4}^P]$ and $E[\Gamma_{T,T-4}^I] = E[\Gamma_{T,T-4}^P]$. Therefore, the last two periods of the game are irrelevant to voters' electoral decision in period T–4 and are not included in the game tree.

The functions $U_I(.), U_E(.)$ e $U_P(.)$ represent the end-of-the-game utility of the incumbent, voters and the opponent, respectively. The argument σ represents the history of the game.

Solution

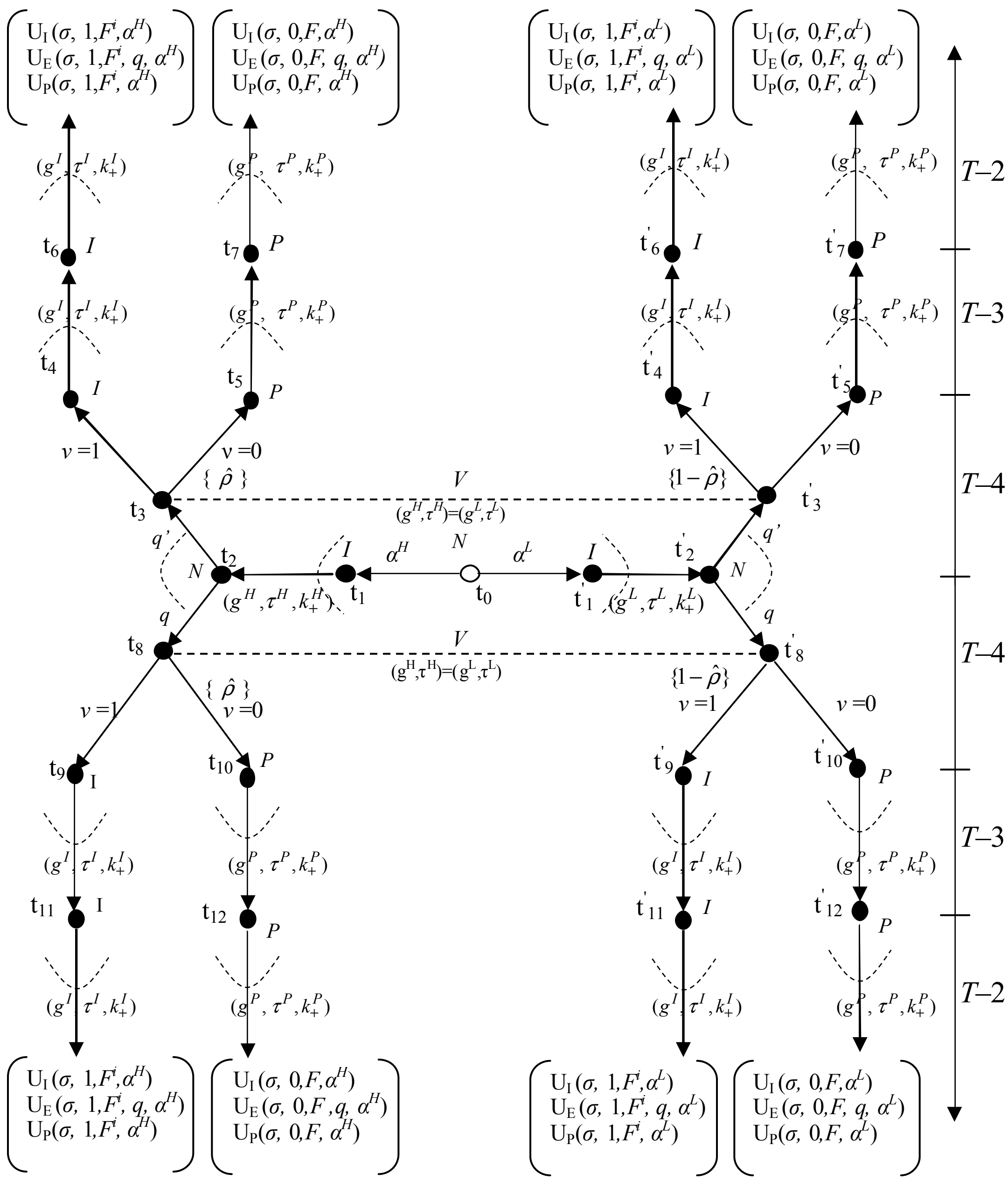
The game in Figure 2 is symmetric. After nature's choice of the incumbent's appearance shock both voters and the incumbent know which game they are playing: the upper or the lower game. Thus we will simply solve for the lower half of the game.

By backward induction, at final decision nodes (t_{11} and t_{12}, t_{11}' and t_{12}') incumbents will choose politics that maximize their utility as common citizens, which means that they will choose the fiscal policy (g,τ) [13] that equalizes the marginal utility of private consumption c to the marginal utility of public good consumption g and to the discounted marginal utility of public investment, k, according to equations (10) and (11). This is due to the fact that there will be no further elections, so that the incumbent cannot benefit of a deviation from the social optimum choice. The same argumentation applies to strategies at nodes t_9, t_{10}, t_9' and t_{10}'. Thus,

$$E_{T-4}[W(\varepsilon_{T-s}, F_{T-s})] = E_{T-4}[W^*(\varepsilon_{T-s}^i, F_{T-s})], \quad \forall i = I, P, \quad \forall s = 0,1,2,3.$$

[13] Incumbent chooses strategy (g, τ, k_+), but since k_+ is obtained residually from equation (3), we are simplifying notation to (g, τ).

Figure 2: Game with Asymmetric Information



On information set $\{t_8, t_8'\}$, voters have the opportunity to vote and choose the next mayor. We will consider two cases: fist, the current mayor is allied to state governor (D^I=1, D^P=0); second, the opponent is the one who is favored by the governor (D^I=0, D^P=1).

Case 1: Incumbent and governor from the same party, i.e., D^I=1, D^P=0.

The mayor will be reelected if and only if $E[\Gamma^I_{T-4}] \geq E[\Gamma^P_{T-4}]$. At the end of period T–4, voters are concerned about what is going to happen from period T–3 onwards, such that voter's choice will be v=1 (reelect the incumbent), if $E[\sum_{s=T-3}^{T} \Gamma^I_{s,T-3}] \geq E[\sum_{s=T-3}^{T} \Gamma^P_{s,T-3}]$, or $E[\Gamma^I_{T-3,T-3} + \Gamma^I_{T-2,T-3}] + E[\Gamma^I_{T-1,T-3} + \Gamma^I_{T,T-3}] \geq E[\Gamma^P_{T-3,T-3} + \Gamma^P_{T-2,T-3}] + E[\Gamma^P_{T-1,T-3} + \Gamma^P_{T,T-3}]$.

Using notation Ω^{j,D^i}, as before, the above condition reduces to:
$\hat{\rho}\Omega^{H,1} + (1-\hat{\rho})\Omega^{L,1} + q_{T-3} \geq \Omega^{P,0}$. Therefore,

$$v = 1 \text{ if and only if } q_{T-3} \geq \Omega^{P,0} - \hat{\rho}\Omega^{H,1} - (1-\hat{\rho})\Omega^{L,1} \tag{19}$$

The expected utility $\Omega^{P,0}$ in the above expression is a function of the competence shock and the political factor as well, and represents voter's expected utility, in period t, if the opponent, P, which opposes the state governor, wins the election; the term $\Omega^{H,1}$ (respectively $\Omega^{L,1}$) represents voter's expected utility when the H-type incumbent (respectively type L-type), which is aligned with the state governor, wins the election.

Equation (19) tells us that voters will reelect the incumbent if and only if the appearance shock is greater than the difference between the expected utility they obtain choosing the opponent and the expected utility of reelecting the current incumbent.

Case 2: Incumbent and governor from opposing parties, i.e., D^I=0, D^P=1.

This case is analogous to the previous one. The incumbent will be reelected $(v = 1)$ if and only if $E[\Gamma^I_{T-4}] \geq E[\Gamma^P_{T-4}]$; or

$$v = 1 \text{ if and only if } q_{T-3} \geq \Omega^{P,1} - \hat{\rho}\Omega^{H,0} - (1-\hat{\rho})\Omega^{L,0} \tag{20}$$

Consider now the incumbent's strategy at nodes t_1 and t_1', where we look for pure strategies equilibria. Recall that the incumbent doesn't observe the appearance shock when he chooses fiscal policy in the beginning of each year. However, in equilibrium (g, τ) must be a best response to beliefs $\hat{\rho}(g,\tau,F)$. Given those beliefs, he will be reelected if $q \geq \Omega^{P,D^P} - \hat{\rho}\Omega^{H,D^I} - (1-\hat{\rho})\Omega^{L,D^I}$.

Let $\pi(\hat{\rho}(g,\tau,F),D^I)$ be the incumbent's estimate of his probability of winning elections. Recall that q has distribution function G. Then,

$$\pi(\hat{\rho}(g,\tau,F),D^I) = E^I[v \mid g,\tau,F] = \text{Prob}\left[q \geq \Omega^{P,D^P} - \hat{\rho}\Omega^{H,D^I} - (1-\hat{\rho})\Omega^{L,D^I}\right] = 1 - G\left[\Omega^{P,D^P} - \hat{\rho}\Omega^{H,D^I} - (1-\hat{\rho})\Omega^{L,D^I}\right] \quad (21)$$

Thus, the greater $\left[\Omega^{P,D^P} - \hat{\rho}\Omega^{H,D^I} - (1-\hat{\rho})\Omega^{L,D^I}\right]$, the greater will be the value for function $G(.)$ and then, the smaller will be the probability $\pi(.)$ that the incumbent wins elections. This discussion is similar to Rogoff (1990).

This is a typical signaling game, in which the first player to move (in this case, the incumbent) knows his type (H or L) and sends a signal (g,τ) to the second player (voters) who interpret the signal and choose action (vote). The possibility of signaling exists because there is a ceiling to the size of the distortion on fiscal policy which the incumbent would be willing to set. This ceiling is due to the fact that the incumbent values office holding but also, as a citizen, values public policy.

We defined earlier the high competence incumbent (type H), as $\varepsilon^H = \alpha_{t-1} + \alpha^H$ and the low competency (type L), as $\varepsilon^L = \alpha_{t-1} + \alpha^L$. The incumbent, whatever his type, will choose the strategy (g,τ) in order to maximize his expected utility. Thus, he will solve the following maximization problem:

$$\begin{aligned} &\underset{g,\tau}{Max}\, Z[g,\tau,F,\hat{\rho}(g,\tau,F),\varepsilon^i] \\ &s.t.\ \ g \geq 0, c = y - \tau \geq 0, k = \tau + \varepsilon^i + F - g \geq 0; \quad i = H, L \end{aligned} \quad (22)$$

Where,

$$Z[g,\tau,F,\hat{\rho}(g,\tau,F),\varepsilon^i] = W(g,\tau,\varepsilon^i,F) + X^{i,D^I}\pi[\hat{\rho}(g,\tau,F),D^I] \quad (23)$$

Equation (24) explains the term X^{i,D^I} as the continuation utility of the incumbent when he is reelected. Observe that it is a function of the utility that the incumbent gets for holding office in each of the four years of mandate, added to the utility that he would have as a regular citizen if he continues in office, subtracted from the utility that he would get if the opponent wins the election, discount by the factor, β.

$$X^{i,D^I} = \beta[X(1+\beta+\beta^2+\beta^3) + \Omega^{I,D^I} - \Omega^{P,D^P}] \quad (24)$$

Define $v(\hat{\rho}(g,\tau,F),q-q^P,D^I)$ as the strategy chosen by voters on information set $\{t_8,t_8'\}$. Then, the strategy profile $\{[(g^i,\tau^i), v(\hat{\rho}(g,\tau,F),q,D^I)];\ i=H,L\}$ describes a perfect Bayesian equilibrium if the following conditions are met. First, (g^i,τ^i) is set to solve maximization problem (22). Second, beliefs are consistent with Bayes rule. Third, voters' strategy $\{\nu(.);\nu(.)\in\{0,1\}\}$ is such that $\nu(.)=1$ if equation (19) is fulfilled (or equation (20), according to the case) and $\nu(.)=0$, otherwise.

Signaling games typically allow for infinite solutions involving both separating and pooling equilibria. Next sections analyses the possible non-dominated and intuitive[14] equilibria.

5.1. Separating Equilibria

In a separating equilibrium, the incumbent's strategy at node t_1 is different from the strategy at node t_1': $(g^H,\tau^H)\neq(g^L,\tau^L)$. In this kind of equilibrium, voters update beliefs so that, $\hat{\rho}(g^L,\tau^L,F)=0$ and $\hat{\rho}(g^H,\tau^H,F)=1$.

It is important to highlight that in this model it is possible to have two different kinds of separating equilibria that we will call the cost equilibria with signaling and the costless separating equilibria. In the first type of equilibria, if the competent incumbent chooses the optimum strategy of complete information, then the incompetent will have an electoral incentive to mimic that same strategy. Therefore, the competent incumbent will have to distort the optimal fiscal policy up to the point that the incompetent incumbent will not be able to mimic him anymore. This equilibrium involves (costly) signaling by the competent incumbent. In the second kind of separating equilibrium, the incompetent incumbent has no electoral incentive to mimic the competent one when the latter adopts the optimal complete information policy. Then, both types of incumbent choose their respective optimal complete information fiscal policies. In this case we say that there is a costless separating equilibrium.

Similarly to the complete information analysis, we will study two cases. In case 1, the opponent is favored by the governor , $(D^I=0,\ D^P=1)$. In the second case, the governor supports the current incumbent, $(D^I=1,\ D^P=0)$.

Case 1: Incumbent and governor from the same party, i.e., D^I=1, D^P=0.

[14] In the sense of Cho & Kreps (1987).

Suppose first that $\Omega^{P,0} > \Omega^{L,1}$, i.e., partisan transfers are not dominant compared to the competence effect. Then, condition (19) will hold for the expected realization of q if $\hat{\rho} = 1$, but does not hold if $\hat{\rho} = 0$. Let us look for the separating equilibria. The analysis in this situation mirrors Rogoff (1990).

Under the present assumption, voters prefer to reelect a competent incumbent, but prefer to replace an incompetent one, even though it means less intergovernmental transfers in the future. Hence, the optimum strategy for the incompetent incumbent is exactly the same as in the model with complete information, that is:

$$(g^L, \tau^L) = [g^*(\varepsilon^L, F), \tau^*(\varepsilon^L, F)] = [g^*(\varepsilon^L, a+b), \tau^*(\varepsilon^L, a+b)] \qquad (25)$$

Now, suppose initially that off-the-equilibrium-path beliefs are $\hat{\rho}(g, \tau, F) = 0,\ \forall (g, \tau) \neq (g^H, \tau^H)$. In order for the strategy $[g^*(\varepsilon^L, a+b), \tau^*(\varepsilon^L, a+b)]$ to be part of a separating equilibrium, the type L incumbent must not have an incentive to mimic type H's strategy. Therefore, it must be the case that:

$$Z(g^*(\varepsilon^L, a+b), \tau^*(\varepsilon^L, a+b), a, 0, \varepsilon^L) \geq Z(g, \tau, a+b, 1, \varepsilon^L).$$

Define A_1 as the set of all (g, τ) such that incumbent of type L prefers to choose his optimum complete information strategy than mimicking type H.

$$A_1 = \{(g, \tau) \mid Z(g, \tau, a+b, 1, \varepsilon^L) \leq Z(g^*(\varepsilon^L, a+b), \tau^*(\varepsilon^L, a+b), a+b, 0, \varepsilon^L)\} \qquad (26)$$

In Figure 3, set A_1 corresponds to all points that are on or outside the dotted ellipse[15]. The curve $\tau = \varphi(g, F)$ corresponds to the solutions to the within-period optimality condition (11). Points I and J correspond to the optimum choices of incumbents of type L and H, respectively, in the game with complete information. If all goods are normal, then J will be positioned at the southeast of I. Function $\tau = \varphi(g, F)$ represents the set of all policies (g, τ) that equalize marginal utilities of consuming private good and public good (equation 11).

---

[15] Observe that the optimum strategy for type L, which corresponds to point $I = [g^*(\varepsilon^L, a), \tau^*((\varepsilon^L, a)]$ is such that $I \notin A_1$. To confirm this information one should substitute this strategy into equation (26). Remember that $W(g,\tau,\varepsilon,F) = U(y-\tau, g) + \beta V(\tau+\varepsilon+F-g)$ and that $U(.)$ and $V(.)$ are continuous and well behaved functions. Thus, there is a convex set, in the neighborhood of point I, such that this set is not within A_1. Therefore A_1 can be depicted in Figure 3 as the set of all points that are outside or on the dotted ellipse.

Let B_1 be the set of all strategies (g,τ) such that a competent incumbent prefers to choose them and be sure that voter believe he is competent and reelect him, than choosing his optimum complete information strategy and not being reelected.

$$B_1 = \{(g,\tau) \mid Z(g,\tau,a+b,1,\varepsilon^H) \geq Z(g^*(\varepsilon^H,a+b),\tau^*(\varepsilon^H,a+b),a+b,0,\varepsilon^H)\} \tag{27}$$

Then, a second condition for a separating equilibrium is that $(g^H,\tau^H) \in B_1$. In Figure 3, the set B_1 corresponds to the area within or on the solid ellipse[16]. The shaded area $B_1 \cap A_1$ corresponds to the locus of all strategies that can result in separating equilibria.

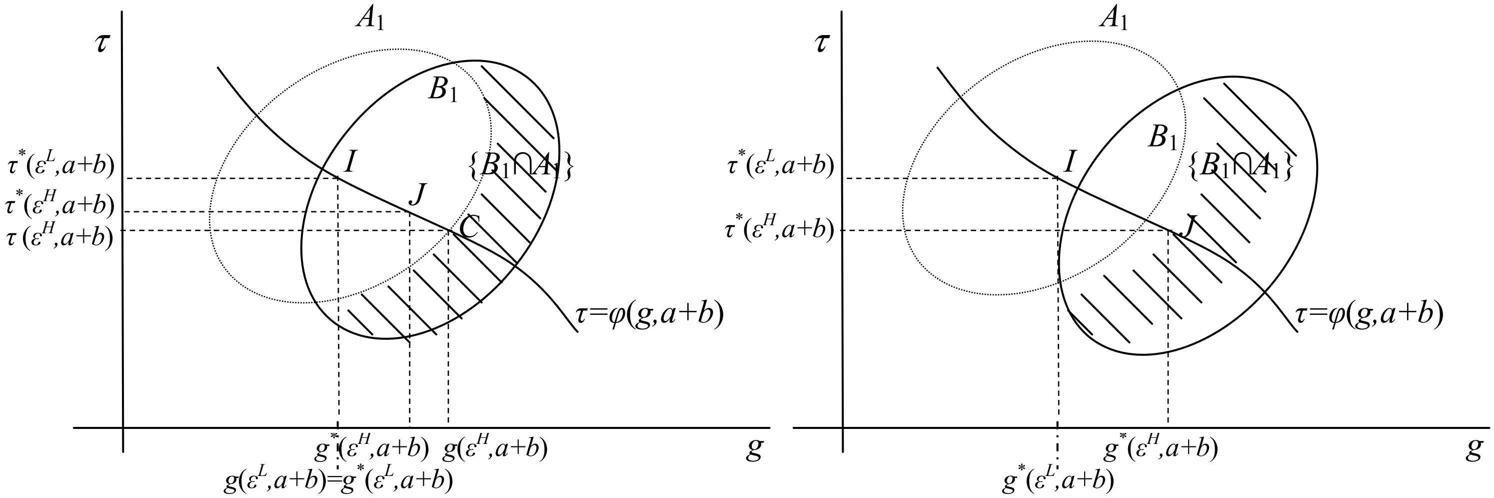
***PROPOSITION* 2.** *Suppose that* $\Omega^{P,0} > \Omega^{L,1}$. *Then, the set of all separating equilibria is nonempty and is characterized by* $(g^L,\tau^L) = [g^*(\varepsilon^L,a+b),\tau^*(\varepsilon^L,a+b)]$ *and* $(g^H \tau^H) \in B_1 \cap A_1$. *Furthermore there is a unique and non-dominated separating equilibrium. This equilibrium corresponds to the competent incumbent choosing the policy* $(g^H \tau^H) \in B_1 \cap A_1$ *on the optimal curve* $\tau = \varphi(g,a+b)$ *that is closest to the complete information optimal choice* $[g^*(\varepsilon^H,a+b),\tau^*(\varepsilon^H,a+b)]$.

Proof: See appendix.

According to Proposition 2, there is a unique non-dominated separating equilibrium in the game with asymmetric information. Note that if the optimum strategy for type H in the complete information game, represented by point J in Figure 3 is such that $J \in B_1 \cap A_1$, then the separating equilibrium emerges naturally without any signaling cost to the competent incumbent (Figure 3 b). Otherwise, separation is costly (Policy C in Figure 3 a). Note that when $\Omega^{P,0} > \Omega^{L,1}$ then partisan transfers do not alter Rogoff (1990)'s property of selecting the most competent incumbent.

[16] Note that $J = [g^*(\varepsilon^H,a+b),\tau^*((\varepsilon^H,a+b)] \in B_1$. To confirm this information, one should substitute J into (27). Remember that $W(g,\tau,\varepsilon,a+b) = U(y-\tau,g)+\beta V(\tau+\varepsilon+a+b-g)$. Furthermore, since $U(.)$ and $V(.)$ are continuous and well behaved functions, then there is a convex set, in the neighborhood of J, such that this set is also contained in B_1. Hence, B_1 can be shown is Figure 3 as a set of all points within or on the solid ellipse.

Figure 3: Separating Equilibrium with Supporting Governor



a. **Costly separating equilibrium** ***b.*** **Costless separating equilibrium**

Suppose now that $\Omega^{P,0} < \Omega^{L,1}$. Then condition (19) will hold for the expected realization of the popularity shock q. Therefore the incumbent expects to be reelected even if voters are sure he is incompetent. But then, the incumbent of each type chooses his optimal complete information policy. This is a separating equilibrium in which the incumbent is always reelected, regardless of competence. This may happen if the intergovernmental transfers are large enough so that they totally offset the benefits of administrative competence. The unique solution to this extreme case highlights the important role that partisan transfers may play in the municipal electoral equilibrium and how it may lead to a result that is totally opposed to the one obtained in Rogoff (1990). Indeed, Rogoff (1990) finds that the political budget cycle is a compromise in which voters give up part of their moral hazard concerns (thus accepting a distorted fiscal policy) in order to satisfy their adverse selection concerns (electing the more competent incumbent). In the present equilibrium, however, voters will give up selecting the most efficient incumbent but gain on moral hazard as both types of incumbent choose first best fiscal policies.

Case 2: Incumbent and governor from opposing parties, i.e., $D^I=0$, $D^P=1$.

The analysis is analogous to the previous case and is presented here for the sake of completeness.

Suppose first that $\Omega^{P,1} < \Omega^{H,0}$, i.e., condition (20) will hold for the expected realization of q if $\hat{\rho} = 1$. Let us look for the separating equilibria.

In this case, the incompetent incumbent is in the worst condition: besides being incompetent, voters know that he is not allied to state governor, thus the city will receive only mandatory transfers ($F = a$) if he is reelected. Therefore, the mayor knows that without a suitable appearance shock (a very high value of q), he will not be reelected ($\pi(0,0) < 0{,}5$). This is the same result obtained in the game with complete information: $\Omega^{L,0}<\Omega^{P,1}$. Hence, the optimum strategy for the incompetent incumbent in a separating equilibrium is exactly the same as in the model with complete information, that is:

$$(g^L, \tau^L) = \left[g^*(\varepsilon^L, F), \tau^*(\varepsilon^L, F)\right] = \left[g^*(\varepsilon^L, a), \tau^*(\varepsilon^L, a)\right] \tag{28}$$

Now, suppose initially that off-the-equilibrium-path beliefs are $\hat{\rho}(g,\tau,F) = 0,\ \forall (g,\tau) \neq (g^H, \tau^H)$. In order for the strategy $[g^*(\varepsilon^L, a), \tau^*(\varepsilon^L, a)]$ to be part of a separating equilibrium, type L incumbent must not have incentive to mimic type H's strategy. Therefore, it must be the case that:

$$Z(g^*(\varepsilon^L, a), \tau^*(\varepsilon^L, a), a, 0, \varepsilon^L) \geq Z(g, \tau, a, 1, \varepsilon^L).$$

Define A_1 as the set of all (g,τ) such that incumbent of type L prefers to choose his optimum complete information strategy than mimicking type H.

$$A_1 = \left\{(g,\tau) \mid Z(g,\tau,a,1,\varepsilon^L) \leq Z(g^*(\varepsilon^L, a), \tau^*(\varepsilon^L, a), a, 0, \varepsilon^L)\right\} \tag{29}$$

In Figure 3, set A_1 corresponds to all points that are on or outside the dotted ellipse[17]. The curve $\tau = \varphi(g, F)$ corresponds to the solutions to the within-period optimality condition (11). Points I and J correspond to the optimum choices of incumbents of type L and H, respectively, in the game with complete information. If all goods are normal, then J will be positioned at the

[17] Observe that the optimum strategy for type L, which corresponds to point $I = [g^*(\varepsilon^L, a), \tau^*((\varepsilon^L, a)]$ is such that $I \notin A_1$. To confirm this information one should substitute this strategy into equation (26). Remember that $W(g,\tau,\varepsilon,F)=U(y-\tau,g)+\beta V(\tau+\varepsilon+F-g)$ and that $U(.)$ and $V(.)$ are continuous and well behaved functions. Thus, there is a convex set, in the neighborhood of point I, such that this set is not within A_1. Therefore A_1 can be depicted in Figure 3 as the set of all points that are outside or on the dotted ellipse.

southeast of I. Function $\tau = \varphi(g,F)$ represents the set of all points (g,τ) that equalize marginal utilities of consuming private good and public good (equation 11).

Let B_1 be the set of all strategies (g,τ) such that a competent incumbent prefers to choose them and be sure that voter believe he is competent and reelect him, than choosing his optimum complete information strategy and not being reelected.

$$B_1 = \{(g,\tau) \mid Z(g,\tau,a,1,\varepsilon^H) \geq Z(g^*(\varepsilon^H,a),\tau^*(\varepsilon^H,a),a,0,\varepsilon^H)\} \tag{30}$$

Then, a second condition for a separating equilibrium is that $(g^H,\tau^H) \in B_1$. In Figure 4, the set B_1 corresponds to the area within or on the solid ellipse[18]. The shaded area $B_1 \cap A_1$ corresponds to the locus of all strategies that can result in separating equilibria.

***PROPOSITION* 3.** *Suppose that $\Omega^{P,1} < \Omega^{H,0}$. Then, the set of all separating equilibria is nonempty and is characterized by $(g^L,\tau^L) = [g*(\varepsilon^L,F),\tau*(\varepsilon^L,F)]$ and $(g^H \tau^H) \in B_1 \cap A_1$. Furthermore there is a unique and undominated separating equilibrium. This equilibrium corresponds to the competent incumbent choosing the policy $(g^H \tau^H) \in B_1 \cap A_1$ on the optimal curve $\tau = \varphi(g,F)$ that is closest to the complete information optimal choice $[g*(\varepsilon^H,F),\tau*(\varepsilon^H,F)]$.*

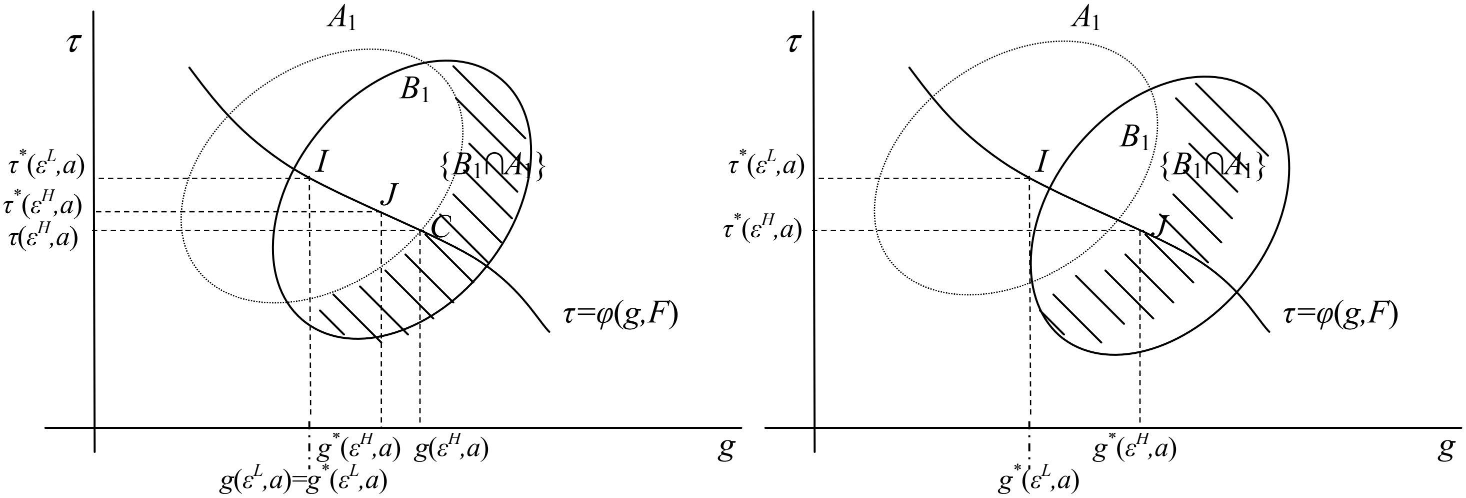
Proof: Analogous to proof of Proposition 2. See appendix.

According to Proposition 3, there is a unique non-dominated separating equilibrium in the game with asymmetric information. Note that if the optimum strategy for type H in the complete information game, represented by point J in Figure 3 is such that $J \in B_1 \cap A_1$, then the separating equilibrium emerges naturally without any signaling cost to the competent incumbent (Figure 4 b). Otherwise, separation is costly (Policy C in Figure 4 a). Note that when $\Omega^{P,1} < \Omega^{H,0}$ then partisan transfers do not alter Rogoff (1990)'s property of selecting the most competent incumbent.

---

[18] Note that $J = [g^*(\varepsilon^H,a),\tau^*((\varepsilon^H,a)] \in B_1$. To confirm this information, one should substitute J into (27). Remember that $W(g,\tau,\varepsilon,a+b) = U(y-\tau,g)+\beta V(\tau+\varepsilon+a+b-g)$. Furthermore, since $U(.)$ and $V(.)$ are continuous and well behaved functions, then there is a convex set, in the neighborhood of J, such that this set is also contained in B_1. Hence, B_1 can be shown is Figure 4 as a set of all points within or on the solid ellipse.

Figure 4: Separating Equilibrium with Opposing Governor



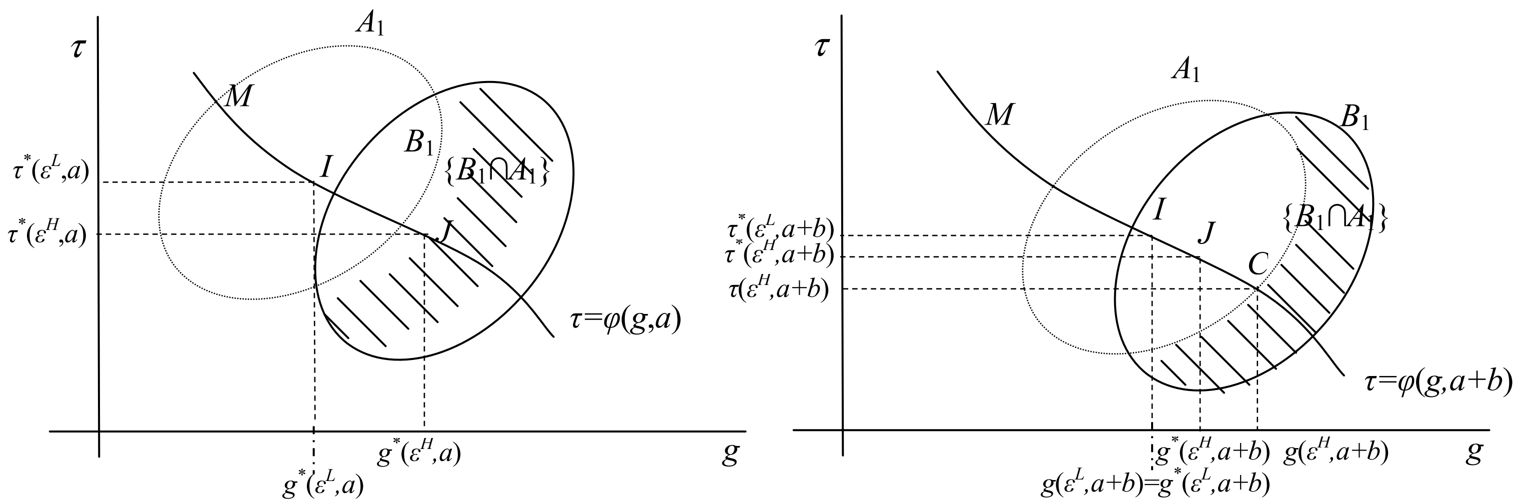
***a.* Costly separating equilibrium** ***b.* Costless separating equilibrium**

Suppose now that $\Omega^{P,1} > \Omega^{H,0}$. Then, condition (20) will not be satisfied for the expected realization of the popularity shock q. Therefore the incumbent expects not to be reelected even if voters are sure he is competent. But then, the incumbent of each type chooses his optimal complete information policy. This is a separating equilibrium in which the incumbent is not reelected, regardless of his competence. This may happen if the intergovernmental transfers are large enough so that they totally offset the benefits of administrative competence. This unique highlights once again the important role partisan transfers may play in the municipal electoral equilibrium.

Comparing the two cases when there is political budget cycle, it is noteworthy that the ellipses in Figure 3 should in fact be more to the lower right hand side and larger than the corresponding ellipses in Figure 4, due to the fact that the budget constraint of the incumbent are more relaxed in Figure 3 (the additional voluntary transfers b). Therefore, one should expect that the distortion associated to the political budget cycle to be more significant in that case. Hence, a natural extrapolation to a comparison with the no-transfers case suggests that the presence of voluntary transfers may, indeed, increase the distortion caused by the budget cycle.

Moreover, under certain conditions, the existence of partisan transfers may create a political budget cycle where it would not occur without those transfers. This may happen because the transfers reduce the importance of the difference between the efficient and the in efficient incumbent, when he is supported by the governor. Indeed, it may be the case that, without any transfers the advantage in competence would have been significant enough so that the incompetent would not have any incentive to mimic the competent incumbent even when the latter chooses the optimal complete information fiscal policy. In this case there would be no costly signaling. But then, because both incumbents are more similar in terms of production abilities when supported by the governor, the more competent one may need to distort fiscal policy in order to signal his type in the presence of transfers. This situation is presented in figure 5 below.

Figure 5: Political Budget Cycle Created by Partisan Transfers



***a.* Costless separating equilibrium without partisan transfers**

***b.* Costly signaling separating equilibrium with partisan transfers**

5.2. Pooling Equilibria

Note first that a pooling equilibrium can only occur if intergovernmental transfers are not too significant, i.e., when $\Omega^{L,1} < \Omega^{P,0} < \Omega^{H,1}$ for the case where the incumbent belongs to the same party as the governor, or when $\Omega^{L,0} < \Omega^{P,1} < \Omega^{H,0}$ for the case where the incumbent opposes the governor. In that case, in any pooling equilibrium the strategy of type L incumbent at node t_1 is the same as type H's strategy at node t_2: $(g^L,\tau^L)=(g^H,\tau^H)$. In this kind of equilibrium, voters can't update beliefs, thus, $\hat{\rho}(g,\tau,F)=\rho$, where $F=a$ or $F=a+b$ according to the case.

If $J \notin B_1 \cap A_1$, that is, if $[g^*(\varepsilon^H, F), \tau^*(\varepsilon^H, F)]$ is not part of a separating equilibrium, then, $(g^L, \tau^L) = (g^H, \tau^H) = [g^*(\varepsilon^H, F), \tau^*(\varepsilon^H, F)]$ and $\hat{\rho}(g^H, \tau^H, F) = \rho$ might be a part of a perfect Bayesian equilibrium. But this strategy profile, or any other, will only be a pooling equilibrium if type L is able to gain at least the same that he would gain if he chose $(g^L, \tau^L) = [g^*(\varepsilon^L, F), \tau^*(\varepsilon^L, F)]$. Therefore, (g, τ) will be a pooling equilibrium only if:

1) $Z(g, \tau, F, \rho, \varepsilon^L) \geq Z(g^*(\varepsilon^L, F), \tau^*(\varepsilon^L, F), F, 0, \varepsilon^L)$, and
2) (g, τ) is such that $g \geq g^*(\varepsilon^H, F)$ and $\tau \leq \tau^*(\varepsilon^H, F)$.

There are multiple undominated pooling equilibria. This multiplicity of equilibria is due to the lack of restriction to off-the-equilibrium-path beliefs in Perfect Bayesian Equilibrium. In fact, there are always off-the-equilibrium-path beliefs that support a given equilibrium. In order to rule out this multiplicity of equilibria, we follow Cho & Kreps (1987)'s intuitive criterion. But then, it follows that all pooling equilibria are unintuitive.

***PROPOSITION* 4.** *All pooling equilibria are unintuitive.*
Proof: See appendix.

According to Propositions 3 and 4, the unique intuitive equilibria of the game with asymmetric information are the separating ones. Therefore, regardless of whether the competent incumbent is chosen or not, all intuitive perfect Bayesian equilibria fully reveal the competence of the incumbent.

6. Conclusion

Both empirical evidence and theoretic analysis suggest a significant relation between macroeconomic outcomes and electoral performance. This relation tends to induce executive incumbents to inflate fiscal policy in electoral years, in order to foster an artificial improvement in economic performance followed by a worsening in the years that follows, producing what is known as a political budget cycle after the seminal analysis in Rogoff (1990).

According to that study, political budget cycles are a second best equilibrium that allows voters to identify and elect the most competent politicians. However, Rogoff's landmark article does not take into account a key aspect present in most fiscal federations, which is the existence of different levels of government (local, state and federal) with important intergovernmental transfers.

This suggests further analyses in order to understand the role of those transfers on the electoral equilibrium. The first part of the present paper performs an econometric analysis of this question for Brazil and finds evidence of a bias in voluntary transfers in the sense that they are significantly explained by partisan identification between the state governor and the mayor.

The second part of our study was dedicated to extending the Rogoff (1990)'s model in order to incorporate the staggered elections for mayors and governors, a reality of our Brazilian case study, and to determine the effect of partisan intergovernmental transfers on the outcome of municipal elections.

The main theoretical finding is that voluntary transfers have the potential effect of breaking down the positive result associated to the political budget cycle found in Rogoff (1990), namely the selection of the candidate with the highest administrative competence. Our extension shows that even with complete information voters may, rationally, decide not to reelect a competent incumbent when he is not favored by the state governor. This happens because voters understand that the additional transferences the challenger candidate will receive from the state government will more than offset the lack of administrative competence. Similarly, voters may find it optimal to keep an incompetent incumbent that belong to the same party as the governor in order to maintain the influx of voluntary transfers from the state.

When we move to the model with asymmetric information, our analysis confirms Rogoff (1990) under certain circumstances, but also may generate very different results, in that adverse selection may subsist in equilibrium.

First, moral hazard, that is the choice of a sub-optimal fiscal policy, will happen in equilibrium in the form of a political budget cycle if partisan transfers are not very significant. In that case, Rogoff (1990)'s optimal selection of the political budget cycle is preserved.

However, adverse selection may also happen in two symmetric situations. First, when a governor supports an incompetent incumbent, which is reelected due to high partisan transfers. Second, when the governor supports the challenger against a competent incumbent and the challenger wins the elections if the subsequent partisan transfers are high enough. In both cases there is full revelation of the incumbent's competence in equilibrium with no political budget cycle.

Therefore, our model shows that the political equilibrium does not necessarily exhibits budget cycles. Moreover, the political process does not always lead to the election of the most competent politician. The model highlights the role of partisan transfers in determining which type of phenomenon, moral hazard (political budget cycles) or adverse selection (the election of an incompetent politician) will hold in equilibrium. Indeed, if partisan transfers are high enough, voters prefer to elect a candidate from the same party as the state governor and there are no budget cycles in equilibrium. Conversely, if partisan transfers are not very significant, voters choose the most competent politician but there are (typically) budget cycles in equilibrium.

The policy recommendations of the present study are very clear. If one believes the adverse selection problem is most damaging to society, then voluntary intergovernmental transfers should be carefully regulated in order to avoid their partisan use.

This paper is a first attempt to extend Rogoff (1990)'s model in order to analyze issues of fiscal federalism. It could be further extended in several ways to deepen the insights obtained so far. First, one may ask what happens if there a bias towards a specific party in the staggered state elections. Second, and more generally, one would like to present a complete model where voters choose both their mayor and, in a larger election, the governor. Then the decision of the governor as to which municipality to make transfers to and as to the specific amount of transfers will be endogenous to the model. These extensions are left as suggestions for future research.

Acknowledgements

The authors thank Werner Baer, Mirta Bugarin, Esteves Conalgo Jr., Giovanni Facchini, Brian Gaines, Mattias Polborn, Leonardo Rezende, the participants of the 2004 Meeting of the Brazilian Econometric Society and of the University of Illinois Political Economy Workshop for insightful comments and suggestions. The financial support of CNPq/Brazil and the Brazilian Central Bank Graduate Program are gratefully acknowledged. The views expressed here are the authors' sole responsibility.

References

Alesina, A., Rosenthal, H. 1996. "A Theory of Divided Government". *Econometrica*, 64, 1311−1341.

BRAZIL. Law n.º 9.504, September 30th , 1997.

BRAZIL. Complementary Law n.º 101, May 4th , 2000.

Cho, I.-K. and Kreps, D. M. 1987. "Signaling Games and Stable Equilibria." *Quarterly Journal of Economics*, 102, 179-221.

Greene, W. H. 2000. *Econometric Analysis,* Prentice Hall, New Jersey, 4th edition, 2000.

Kerr, W. A. 1944. "A Quantitative Study of Political Behavior", *Journal of Social Psychology*, 19, 273–81.

Kramer, G. H. 1971. "Short Term Fluctuations in U.S. Voting Behavior, 1896–1964", *American Political Science Review*, 65, 131–43.

Nordhaus, W. D. 1975. "The Political Business Cycle". *The Review of Economic Studies*, 42, 169−190.

Persson, T. & Tabellini, G. 2000. *Political Economics: Explaining Economic Policy*. Cambridge: MIT press.

Prado, Sérgio. *Transferências Fiscais e Financiamento Municipal no Brasil.* (Fiscal Transfers and the Financing of Municipalities in Brazil). Mimeo. UNICAMP, julho de 2001.

Rogoff, K. 1990. "Equilibrium Political Budget Cycles". *The American Economic Review*, 80, 21−36.

Brazilian Treasure Secretariat. "Finanças do Brasil" (Brazilian Finances), available on http://www.stn.fazenda.gov.br/estados_municipios/index.asp.

Wooldridge, J. 2002. *Econometric Analysis of Cross Section and Panel Data*, MIT press.

Appendix

Cluster analysis

The table below presents the output of a fixed effect regressions run after the division of municipalities into 10 clusters selected using factor and cluster analysis in order to maximize homogeneity of municipalities within each cluster and maximize the differences among clusters. Although all municipalities were used in order to determine the clusters, only the original 1414 cities for which we had detailed fiscal and electoral data were used in the econometric analysis. Clusters 4, 7 and 9 contained a very reduced number of municipalities and therefore were excluded from the sample. The variables are similar to the ones in section 2 and self explanatory. For example, variable $Ds.POP1_{i,t}$, indicates the product of dummy *Ds* and the natural log of population of city *I* in cluster 1 at period *t*. The results points to the significance of partisan motivated transfers from states to cities in clusters 5, 6, 8 and 10. These clusters represent 3417 cities in Brazil (62% of the total of 5506 municipalities considered within this study).

Testing Partisan Transfers in Brazil: a Cluster Analysis

$Transf_{i,t}$	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
$TMand_{i,t}$	**0.76044**	0.014	54.49	**0.00**	0.733	0.788
$RT_{i,t}$	-0.00184	0.003	-0.7	0.48	-0.007	0.003
$POP_{i,t}$	**0.10020**	0.018	5.57	**0.00**	0.065	0.135
$Year_t$	**0.01402**	0.002	7.27	**0.00**	0.010	0.018
$D_S.POP1_{i,t}$	-0.00076	0.002	-0.46	0.65	-0.004	0.002
$D_S.POP2_{i,t}$	0.00141	0.002	0.9	0.37	-0.002	0.004
$D_S.POP3_{i,t}$	-0.00001	0.001	-0.01	0.99	-0.001	0.001
$D_S.POP5_{i,t}$	**0.00235**	0.001	1.91	**0.06**	0.000	0.005
$D_S.POP6_{i,t}$	**0.00217**	0.001	2.48	**0.01**	0.000	0.004
$D_S.POP8_{i,t}$	**0.00188**	0.000	3.87	**0.00**	0.001	0.003
$D_S.POP10_{i,t}$	**0.00106**	0.001	1.75	**0.08**	0.000	0.002
$D_P.POP1_{i,t}$	0.00124	0.002	0.6	0.55	-0.003	0.005
$D_P.POP2_{i,t}$	0.00018	0.002	0.1	0.92	-0.003	0.004
$D_P.POP3_{i,t}$	**0.00158**	0.001	1.65	**0.10**	0.000	0.003
$D_P.POP5_{i,t}$	0.00049	0.001	0.39	0.70	-0.002	0.003
$D_P.POP6_{i,t}$	**-0.00353**	0.001	-2.55	**0.01**	-0.006	-0.001
$D_P.POP8_{i,t}$	0.00080	0.001	1.1	0.27	-0.001	0.002
$D_P.POP10_{i,t}$	0.00043	0.001	0.56	0.58	-0.001	0.002
α_1	**2.80372**	0.235	11.93	**0.00**	2.343	3.264

Number of obs:	9888
Number of groups:	1414
R-sq (within):	0.898
F(18,8456) =	4145

***Proof of Proposition* 1.** From expressions (13), (14) and (15) se may write:

$\Omega^{H,0} = u + v$, $\Omega^{P,1} = x + y$, $\Omega^{L,1} = z + w$, $\Omega^{P,0} = m + n$, where,

$u = \rho w^*(2\alpha^H + a) + (1-\rho)w^*(\alpha^H + \alpha^L + a)$,

$v = \beta\left[\rho^2 w^*(2\alpha^H + a) + 2\rho(1-\rho)w^*(\alpha^H + \alpha^L + a) + (1-\rho)^2 w^*(2\alpha^L + a)\right]$,

$x = \rho^2 w^*(2\alpha^H + a + b) + 2\rho(1-\rho)w^*(\alpha^H + \alpha^L + a + b) + (1-\rho)^2 w^*(2\alpha^L + a + b)$,

$y = \beta\left[\rho^2 w^*(2\alpha^H + a + b) + 2\rho(1-\rho)w^*(\alpha^H + \alpha^L + a + b) + (1-\rho)^2 w^*(2\alpha^L + a + b)\right]$,

$z = \rho w^*(\alpha^H + \alpha^L + a + b) + (1-\rho)w^*(2\alpha^L + a + b)$,

$w = \beta\left[\rho^2 w^*(2\alpha^H + a + b) + 2\rho(1-\rho)w^*(\alpha^H + \alpha^L + a + b) + (1-\rho)^2 w^*(2\alpha^L + a + b)\right]$

$m = \rho^2 w^*(2\alpha^H + a) + 2\rho(1-\rho)w^*(\alpha^H + \alpha^L + a) + (1-\rho)^2 w^*(2\alpha^L + a)$,

$n = \beta\left[\rho^2 w^*(2\alpha^H + a) + 2\rho(1-\rho)w^*(\alpha^H + \alpha^L + a) + (1-\rho)^2 w^*(2\alpha^L + a)\right]$,

(i) Consider the comparison between $\Omega^{H,0} = u + v$ and $\Omega^{P,1} = x + y$.

Note that, for every b>0, y>v. Therefore, a sufficient condition for $\Omega^{P,1}$ to be bigger than $\Omega^{H,0}$ is that x≥u, which is condition (17).

(ii) Consider now the comparison between $\Omega^{L,1} = z + w$, and $\Omega^{P,0} = m + n$.
Note first that, for every b>0, w>n. Therefore, a sufficient condition for $\Omega^{L,1}$ to be bigger than $\Omega^{P,0}$ is that z≥m, which is condition (18).

(iii) Note first that x can be rewritten as:

$$x = \rho\left[\rho w^*(2\alpha^H + a + b) + (1-\rho)w^*(\alpha^H + \alpha^L + a + b)\right] + (1-\rho)\left[\rho w^*(\alpha^H + \alpha^L + a + b) + (1-\rho)w^*(2\alpha^L + a + b)\right]$$

Therefore, x will be higher than u, in which case $\Omega^{P,1} > \Omega^{H,0}$, whenever:

$$\rho w^*(\alpha^H + \alpha^L + a + b) + (1-\rho)w^*(2\alpha^L + a + b) \geq \rho w^*(2\alpha^H + a) + (1-\rho)w^*(\alpha^H + \alpha^L + a).$$

Suppose now that $b \geq \alpha^H - \alpha^L$. Then, substituting b by $\alpha^H - \alpha^L$ in the left hand side of the previous inequality yields:

$$\begin{aligned} \rho w^*(\alpha^H + \alpha^L + a + b) + (1-\rho)w^*(2\alpha^L + a + b) &\geq \rho w^*(\alpha^H + \alpha^L + a + \alpha^H - \alpha^L) + (1-\rho)w^*(2\alpha^L + a + \alpha^H - \alpha^L) \\ &= \rho w^*(2\alpha^H + a) + (1-\rho)w^*(\alpha^H + \alpha^L + a) \end{aligned}$$

Similarly, m can be rewritten as:

$$m = \rho\left[\rho w^*(2\alpha^H + a) + (1-\rho)w^*(\alpha^H + \alpha^L + a)\right] + (1-\rho)\left[\rho w^*(\alpha^H + \alpha^L + a) + (1-\rho)w^*(2\alpha^L + a)\right].$$

Therefore, z will be higher than m, in which case $\Omega^{L,1} > \Omega^{P,0}$, whenever:

$$\rho w^*(\alpha^H + \alpha^L + a + b) + (1-\rho)w^*(2\alpha^L + a + b) \geq \rho w^*(2\alpha^H + a) + (1-\rho)w^*(\alpha^H + \alpha^L + a).$$

But that is the same condition we have shown holds if $b \geq \alpha^H - \alpha^L$.

***Proof of Proposition* 2:** We begin by showing that $B_1 \cap A_1 \neq \phi$. From (24), since $X^{i,D^I} = \beta[X(1+\beta) + \Omega^{i,D^I} - \Omega^{P,D^P}]$, then, $X^{H,D^I} > X^{L,D^I}$. From (3), we see that keeping g and τ constant, a type H invests $(\alpha^H - \alpha^L)$ more units than a type L. Thus, $W(g,\tau,\varepsilon^H,F) > W(g,\tau,\varepsilon^L,F)$. Hence, given the initial hypothesis that $V''(k)$<0, a type H can, keeping (g,τ) constant, cut investments with lower marginal cost than a type L. Thus, since $V(.)$ is continuous and strictly increasing, and $\lim_{k\to 0} V(k) = -\infty$, there is a $\tilde{k}$ such that for all $k \leq \tilde{k}$ the disutility to type L is so high that he won't try any further reduction on investments (k). From that point on, the equilibrium is separating.

We now show that there is a unique non-dominated separating equilibrium, and that within this equilibrium, $U_c(y-\tau,g) = U_g(y-\tau,g)$. We know that by Bayesian consistence, any $(g,\tau) \in B_1 \cap A_1$ guarantees that $\hat{\rho} = 1$. But then, a type H is free to choose a $[(g,\tau) \in B_1 \cap A_1]$ that is more suitable to him. Hence, he will

$$\begin{aligned} &\underset{g,\tau}{Max}\ W(g,\tau,\varepsilon^H,F) + X^{H,D^I}\pi[1,D^I] \\ &s.a.\, g \geq 0 \\ &\quad c = y - \tau \geq 0 \\ &\quad k = \tau + \varepsilon^H + F - g \geq 0 \\ &\quad (g,\tau) \in B_1 \cap A_1 \end{aligned}$$

Again, the second term on the objective function is exogenous[19]. Thus, the incumbent type H will maximize the first term, making this problem similar to the one with complete information, but with the additional restriction: $(g,\tau)\in B_1 \cap A_1$.

This problem has already been solved (equation 11) and the solution, $U_c(c,g)=U_g(c,g)$, shapes the curve $\tau=\varphi(g,F)$ shown in Figure 3. If $J\in B_1\cap A_1$, then, $[g^*(\varepsilon^H,a),\tau^*(\varepsilon^H,a)]$ will be the equilibrium separating strategy for type H.

If $J\notin B_1\cap A_1$, then, since φ'<0, c and g are normal goods, the unique non-dominated separating equilibrium will be given by C=(g,τ) in Figure 3. This is the point on the curve $\tau=\varphi(g,F)$) — with $(g,\tau)\in B_1\cap A_1$ — that is closer to the first best solution in the game with complete information (Point J)[20]. This allocation is efficient in the sense that no other reallocation of between private and public goods can yield superior welfare to voters. Observe that in Figure 3, $g>g^*(\varepsilon^H,a)$ and $\tau^*(\varepsilon^H,a)$.

***Proof of Proposition* 4:** Applying the definition of Cho & Kreps (1987) the equilibrium $\{(g_L,\tau_L),(g_H,\tau_H)\}$ is unintuitive if there is a point $(\bar{g},\bar{\tau})$ such that (31) and (32) are simultaneously satisfied:

$$Z(g^L,\tau^L,\hat{\rho}(g^L,\tau^L,F),\varepsilon^L)>Z(\bar{g},\bar{\tau},1,\varepsilon^L) \tag{31}$$

$$Z(g^H,\tau^H,\hat{\rho}(g^H,\tau^H,F),\varepsilon^H)<Z(\bar{g},\bar{\tau},1,\varepsilon^H) \tag{32}$$

Equation (31) stipulates that a type L strictly prefers the equilibrium strategy (g^L,τ^L) to strategy $(\bar{g},\bar{\tau})$, even if that strategy would delude voter making them believe that he is a type H. Equation (32) tells that a type H strictly prefers strategy $(\bar{g},\bar{\tau})$, if it would convince voters that he is of type H for sure.

Suppose (g^a,τ^a) is any point selected with positive probability by both types. Let $R(g,\tau)$ be a utility surplus for incumbent type i (i=L,H) if he chooses strategy (g,τ) that make voter think he is a type H with probability one, relative to a strategy (g^a,τ^a) that doesn't update voter's belief:

$$R^i(g,\tau)=Z(g,\tau,1,\varepsilon^i)-Z(g^a,\tau^a,\hat{\rho}(g^a,\tau^a,F),\varepsilon^i),\quad i=L,H$$

Then, consider a strategy profile $[(\bar{g},\bar{\tau});\bar{\tau}=\varphi(\bar{g},F)]$ such that:

a) $\varphi(\bar{g},F)-\bar{g}<\tau^*(\varepsilon^H,F)-g^*(\varepsilon^H,F)$. This indicates that the pair $[\bar{g},\varphi(\bar{g},F)]$ is positioned, in Figure 6, to the southeast of $[g^*(\varepsilon^H,F),\tau^*(\varepsilon^H,F)]$.

---

[19] As in the solution with complete information, within separating equilibrium the incumbent's type is revealed, justifying the term being exogenous.

[20] Point $C=(g(\varepsilon^H,a),\tau(\varepsilon^H,a))$ is the strategy of type H that guarantees undominated separating equilibrium. Another way to find this equilibrium other then the graphic solution is: C corresponds to strategy $\{(g,\tau)\,|\,g+\tau=k+\varepsilon^L+F,k=\tilde{k},U_c(.)=U_g(.)\}$ that type L would have chosen if he decided for an amount of investments $k=\tilde{k}$.

b) $R^H[\bar{g},\varphi(\bar{g},F)]=0 \Leftrightarrow Z(\bar{g},\varphi(\bar{g},F),1,\varepsilon^H)-Z(g^a,\tau^a,\hat{\rho}(g^a,\tau^a,F),\varepsilon^H)=0$. This condition makes type H indifferent between choosing $[\bar{g},\varphi(\bar{g},F)]$ and signaling his type to voter or choosing $[g^a,\varphi(g^a,F)]$ and doesn't signal his type.

If $\pi[1,F]>\pi[\hat{\rho},F]$ then, by (23) and (24), $W(\bar{g},\varphi(\bar{g},F),\varepsilon^H,F)<W(g^a,\tau^a,\varepsilon^H,F)$. But then, the pair (g^a,τ^a) is closer to $[g^*(\varepsilon^H,F),\tau^*(\varepsilon^H,F)]$ then $[\bar{g},\varphi(\bar{g},F)]$, meaning that (g^a,τ^a) is positioned at northwest of $[\bar{g},\varphi(\bar{g},F)]$ in Figure 6. Thus, $\varphi(\bar{g},F)-\bar{g}<\tau^a-g^a$. Furthermore, by (3), $g_t+k_{t+1}=\tau_t+\varepsilon_t+F_t$, and if condition (b) is fulfilled, then $R^H[\bar{g},\varphi(\bar{g},F)]=0 \Leftrightarrow Z(\bar{g},\varphi(\bar{g},F),1,\varepsilon^H,F)=Z(g^a,\tau^a,\hat{\rho}(g^a,\tau^a,F),\varepsilon^H,F)$. But then, since $V''(k_{t+1})<0$, we conclude that $R^L[\bar{g},\varphi(\bar{g},F)]<0$. And by continuity of R^i, there is a $\delta>0$ such that:

$$R^L[\bar{g}-\delta,\varphi(\bar{g}-\delta,F)]<0 \Rightarrow Z(\bar{g}-\delta,\varphi(\bar{g}-\delta,F),1,\varepsilon^L,F)-Z(g^a,\tau^a,\hat{\rho}(g^a,\tau^a,F),\varepsilon^L,F)<0, \text{ and}$$

$$R^H[\bar{g}-\delta,\varphi(\bar{g}-\delta,F)]>0 \Rightarrow Z(\bar{g}-\delta,\varphi(\bar{g}-\delta,F),1,\varepsilon^H,F)-Z(g^a,\tau^a,\hat{\rho}(g^a,\tau^a,F),\varepsilon^H,F)>0.$$

Observe $\forall\delta>0$, given that $\varphi(g,F)$ is decreasing in g, the point $[\bar{g}-\delta,\varphi(\bar{g}-\delta,F)]$ is located at northwest of $[\bar{g},\varphi(\bar{g},F)]$ in Figure 6, getting closer to the optimum strategy $[(g^*(\varepsilon^H,F),\tau^*(\varepsilon^H,F)]$ of complete information. Hence, $R^H[\bar{g}-\delta,\varphi(\bar{g}-\delta,F)]>0$.

But, as in the pooling equilibrium $[g^L,\tau^L,\hat{\rho}(g^L,\tau^L,F)]=[g^H,\tau^H,\hat{\rho}(g^H,\tau^H,F)]$, thus, equations (31) and (32) become, respectively:

$$Z(g^L,\tau^L,\hat{\rho}(g^L,\tau^L,F),\varepsilon^L)>Z(\bar{g},\bar{\tau},1,\varepsilon^L,F)$$

and

$$Z(g^H,\tau^H,\hat{\rho}(g^H,\tau^H,F),\varepsilon^H,F)<Z(\bar{g},\bar{\tau},1,\varepsilon^H,F)$$

But this proves that the original equilibrium $[(g^L,\tau^L),(g^H,\tau^H)]$ in unintuitive.

Figure 6: Separating equilibria