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Shaking rivers and budget cycles:

A comprehensive framework

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Abstract

The 1990s were host to a variety of political economy papers that tried to explain why and how incumbents would use fiscal resources strategically to get reelected. Under the main argument, a politician might be inclined to increase spending/reduce taxes when close to an election to increase their reelection probabilities, even if this goes against their preferences (i.e. a party increases expenditure even if it's right-leaning) or if it harms the economy in the long run (by reducing the stream of resources in the future). Allegedly, this literature - called the *political budget cycle* literature - wanted to endow the experiences of the Reagan administration (among others) with a rationale, especially those near the end of his second term. In this thesis I will focus on two objectives. First, I will study the US case to try to understand whether these dynamics are present there, if they are heterogenous across parties and how they are affected by the likelihood of being reelected. Secondly, I will develop a theoretical framework in which parties use fiscal variables detrimentally to enhance their chances at reelection, and explore the interplay between election prospects and the behavior of the incumbent regarding fiscal variables.

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1 Introduction

It is undeniable that there is a certain link between fiscal variables (such as government expenditure, taxes, fiscal surplus, among others) and the electoral cycle. As elections get closer, politicians in power experience a stronger incentive to use resources to enhance their (or their parties') probabilities of reelection. Politicians might resort to alter fiscal variables in directions opposed to their preferences in order to achieve this goal. For example, a right-leaning candidate might increase public expenditure if she was convinced this would attract more votes, even if this behavior goes against her ideals of the optimal size of expenditure. This could also be interpreted as incumbents being short-sighted when an election is incoming to ensure their continuation probabilities. In other words, a politician might "harm themself" in the short run by increasing expenditure/reducing taxes to improve their reelection chances. This is the main idea behind the *political budget cycle* literature. In this line, the objective of this paper is to analyze in detail the case of the US and to extend an existing model to incorporate uncertainty about the reelection of the incumbent. In other words, I plan to study whether there is some evidence in favor of the existence of a *political budget cycle* in the US, and to develop a model that can be used to further analyze the dynamics of fiscal variables around the time of a presidential election. Although a strict connection between the data and the model is possible, it is beyond the scope of the present work, since this would entail calibrating/estimating parameters and will, therefore, require a strictly larger sample than the one used in this work. There is a vast literature that explores both the incentives and the results of these dynamics, and the evidence regarding whether there is a *political budget cycle* (that is, an influence exerted from the political events to the management of budget variables by the government) and what are its effects is mixed.

On the empirical side of the literature, Persson and Tabellini (2003) find evidence for the existence of political budget cycles in OECD and developing countries but only for a few variables. More specifically, in a sample of over 60 countries since the 1960s they find no evidence of cycles in aggregate spending during the election year, although expenditure falls the following year. This result is not altered through the inclusion of a democracy quality variable in the regression. However, more recent evidence suggests a different view. Shi and Svensson (2006) provide evidence of a political budget cycle. In their sample of over 70 countries spanning from 1975 to 1995 they find that deficit increases by 1% of GDP in election years. Also, this result is larger (and more robust) in developing economies. This provides mixed evidence of a budget cycle existing and/or its importance being altered by the development level of the country. However, the political budget cycle literature takes as given that increasing the expenditure of the government is a *safe* way to increase the probabilities of reelection. This is not necessarily true, since increases in expenditure/deficit might signal future increases in taxes, a move that might be punished by forward-looking voters. In this vein, Brender and Drazen (2008) use a pool of countries and find that persistent budget deficits over the presidential term tend to *harm* the reelection chances of the incumbent. Furthermore, they find no effect of running higher budget deficits on the probability of reelection. Therefore even starting from a balanced budget and running a deficit from there might not prove useful for the incumbent.

Nonetheless, the forces at play are several and often operate simultaneously. Since regressions are not able to fully capture the richness of these interactions, a model might be needed to provide guidance to look at the data. On the theoretical side of this literature, models that try to explain the existence of political budget cycles resorted to different mechanisms. Persson and Svensson (1989) show that in a model where the parties have different preferences for expenditure levels and the incumbent party knows that is going to be replaced, parties will go **against** their preferences and increase/decrease expenditure in order to induce the successor to choose an expenditure level closer to the one that the current incumbent prefers. Alesina and Tabellini (1990) offer a different explanation. In their model, parties differ on their preferences across two types of public goods (rather than the level of overall expenditure). When the probability of reelection for the incumbent gets smaller, incumbents will increase the debt they issue to finance more of the public good that they prefer the most. This has the consequence of generating a *deficit bias* in democracies whose elections are more competitive, due to the fact that a lower probability of reelection reduces the marginal cost of issuing debt, since the incumbent becomes more likely not to pay it back.

The advantage of these models is that they depart from the notion of parties as benevolent dictators that maximize the utility of the median voter. In these, parties have their own preferences, and might choose their variables in a way that is not necessarily optimal for *all* voters. However, these two models lack a critical ingredient: they do not incorporate an interplay between the choice of fiscal variables and the incumbent's probability of reelection. In other words, in these models the strategic behavior of incumbents arises due to either a maneuver to induce the successor to choose a certain level of expenditure or due to the fact that the incumbent is less likely to pay back the debt that it issues. In addition, they assume that default risk of the debt issued by the government is zero, and thus evade modelling the bond market. Aghion and Bolton (1990) model the incentives of default on debt issued by the previous government and find an asymmetry result: left-leaning parties might be induced to increase debt issuance if a right-leaning party is more likely to succeed them, but the contrary is not true. I will not focus on this aspect of the literature, since I will assume perfect commitment. Including default risk entails modelling not only the bond market but also the on-default dynamics of bonds prices and its effects on production, two dimensions that I will not contemplate in this work but are contemplated in other papers (see Scholl (2017) for an application).

However, in both Persson and Svensson and Alesina and Tabellini the probability of reelection is not altered by these fiscal choices. Milesi-Ferretti and Spolaore (1994) do so through a model in which the incumbent party has a preference for being in power, and thus will use fiscal variables to increase its chances of reelection. Now the reelection probability not only is not exogenous as before, but is directly linked to the choice of fiscal resources. However, this model assumes too much certainty on the side of the policymaker: as we will see later, the incumbent party knows exactly the preferences of each of the voters that should target through fiscal resources. This is a strong assumption, since in reality the incumbent party has to make decisions without knowing exactly the preferences of the median voter, and this can have significant effects in their strategic use of government variables.

In this regard, my contribution is twofold. First, I examine the US case in more detail compared to Persson and Svensson (1989), and compare the evidence of US with the predictions of all these theoretical models. Since this is one of the case that brought attention to this issue in recent years, a fresh look into the data seems to be a solid starting point to understand the existence (and strength) of political budget cycles in the US. Secondly, I extend Milesi-Ferretti and Spolaore (1994) to incorporate uncertainty into this environment. In the original model, the true distribution of unattached voters (that is, those targeted by the incumbent through fiscal variables) is known by the incumbent. Therefore the incumbent sets the resources such that the median voter will vote for her, and wins the election with probability one. However, if instead the incumbent only had a conjecture of the unattached voters and where the median voter will be, they would act differently than in the benchmark model (and election would become uncertain). This is the main line that I explore in this thesis. This model is suggested in Milesi-Ferretti and Spolaore (1994) but not developed thoroughly, which is exactly what I will do in this work. I believe this leaves the door open for future models that can be build on this one to be calibrated/extended and used to test its implications with data.

I will proceed as follows. Section 2 establishes the main facts about the political budget cycle for the US and examines whether these are consistent with the predictions made by the theoretical papers mentioned so far. Section 3 develops the model that contains mechanisms to explain how would uncertainty about the reelection of the incumbent affect its behavior. Section 4 comments on possible extensions of the model to test the predictions described in this project with data. Section 5 concludes.

2 Data

Papers mentioned in the introduction share a common trait: if the incumbent party will certainly be reelected, then there is no incentive to utilize certain variables in strategic form. If, on the contrary, with probability one they will be replaced by another party in the next period, the incentives to utilize expenditure and/or debt to reduce constrain their successor (Milesi-Ferretti and Spolaore (1994), Alesina and Tabellini (1990)) are the most intense. As pointed out in Alesina and Tabellini (Alesina and Tabellini, 1990, proposition 2), the higher the probability of being reelected, the lower the debt the incumbent will issue. Thus these papers predict that the incentives to utilize debt/expenditure in a strategic manner are increasing in the probability of another party succeeding the incumbent.

In these last two models there is no default-risk. This allows us to talk about debt and deficit interchangeably, since if there were default-risk incumbents could be constrained if their issuing of debt is perceived by the bond market as being too aggressive or likely to be defaulted. If default-risk is introduced and under specific circumstances, results can become asymmetric between parties. For example, left-leaning parties might be induced to increase debt issuance if a right-leaning party is more likely to succeed them, but the contrary would not be true (Aghion and Bolton (1990)).

These theoretical predictions lead us to think about the association between probability of reelection and the behavior of accumulation of assets, debt, expenditure, taxes and fiscal surplus. In order to test them, I use monthly data on intention to vote gathered by Gallup, quarterly data on government assets provided by the Z.1 package of the Federal Reserve Bank and Tables 3.1 and 1.1.5 from the Bureau of Economic Analysis, which provide quarterly data on government expenditure, taxes and fiscal surplus. Combining these three databases, the sample spans from 1960Q1 to 2008Q4. Details about the construction of the databases and variables are in Appendix A.

To begin with, and as a baseline, I estimate the following parameters through OLS:

$$y_t = \alpha + \delta_0 \mathbb{1}_{2008} + \delta_1 g_t + \delta_2 \sigma_t^g + \varepsilon_t \tag{1}$$

where y_t is a the dependent variable, $\mathbb{1}_{2008}$ is a dummy that is equal to one when year is 2008 (to control for the financial recession), g_t is the gap (in percentage points) between the incumbent and the opposing party, taken as the mean difference in polls over quarter t and σ_t^g is the quarterly variance of this gap. Outcome variables will be government assets, expenditure, debt, taxes and primary fiscal surplus. All of them will be measured as percentage of GDP, seasonally adjusted and detrended. More details about data and variables construction can be found in Appendix A.

The coefficient of interest will be δ_1, since it reflects the direct effect of having a more comfortable lead on the dependent variable. We will use this coefficient to assert whether current conjectures have a numerical counterpart in data (at least for the US). In addition, δ_2 will represent the interaction of *certainty* about the probability of being reelected and incumbents' behavior. Since this dimension is not incorporated in any of the models developed, our priors about its sign and/or value are unclear.Since intention to vote is only calculated on election years, this means that there are, at most, four observations for every election (one for each quarter). This explains why most observations are lost when running the regression.

Table 1: Full sample

	(1)	(2)	(3)	(4)	(5)
	Assets	Debt	Expenditure	Taxes	Fiscal Surplus
Gap (% of votes)	0.0053	-0.0211	0.0105	-0.0250***	-0.0364*
	(0.012)	(0.038)	(0.015)	(0.009)	(0.018)
σ^g	-0.0505	0.2321	0.2819***	-0.0975*	-0.3902***
	(0.078)	(0.249)	(0.100)	(0.056)	(0.120)
R-Squared	0.05	0.46	0.29	0.50	0.48
Observations	38	38	38	38	38

The results of our regression are in Table 1. As we can observe, there seems to be some evidence that political budget cycles are in fact important. As the election becomes more uncertain, governments tend to increase expenditure and therefore reduce fiscal surplus. This will be consistent with the model section, when uncertainty plays a role in the resource-allocation problem of the government. What seems to be striking is that taxes are *reduced* when the gap is higher, something that contradicts the hypothesis of the political budget cycles. However, this effect is less strong than the one present in expenditure and therefore the overall effect seems to be consistent with the predictions of the hypothesis.

Now we turn into the question of whether this behavior happens only with a certain party. To do so, we split the sample between Democrat incumbents and Republican ones, and run the same regression as before. The results are displayed in Table 2 and Table 3.

As we can observe, there is some evidence of differences between the behavior of the Republican and the Democrat parties. We can observe these by comparing the coefficients in these tables as

Table 2: Democrat incumbents sample

	(1) Assets	(2) Debt	(3) Expenditure	(4) Taxes	(5) Primary Surplus
Gap (% of votes)	0.0022	0.0022	0.0122	-0.0296***	-0.0436**
	(0.009)	(0.025)	(0.015)	(0.007)	(0.017)
σ^g	-0.0402	0.4688**	0.3191**	-0.0542	-0.3835**
	(0.069)	(0.196)	(0.116)	(0.053)	(0.134)
R-Squared	0.02	0.25	0.31	0.52	0.43
Observations	20	20	20	20	20

Table 3: Republican incumbents sample

	(1) Assets	(2) Debt	(3) Expenditure	(4) Taxes	(5) Primary Surplus
Gap (% of votes)	-0.0006	-0.4052**	-0.0851**	0.0071	0.1005*
	(0.049)	(0.148)	(0.029)	(0.038)	(0.051)
σ^g	-0.1054	-1.1481*	-0.0605	-0.0864	-0.0161
	(0.191)	(0.576)	(0.113)	(0.148)	(0.199)
R-Squared	0.17	0.69	0.81	0.51	0.79
Observations	18	18	18	18	18

well as in the table that contains the same regression as before but with an interaction term between the party and the relevant variables. This is shown in Table 4.

Table 4: Full sample, party-specific parameters

	(1) Assets	(2) Debt	(3) Expenditure	(4) Taxes	(5) Fiscal Surplus
Gap (% of votes)	0.0030	-0.0082	0.0116	-0.0295***	-0.0428**
	(0.012)	(0.038)	(0.012)	(0.009)	(0.016)
σ^g	-0.0138	0.1463	0.3009***	-0.0538	-0.3574***
	(0.080)	(0.261)	(0.085)	(0.062)	(0.111)
Rep. incumbent=1 × Gap (% of votes)	-0.0189	-0.2109*	-0.0862**	0.0364	0.1282***
	(0.032)	(0.105)	(0.034)	(0.025)	(0.045)
Rep. incumbent=1 × σ^g	-0.1703**	-0.3330	-0.3069***	-0.0339	0.2636***
	(0.064)	(0.207)	(0.068)	(0.049)	(0.088)
R-Squared	0.22	0.55	0.61	0.54	0.66
Observations	38	38	38	38	38

Using Table 4, if we analyze the differential behavior only through the lens of party-specific parameters (instead of party-specific subsamples) we can observe that one of the differences between parties' behavior is in the part of expenditures. Precisely in that regard, we can observe that, overall, Republican incumbents tend to decrease the amount of expenditure when the gap between them and the opposing party increases. Meanwhile, there is no statistical relationship between the gap and the expenditure of Democrat incumbents.

Another dimension in which they differ is that whenever the election gets more uncertain (i.e. the standard deviation of intention to vote increases) the Democrat incumbents tend to increase expenditure while the Republican ones tend to leave it unchanged. This very difference gets reflected in the fiscal surplus regression as well: meanwhile Republican incumbents tend to increase surplus when the election gets more uncertain and when the gap is bigger, Democrats tend to do the opposite. This points to a certain heterogeneity in behavior between both parties when in control of the government.

This, however, is a fairly simple test of heterogeneity between parties. A more thorough and methodologically sound test should be conducted to determine whether Republicans *effectively* behave differently than Democrats. Unfortunately, this exercise is beyond the scope of this work and is therefore relegated to future research. The takeaway of this section is that there is some evidence about the existence of a political budget cycle in the US although it is less clear than what the theoretical models would predict.

3 Model

There are two political parties fighting for power in an economy where elections are held every period. Parties, rather than being benevolent dictators, satisfy their own demands (or preferences) and their constituency in a way similar to Alesina and Tabellini (1990) and Persson and Svensson (1989). Each political party has their own constituency, with measure m_t^j for each period t. We will impose that party A holds the power in the initial period. There is also a measure $m - (m_t^A + m_t^B)$ of undecided voters. This model builds heavily on Milesi-Ferretti and Spolaore (1994), and the next sections describe voters behavior and parties behavior in detail.

The model will try to replicate the behavior of the incumbents *around* the time of the election. In this sense, we can think of these tradeoffs concerning the politician only when election is "around the corner". As to what the meaning of "around the corner" is (and therefore what sort of unit is a period) there are two interpretations that are somewhat equivalent. On one hand, we can think of period as quarters, and then the election is "around the corner" when it is in the next quarter. Although this interpretation might seem compelling at first, it is not clear that the effects of changes in fiscal variables will be felt so strongly in such a short span of time. That leads to the second (and more compelling) interpretation: a period is a year, and the election is "around the corner" when it is in the current year (given that, in many cases, elections are held in november/december). In addition, since the model is general enough, it should not be thought of as a model of any particular country or time period if conditions for it were to be met (i.e. the country features two parties).

Voters

Single-period utility function for party A and members of its constituency is the same and equal to

$$u_t^A(h_t, g_t) = (g_t^{\frac{1}{\rho}} + \delta_t \theta^A h_t^{\frac{1}{\rho}})^\rho + \delta_t q^A, \quad \rho \geq 1 \tag{2}$$

Where g_t is *productive* public expenditure (namely, public expenditure that enters every agent utility function), h_t is *unproductive* public expenditure (the one that only enters in incumbent's constituency utility function), θ^A is a scaling parameter that reflects preference for unproductive public expenditure for members of party A, q^A is a parameter that measures A's utility derived from being in power, δ_t is a dummy with value 1 if party A is in power and ρ measures the elasticity of inter-temporal substitution between both kind of goods.

Notice that, for a given amount of resources R_t, when party A is in power, it will allocate

$$h_t^A = \frac{\alpha^A}{1+\alpha^A}\varepsilon_t M \tag{3}$$

$$g_t^A = \frac{1}{1+\alpha^A}\varepsilon_t M \tag{4}$$

where $\alpha^A = (\theta^A)^{\frac{\rho}{(\rho-1)}}$ is a parameter measuring the preference of party A for unproductive spending. From here on, we will focus solely on the percentage of total resources that are available each period for public spending. I will refer to this as $\varepsilon_t \in [0,1]$ and it will be true for each period t that $R_t = \varepsilon_t M$.

For political party B, their constituents have an utility function as follows:

$$u_t^B = g_t + (1-\delta_t)q^B \tag{5}$$

Analogous to the previous case, party B will allocate resources following equations $h_t^B = \frac{\alpha^B}{1+\alpha^B}R_t$ and $g_t^B = \frac{1}{1+\alpha^B}R_t$ when in power. I will follow Milesi-Ferretti and Spolaore (1994) in assuming that $\theta^B = 0$ (in other words, party B does not have a preference for unproductive public spending), and this will be the main difference between parties A and B. This simplifies choices of B to $h_t^B = 0$ and $g_t^B = \varepsilon_t M$ when in power.

Notice that, so far, members of the constituency of each party differ between each other only in two dimensions, aside for preference for spending: their "preference for power" parameter $(q^A - q^B)$ and whether their party is in power or not (δ_t).

The group of voters which differs from members of each constituency in an additional dimension is that of undecided voters, which have the following utility function:

$$u_t^i = g_t + \delta_t q^i \tag{6}$$

Here q^i represents unattached voter i preference towards party A being in power. Since these unattached voters only care about *productive* government spending, if indifferent between party A and party B being in power (i.e. $q^i = 0$) they will vote for party B, since by definition $g^B(\varepsilon) > g^A(\varepsilon)\ \forall \varepsilon > 0$. Each unattached voter i will vote for party A next period if and only if

$$g_{t+1}^A + q^i - g_{t+1}^B \geq 0 \iff q^i \geq \frac{\varepsilon_{t+1}M}{\gamma} \tag{7}$$

where $\gamma = \frac{1+\alpha^A}{\alpha^A}$ will represent how rigid is the preference of unattached voters for party A being in power when it changes the amount of resources. As an example, suppose that party A has fixed resources in $\varepsilon' = 1$. Now take two voters, one with $q^1 = 2\frac{M}{\gamma}$ and another with $q^2 = \frac{M}{2\gamma}$. Voter one will vote for party A, since $q^1 = 2\frac{M}{\gamma} \geq \frac{M}{\gamma}$ but voter two will vote for party B, as $q^2 = \frac{M}{2\gamma} < \frac{M}{\gamma}$. This is true since q^i captures the bias towards party A for unattached voter i, and thus the higher the value of q^i the more likely it is that voter i will vote for this party (*ceteris paribus* other variables). q^i can of course be negative, and this can be interpreted as a bias towards party B.

Most relevant applications of the model will involve that each party is not able to win an election recurring solely to its constituency, and therefore will have to target the median voter (which will be, by definition, an unattached voter). Let q^* denote the median voter. This tells us that whenever $q^* \geq \frac{\varepsilon_{t+1}M}{\gamma}$, party A will win election in period $t+1$, and party B will win otherwise. The key mechanism of the strategic behavior of resources by party A lies in Equation 7. As ε_{t+1} gets smaller, the differences between party A and party B productive spending get smaller, and this reduces the threshold for unattached voters to vote for party A, since they will observe that with this low level of resources, party A and B become more alike in terms of spending. Therefore, as ε_{t+1} gets smaller, unattached voters vote more on the basis of their party biases (namely, q^i) than on the basis of the difference in productive spending between these two. Finally, notice that when q^i values are known by the incumbent, the party in power chooses ε_{t+1} and knows *ex-ante* the result of the election that will take place next period. Our first departure from this baseline version of the model will entail that the incumbent will have knowledge only of the distribution of q^i, but not on every value of q^i. This will imply that she won't know what is the value of q^*, and thus will have to make decisions without knowing the result of the election next period. This will be the main source of uncertainty in the model and we will explore it later.

Parties

The governing party will try to maximize the discounted stream of utility of its constituents, namely

$$U^A = \sum_{t=0}^{\infty} \beta^t u_t^A(h_t, g_t)$$

To do this, they will have three control variables. On the one hand, the policymaker will allocate current resources R_t between productive and unproductive public expenditure, satisfying a balanced-budget condition $h_t + g_t \leq R_t$. On the other, the policymaker also determines the total amount of resources available for public spending next period (R_{t+1}) by choosing a point on the interval $[0, M]$. We can think that the policymaker chooses $\varepsilon_{t+1} \in [0, 1]$ with $R_{t+1} = \varepsilon_{t+1}M \;\; \forall t \geq 0$. Notice that this presupposes a commitment device: decisions over government efficiency (ε_t) for the next period are made by the incumbent in the *current* period, and the party governing in next period will have to take this amount as given.

Therefore, when party A is the incumbent, it solves the following maximization problem:

$$\max_{\{g_t^A, h_t^A, R_{t+1}^A\}} \sum_{t=0}^{\infty} \beta^t [z_t u_t^A(h_t^A, g_t^A) + (1 - z_t) u_t^A(h_t^B, g_t^B)] \text{ s.t. } \quad h_t^A + g_t^A \leq R_t^A \ \forall t \geq 0$$

Where $z_t = p(\delta_t = 1)$ is the probability that party A is in government in period t. Since A is incumbent in $t = 0$, we have that $z_0 = 1$. We will impose that distribution of tastes of unattached voters q^i does not change over time. The variant of the model that I will explore is one in which both parties have access to a common forecast of the distribution of q^i, which is distributed with cdf F. This is our main departure from Milesi-Ferretti and Spolaore (1994), since in their benchmark model q^i is deterministic and known by both parties. Now the policymaker cannot make decisions contingent on the value of q^i, but only on its distribution, and thus the result of the election next period becomes uncertain. The objective of this is to add a layer of complexity to the model, and examine whether this layer becomes relevant to represent the incentives of the policymaker when faced with incomplete information about its median voter target. In this case, the probability that party A will be elected next period given that next period resources are given by ε' is:

$$P(q^* \geq \frac{\varepsilon' M}{\gamma}) = 1 - F(\frac{\varepsilon' M}{\gamma})$$

where q^* is the value of party A preference for the median voter. When there is no uncertainty (as in the benchmark model of Milesi-Ferretti and Spolaore (1994)) q^* is known by the policymaker, who chooses whether to fix $\varepsilon' = \frac{\gamma q^*}{M}$ or not. When uncertainty is added, the policymaker now chooses ε' without knowing q^*, but knowing its distribution F.

The optimization problem when party B is incumbent is symmetric and less relevant (since party B will not have incentives to manipulate resources to secure reelection), so I will focus solely on party A problems. With these assumptions, we can reformulate the problem of the incumbent party in a recursive fashion. Now both parties should find their two value functions (one for when in power and one for being a contender). Therefore, the decision problem of parties can be defined through the following system of equations:

$$V^i(\varepsilon, \delta) = u^i(\varepsilon, \delta) + \beta[z(\varepsilon'^{\delta}) V^i(\varepsilon'^{\delta}, 1) + (1 - z(\varepsilon'^{\delta})) V^i(\varepsilon'^{\delta}, 0)] \tag{8}$$

where $i \in \{A, B\}$ represents the party, $\delta \in \{0, 1\}$ signals party A is in power when equal to one and zero otherwise, and ε is the amount current resources that the government has to spend. For party A, we will have that:

$$u^A(\varepsilon, \delta) = \begin{cases} u^A(g^A(\varepsilon), h^A(\varepsilon)), & \delta = 1 \\ u^A(\varepsilon M, 0), & \delta = 0 \end{cases} \tag{9}$$

and we will have an analogous equation for party B (although with the values of j reversed). Lastly, we have that

$$\varepsilon'^{\delta} := \begin{cases} \arg\max_{\varepsilon' \in [0,1]} z(\varepsilon')V^B(\varepsilon', 1) + (1 - z(\varepsilon'))V^B(\varepsilon', 0), & \delta = 0 \\ \arg\max_{\varepsilon' \in [0,1]} z(\varepsilon')V^A(\varepsilon', 1) + (1 - z(\varepsilon'))V^A(\varepsilon', 0), & \delta = 1 \end{cases} \tag{10}$$

represents the optimal choice of ε' for party A when in power and for party B when in power. We can define the problem in this way since the allocation of resources between productive and unproductive expenditure is a intra-temporal decision, and thus does not affect the choice of ε'.

The value function of each party depends on two state variables. On one hand, the amount of resources available for public spending in the current period, ε, and on the other, the value of δ, that reflects whether in the current period party A is in government or not. The fact that there is a value function for when parties are *not* in power is due to the problem being infinite-period. If this game only had two periods the parties would simply get as a payoff the instantaneous utility they get when they are not in power. Once the problem is solved using this setup, we can contemplate whether parties will care about second-order effects by comparing this solution with the one obtained in the two-period case, when trivially parties incorporate that if they lose the election they will only get the instantaneous utility when not in power (since, obviously, the world will end in said period, and no continuation value is possible).

Before diving into that, let's explore the problem of incumbent party A. First of all, note that since the current amount of resources ε only impacts on the magnitude of spending that is allocated to productive or unproductive uses, we can abstract from the decision of these two variables, since its value will not affect in any way the choice of *future* amount of resources, ε', due to this decision being a intra-temporal one. Thus, $h^A(\varepsilon)$ and $g^A(\varepsilon)$ will be the choices of incumbent A when given amount of resources ε, given by equations 3 and 4 respectively. Once this choice is taken into account, the only variable that affects incumbent A's future value functions (and its chances of reelection) is ε'. The first order condition of the problem of incumbent A is as follows:

$$[\varepsilon'] \quad z'(\varepsilon')(V^A(\varepsilon', 1) - V^A(\varepsilon', 0)) + z(\varepsilon')\frac{\partial V^A(\varepsilon', 1)}{\partial \varepsilon'}(\varepsilon', 1) + (1 - z(\varepsilon'))\frac{\partial V^A(\varepsilon', 0)}{\partial \varepsilon'}(\varepsilon', 0) = 0 \tag{11}$$

The choice of ε' can be broken down into two incentives. On one hand, whenever the incumbent party increases ε', it does not increase its chances that it will be reelected. We can infer that from

$z'(\varepsilon') = -\frac{M}{\gamma}\frac{\partial F(\frac{\varepsilon' M}{\gamma})}{\partial \varepsilon'} \leq 0$. By increasing the amount of resources that will be available for spending next period, party A reduces (or at least does not improve) its chances at reelection since this intensifies the gain of every unattached voter from voting for party B instead of A, due to the fact that the difference in productive expenditure between parties is increasing in ε' (and unattached voters'utility function are, of course, increasing in this argument). In other words, the first term measures the change in the chances of reelection when A increases ε', multiplied by the "incumbency premium" of party A that comes from being in power for a given ε'.

On the other hand, the last two terms reflect, for a given chance of reelection $z(\varepsilon')$, the change in both value functions when party A increases infinitesimally from ε'. Notice that both these terms are positive, since both value functions are increasing in the amount of resources available for spending next period. In the case of $V^A(\varepsilon, 0)$ this is obvious since $\frac{\partial V^A(\varepsilon,0)}{\partial \varepsilon} = M\frac{\partial u^A(\varepsilon M,0,0)}{\partial \varepsilon} > 0$ by u^A being strictly increasing in productive expenditure. In the case of $V^A(\varepsilon, 1)$, since this function is a maximum and is differentiable, we can use the envelope theorem to obtain:

$$\frac{\partial V^A(\varepsilon,1)}{\partial \varepsilon} = \frac{\partial u^A(g^A(\varepsilon), h^A(\varepsilon), 1)}{\partial g^A(\varepsilon)}\frac{\partial g^A(\varepsilon)}{\partial \varepsilon} + \frac{\partial u^A(g^A(\varepsilon), h^A(\varepsilon), 1)}{\partial h^A(\varepsilon)}\frac{\partial h^A(\varepsilon)}{\partial \varepsilon}$$

Now because u^A is strictly increasing in its first two arguments, we have that

$$\frac{\partial u^A(g^A(\varepsilon), h^A(\varepsilon), 1)}{\partial g^A(\varepsilon)} > 0, \frac{\partial u^A(g^A(\varepsilon), h^A(\varepsilon), 1)}{\partial h^A(\varepsilon)} > 0$$

In addition we have that $g^A(\varepsilon) = \frac{1}{1+\alpha^A}\varepsilon M$ and $h^A(\varepsilon) = \frac{\alpha^A}{1+\alpha^A}\varepsilon M$. Thus we conclude that $\frac{\partial g^A(\varepsilon)}{\partial \varepsilon} > 0$ and $\frac{\partial h^A(\varepsilon)}{\partial \varepsilon} > 0$. Putting this inequalities together yields $\frac{\partial V^A(\varepsilon,1)}{\partial \varepsilon} > 0$. The reasoning is similar for value functions of party B.

To refer to the incentives mentioned before, I will coin the terms *reelection incentive* and *resources incentive* for the first and second terms, respectively. Thus, we can see that the *reelection incentive* conspires against the increasing of resources available for spending next period, while the *resources incentive* pushes for it. It is precisely the *reelection incentive* that perverts party A into lowering resources to increase its probabilities of reelection. Absent this incentive, and the value function of both parties when they are in power would be trivial, since both would fix $\varepsilon' = 1$.

Now that this is clear, it is easier to observe that the characteristics of distribution F matter more for the *reelection incentive* than to the *resources incentive*. This is because the former is specifically linked to the behavior of the cdf of q^i in response to changes in ε', while the latter holds the current probabilities constant to assess the impact of more resources in terms of value. As an example to aid our intuition, imagine that F is actually a uniform distribution with support $[0.5, 1]$. In this case, it is clear that any increase in ε' will reduce the chances of reelection of party A in the same magnitude, since the density function of F is a constant. However, if F were a normal distribution, increases when ε' is on the mean value of F will create a higher decrease in the probability that A is reelected than increases when ε' is on the tails of F. This is because the density function is steeper around the mean that at its tails.

However, there is a more intriguing result that Milesi-Ferretti and Spolaore (1994) manifest in their paper, which is the non-monotonicity of the optimal choice of ε' with respect to the uncertainty of the distribution of q^i. The difficulty lies in that, in order to explore this, we need to find a way to express the optimal choice of ε' in closed form, something that many times is unattainable and limits our understanding of the solution only to closed-form ones. Therefore, I will try to grasp the intuition of optimal choice by using numerical methods to solve the model. Before doing that, however, we can go a little bit further using only theory to understand why this non-monotonicity arises and if it's sustained using distributions other than the uniform.

Let $[\underline{\mu}, \bar{\mu}]$ be the support of F and assume $\frac{M}{\gamma} = 1$.[1]

We know that since $\varepsilon' \in [0, 1]$, then the lowest probability of being reelected comes when $\varepsilon' = 1$ and its equal to $z(1) = 1 - F(1)$. Likewise, the highest probability of being reelected comes when $\varepsilon' = 0$ and its equal to $z(0) = 1 - F(0)$. These two points and their interplay with the bounds of F will play a crucial part in determining where will ε' lie in the $[0, 1]$ interval (or, more likely, where it will *not* lie).

Thus we have the following lemmas:

Lemma 1. *Let ε^* be the optimal solution to the maximization problem of the party A. If $\underline{\mu} > 0$, then $\varepsilon^* \in [\underline{\mu}, 1]$.*

Proof. Let $\varepsilon' \in [0, \underline{\mu})$. Then $z(\varepsilon') = 1 - F(\varepsilon') = 1$ since ε' is not in the support of F. Now by definition of cdf F, $F(\underline{\mu}) = 0$ and thus $z(\underline{\mu}) = 1 - F(\underline{\mu}) = 1$. Since

$$z(\varepsilon')\frac{\partial V^A(\varepsilon', 1)}{\partial \varepsilon'}(\varepsilon', 1) + (1 - z(\varepsilon'))\frac{\partial V^A(\varepsilon', 0)}{\partial \varepsilon'}(\varepsilon', 0)$$

is positive for any ε', as $\underline{\mu} > \varepsilon'$ we have that

$$z(\underline{\mu})V^A(\underline{\mu}, 1) + (1 - z(\underline{\mu}))V^A(\underline{\mu}, 0) > z(\varepsilon')V^A(\varepsilon', 1) + (1 - z(\varepsilon'))V^A(\varepsilon', 0)$$

and therefore $\underline{\mu}$ is strictly preferred to ε'. □

Lemma 2. *Let ε^* be the optimal solution to the maximization problem of the party A. If $\bar{\mu} < 1$, then $\varepsilon^* \in [0, \bar{\mu}) \cup \{1\}$.*

[1] This simplifies the algebra vastly, and imposes no restriction since the choice of M is irrelevant to the problem at hand.

Proof. Let $\varepsilon' \in [\bar{\mu}, 1)$. We know that $z(\varepsilon') = 1 - F(\varepsilon') = 0$ since $\varepsilon' \geq \bar{\mu}$. Now again by definition of value functions, we have that as $1 > \varepsilon'$,

$$z(1)V^A(1,1) + (1 - z(1))V^A(1,0) > z(\varepsilon')V^A(\varepsilon', 1) + (1 - z(\varepsilon'))V^A(\varepsilon', 0)$$

Thus we have that 1 is strictly preferred to ε'. □

Lemma 3. *Let ε^* be the optimal solution to the maximization problem of the party A. If $\bar{\mu} < 0$ or $\underline{\mu} > 1$, then $\varepsilon^* = 1$.*

Proof. If $\bar{\mu} < 0$, then $z(\varepsilon') = 1 - F(\varepsilon') = 0$ for any $\varepsilon' \in [0, 1]$. Thus, the value function of government A simplifies to

$$V^A(\varepsilon', 1) = \max_{\varepsilon' \in [0,1]} u^A(g^A(\varepsilon'), h^A(\varepsilon'), 1) + \beta V^A(\varepsilon', 0)$$

and since $V^A(\varepsilon', 0)$ is strictly increasing in ε', we have that $\varepsilon^* = 1$. Conversely, for $\underline{\mu} > 1$ we have that $z(\varepsilon') = 1 - F(\varepsilon') = 1$ for any $\varepsilon' \in [0, 1]$. Thus, the value function of government A simplifies to

$$V^A(\varepsilon', 1) = \max_{\varepsilon' \in [0,1]} u^A(g^A(\varepsilon'), h^A(\varepsilon'), 1) + \beta V^A(\varepsilon', 1)$$

with $V^A(\varepsilon', 1)$ strictly increasing in ε'. Thus, $\varepsilon^* = 1$. □

To exemplify these lemmas, consider the following distribution for the median voter:

As you can see in Figure 1, the limits of F coincide with points $\{0, \frac{M}{\gamma}\}$. In this case none of the lemmas apply. However, if we observe the following two images, we can apply some of them.

In here two lemmas come into play. On the left panel of Figure 2 we can see how the first lemma applies, as $\underline{\mu} > 0$. Therefore, in this case we know that $\varepsilon^* \in [\underline{\mu}, 1]$. On the other hand, in the right panel of Figure 2 we can see how the third lemma applies, as $\bar{\mu} < 0$. Therefore, in this case we know for sure that $\varepsilon^* = 1$, since the incumbent will lose the election next period disregarding what value of ε' she chooses.

From observing these three lemmas, the non-monotonicity of behavior seems less enigmatic. Paraphrasing these results, what occurs is that we have two asymmetries. On one hand, governments are cynical, but not *inelastically* cynical. Therefore, incumbents who have high chances of facing a median voter who is unresponsive to their choice of ε' (be it because this median voter will always vote for them or will never vote for them) will not find useful to use government resources strategically. This happens because the *reelection incentive* becomes less relevant, and the *resources incentive* becomes comparatively stronger. This pushes incumbents to fix a higher level of resources for next period. On the other hand, there is an asymmetry between having a "higher floor"($\underline{\mu} > 0$) or a "lower ceiling" ($\bar{\mu} < 1$) in terms of its effect on the behavior of the incumbent. While in the

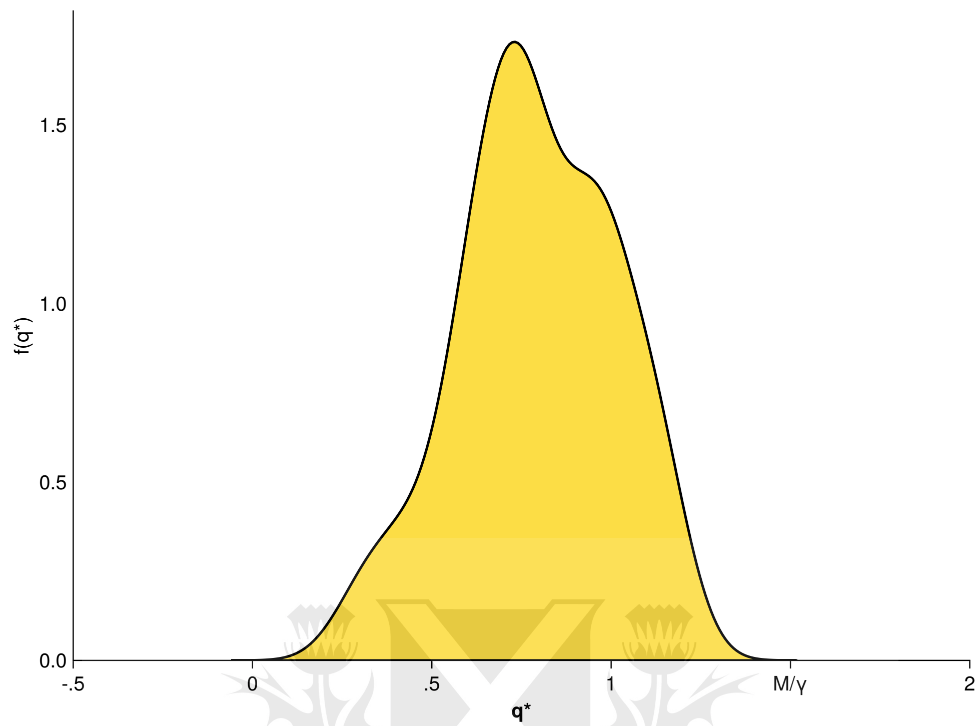
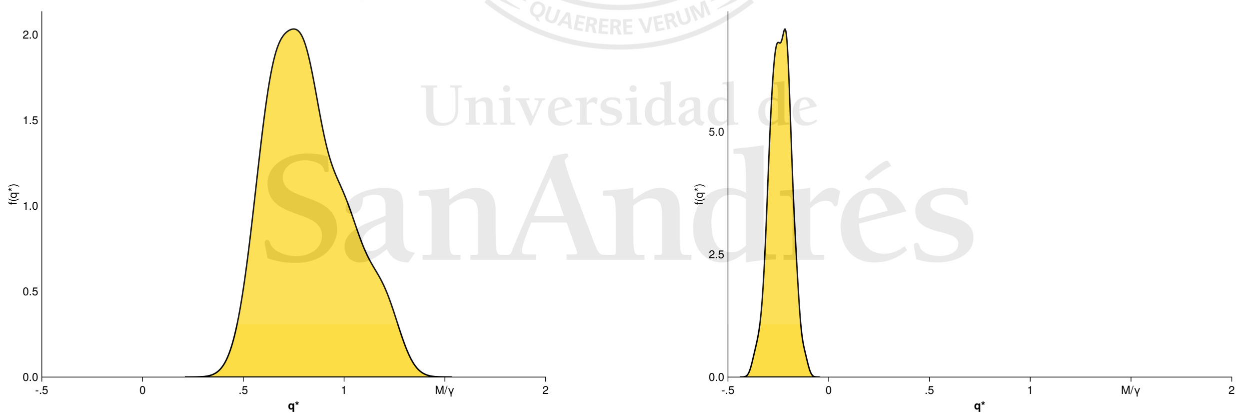


Figure 1: F entirely contained in the interval $[0, \frac{M}{\gamma}]$



(a) $\underline{\mu} > 0$

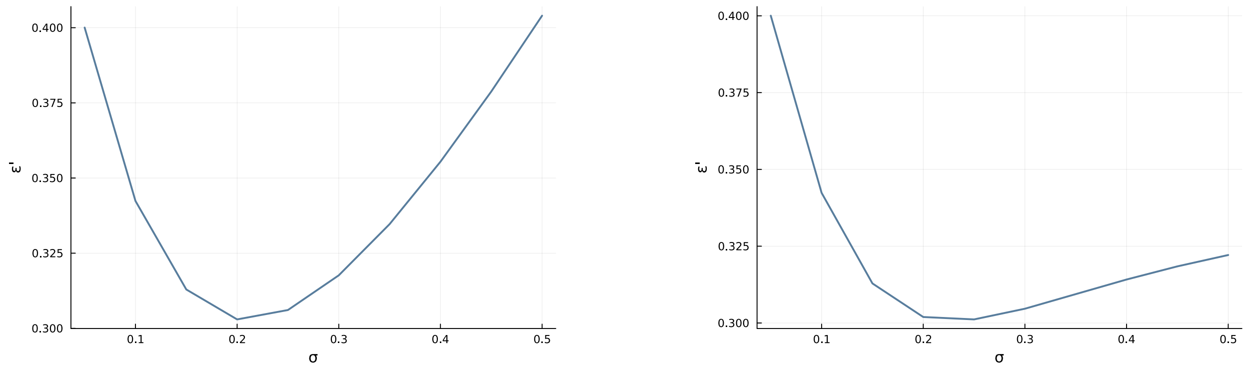
(b) $\bar{\mu} < 0$

Figure 2: Non-overlapping intervals of F

first case this pushes the incumbent to fix a higher level of resources, this is not necessarily true in the second case, because we cannot rule out $\varepsilon' = 1$ as the optimal choice.

When these two asymmetries are combined, we get what we were looking for: a non-monotonic behavior of the optimal choice of ε' with respect to the uncertainty of the median voter distribution.

Here our logical conclusions take even more shape. These two graphs show the optimal choice



(a) Normal

(b) Truncated Normal (truncated at 0 and 1)

Figure 3: Optimal policy for normal distributions with $\mu = 0.5$

of ε' for two normal distributions with the same mean ($\mu = 0.5$) for different values of the standard deviation σ. The sole difference between these two plots is that the one on the right has values truncated between 0 and 1. As we can see, the optimal choice of ε' is non-monotonic in the degree of uncertainty coming from increases in the variance. However, we can conclude more by observing that the optimal choice of ε' is *higher* after its minimal point when the distribution is *not* truncated. The reasoning of this is simple: when σ is low, truncating or not the distribution has virtually no effect on the choice of ε', since the cases in which truncation becomes relevant are highly unlikely. However, as the standard deviation increases, the truncation becomes "more binding" as now the probability of $q^* > 1$ or $q^* < 0$ increases. In other words, the probability that the election becomes heavily one-sided (and thus the probability that choices of ε' become entirely irrelevant) grow significant for the Normal distribution as σ increases and remain at zero for the truncated Normal distribution.

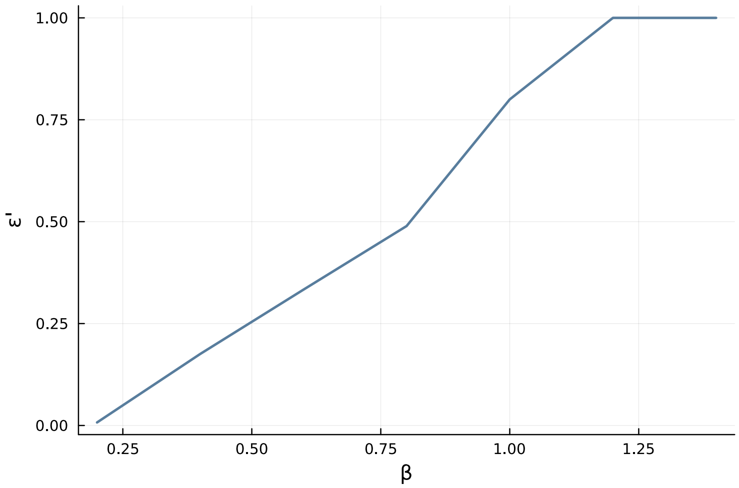


Figure 4: Optimal policy for an exponential distribution with scale parameter β

Now consider the exponential distribution, which has the following pdf: $f(x;\beta) = \frac{1}{\beta}e^{-\frac{x}{\beta}}\mathbb{1}_{x\geq 0}$. Its mean is β and its variance is β^2. In this distribution, the variance grows twice as fast as the mean, and thus the uncertainty of the distribution increases with β, which is its scale parameter. However, more important than uncertainty is the fact that whenever β increases, the probability that $q^* > 1$ increases as well. Thus we would expect that now ε' increases faster than in the case of normal distributions since not only the mean increases with β, but also the probability of the election becoming one-sided. This is exactly what we observe in Figure 4.

To finalize these examples, we will examine the case of the Raleigh distribution. Its pdf is $f(x;\sigma) = \frac{x}{\sigma^2}e^{-\frac{x^2}{2\sigma^2}}\mathbb{1}_{x\geq 0}$. Mean and variance are $\sigma\sqrt{\frac{\pi}{2}}$ and $\frac{4-\pi}{2}\sigma^2$, respectively. As here the variance grows faster than the mean as σ increases, we would expect that behavior of ε' is similar to the one of the exponential distribution. As we can see in Figure 5, this is indeed the case.

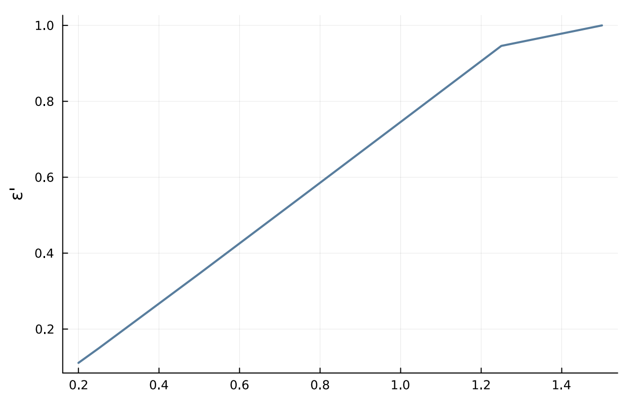


Figure 5: Optimal policy for a Rayleigh distribution with scale parameter σ

An important remark should be made: uncertainty not only affects the behavior of incumbents but also the probability of their reelection. That is, it is not always optimal (even when possible) to maximize the probability of their reelection since this might entail restricting future resources a lot more than profitable. There is a graphical representation of the effects of uncertainty on reelection probabilities in Appendix B.

4 Extensions

Now that the model has been fully developed, I will explore two different extensions that can be done to the model to enrich its predictions without adding too much complexity to it.

In the first place, one could use polls data to construct a distribution of the unattached voters' preferences. Using high frequency data, one could estimate F through some parametric (or non parametric) density function to recover the distribution of q^i. This could be used to predict actual behavior from policymakers near the time of the elections. I believe this is the most immediate yet purposeful extension to be considered, as this relies fully on the model developed so far and can be done with data that is supposedly readily available. The difficulty in here would lie in estimating properly this distribution, as one should have to combine different polls, and this by itself is a sizable task.

In the second place, this model can serve as a platform to study the choices of politicians under more complex environments in terms of the policy instruments at their disposal. In this model we have assumed that politicians have access to a perfect commitment: once they set ε', there is nothing that can be done to change this magnitude. However, what would happen if certain values of ε' could be disputed by the opposition? Suppose, for example, that incumbent party A sets ε' too low, and there is a consensus that if B comes to power it is more desirable that they have more resources, so that the actual ε' ends up being higher than the one chosen by A. This would be the case of an imperfect commitment, and would be interesting to explore whether (and when) announcements of ε' are "effective" into guiding people into voting for A. In a similar vein, one could resort to more difficult policy instruments related to the issuance of debt. In this case, the imperfect commitment story could be easily understood, since for high levels of government debt, low ε' signals the bond market that the default risk of government debt for next period will be higher, as the state will be more depleted with resources tomorrow. Interactions between these variables and announcements from the opposing party of their intentions to repay or not the issued debt could be used to determine whether this can result in a credible threat or not on the side of the opposing party (and how this would alter the dynamics of the model).

5 Conclusion

Throughout the work, I have tried to understand the dynamics of fiscal variables in a political economy setting.

On the empirical side, we have seen that there is evidence of a political budget cycle, although this is mixed as it only appears on certain variables. This suggests that a "naive" regression run without a model could be misleading, as its results could not be easily linked to any theoretical framework. There is some evidence of a difference between the behavior of the republican party and the democratic party, although both parties coincide in the sign of the correlation of these aforementioned variables with their projected chances of winning the election, which are also aligned with theoretical predictions of existing models. However, we have faced ourselves with a difficulty of interpreting the coefficients of the standard deviation of these chances of winning the election, not only because this is difficult to do without a model but also because there is no clear dominant hypothesis in the literature that could help us interpret these coefficients.

On the theoretical side, we have shed some light into the mechanisms at display when a party in power tries to use fiscal variables (in this case, the amount of resources available) to secure reelection. We have seen that the incentives of the policymaker are not straightforward, that uncertainty affects in non-linear, non-monotonic ways to the optimal choice of ε', and that the characteristics of the distribution of unattached voters' preferences are crucial to determine the behavior of the policymaker, although not in a straightforward way. This dimension is crucial, as it renders contingent the effect of uncertainty in our predictions of fiscal variables: more uncertainty is not necessarily "bad" for the incumbent, nor it necessarily increases the amount of resources that the incumbent will choose to allocate for next period. In fact, the behavior of the incumbent seems to be more sensitive to the link between the bounds of the distribution of q^i and the bounds of the $[0, 1]$ interval, as the former comprises relevant information for the incumbent, more relevant than just the uncertainty of the distribution as measured by the standard deviation.

Finally, we have seen that this model can be extended in many ways to enrich its predictions and make it more realistic. This is a fertile ground for future contributions, and I have only mentioned a few of the many possible extensions that can be done to this model, as this are the ones I imagine people doing.

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Appendix A: Data construction

Data used in this paper come from three different sources: data on intention to vote comes from Gallup and is available at monthly frequency. Government assets data is available at quarterly frequency and comes from the Federal Reserve Bank; and lastly, quarterly data on government expenditure, taxes and fiscal surplus comes from Bureau of Economic Analysis. The sample ranges from 1960Q1 to 2008Q4. All variables (except for the intention to vote) are already seasonally-adjusted by the corresponding institution. In order to account for possible trends in the data, I detrend all variables (again, except for the intention to vote) using a linear trend for every presidential mandate. To give an example: I regressed the data on every variable against a linear trend for the first mandate of Reagan. I did the same for the second mandate of Reagan, and so on. The idea of doing so was to capture whether the election year was any different for these variables than the rest of the years of the mandate. Finally, regarding fiscal variables, they are all expressed in terms of GDP.

Variables

The variables used in this paper are the following:

- **Intention to vote**: This variable is the percentage of people who say they will vote for each party in the next presidential election. Although this does not include undecided voters, the percentage of undecided voters is usually very low, and thus this variable is a good proxy for the overall attitude toward each party/candidate.

- **Government assets**: This variable is the amount of assets that the government has at its disposal. This is a measure of whether the government induces a deaccumulation of assets in the year of election to transfer some of them to the population in expectation of their vote. This is supposedly a secondary measure, since we should expect the most important ones to be expenditure and/or taxes.

- **Government expenditure**: This variable is the amount of resources that the government allocates to public spending. This includes not only current expenditures but also investment on the part of the general government.

- **Government taxes**: This variable is the amount of resources that the government collects from the population. Although this can vary by aggregate circumstances that alter the base of the tax, by detrending and seasonally adjusting this variable we should expect that changes in this reflect factors other than those.

- **Fiscal surplus**: This variable is the difference between government expenditure and government taxes.

Appendix B: Robustness and additional results

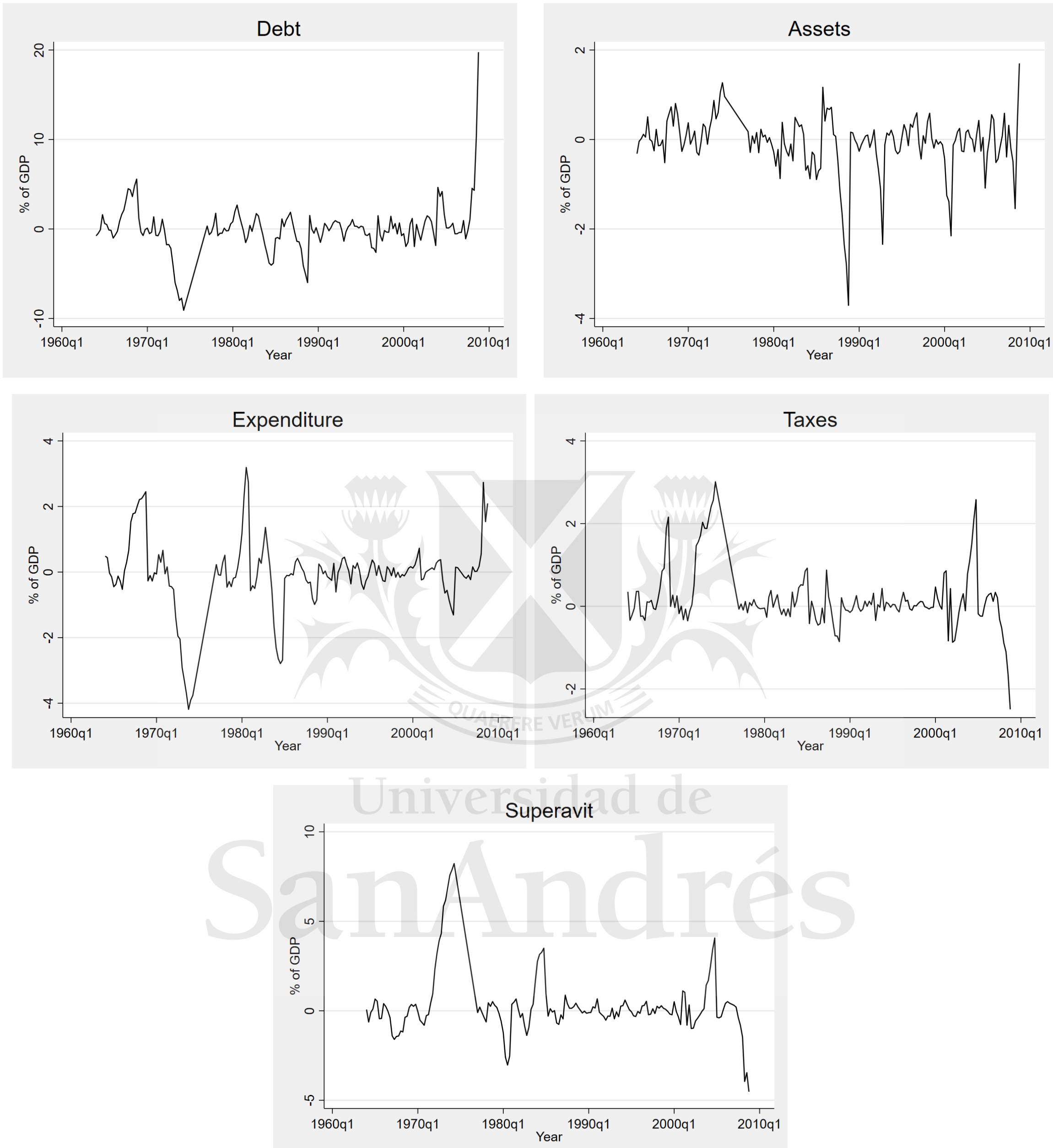

Figure 6: Fiscal variables - detrended

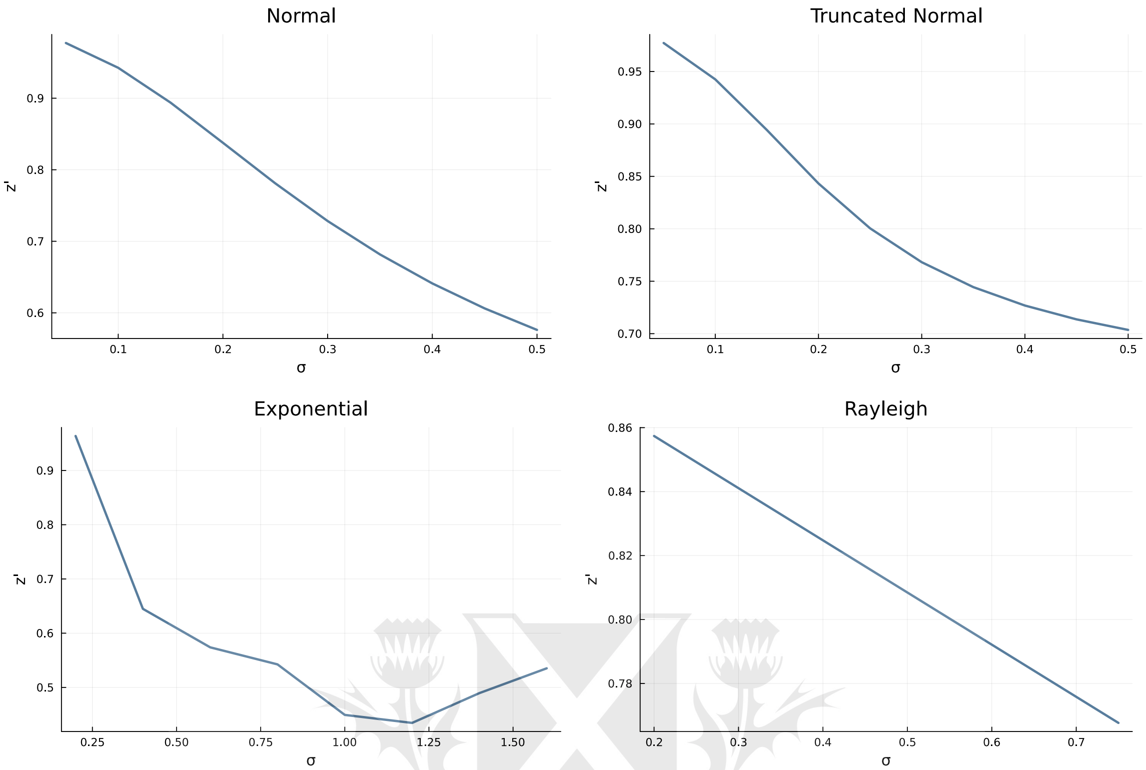

Figure 7: Probability of reelection for different distributions

Lagged specifications

In the following tables, we replicate the same regression as before, but now with one-quarter lagged variables. The regression that is estimated through pooled OLS is:

$$y_{t+1} = \alpha + \delta_0 \mathbb{1}_{2008} + \delta_1 g_t + \delta_2 \sigma_t^g + \varepsilon_t \tag{12}$$

where y_{t+1} is the one of the outcome variables (either taxes, expenditure, surplus, assets or debt), g_t is the gap between the intention to vote for the incumbent relative to the contender, and σ_t^g is the quarterly variance of the gap. We are also allowing for a dummy variable that takes value one when year is 2008 to account for the financial crisis. The results are presented in the following tables:

Table 5: Full sample

	(1) Assets	(2) Debt	(3) Expenditure	(4) Taxes	(5) Fiscal Surplus
L.Gap (% of votes)	-0.0006	0.0213	0.0221	-0.0215**	-0.0494***
	(0.011)	(0.035)	(0.014)	(0.009)	(0.018)
L.σ^g	-0.1943***	0.2184	0.2886***	-0.0784	-0.3981***
	(0.068)	(0.229)	(0.092)	(0.058)	(0.117)
R-Squared	0.22	0.51	0.36	0.45	0.53
Observations	38	38	38	38	38

Table 6: Republican incumbents sample

	(1) Assets	(2) Debt	(3) Expenditure	(4) Taxes	(5) Primary Surplus
L.Gap (% of votes)	-0.0096	0.0159	0.0107	-0.0101	-0.0347
	(0.017)	(0.070)	(0.020)	(0.016)	(0.032)
L.σ^g	-0.3838***	-0.2117	0.0638	-0.1649*	-0.2842
	(0.094)	(0.387)	(0.112)	(0.090)	(0.178)
R-Squared	0.48	0.58	0.50	0.52	0.59
Observations	24	24	24	24	24

Table 7: Democrat incumbents sample

	(1) Assets	(2) Debt	(3) Expenditure	(4) Taxes	(5) Primary Surplus
L.Gap (% of votes)	-0.0045	0.0283	0.0221*	-0.0230***	-0.0513***
	(0.008)	(0.021)	(0.012)	(0.008)	(0.016)
$L.\sigma^g$	-0.0738	0.4801***	0.3737***	-0.0103	-0.4180***
	(0.055)	(0.153)	(0.088)	(0.056)	(0.118)
R-Squared	0.08	0.33	0.47	0.29	0.47
Observations	25	25	25	25	25

Table 8: Full sample, party-specific parameters

	(1) Assets	(2) Debt	(3) Expenditure	(4) Taxes	(5) Fiscal Surplus
L.Gap (% of votes)	-0.0024	0.0045	0.0188	-0.0318**	-0.0522**
	(0.012)	(0.050)	(0.015)	(0.011)	(0.019)
$L.\sigma^g$	-0.1152	0.2590	0.3820***	-0.0706	-0.4625***
	(0.085)	(0.342)	(0.100)	(0.078)	(0.133)
Rep. incumbent=1 × L.Gap (% of votes)	0.0173	-0.1161	-0.0801*	0.0445	0.1262**
	(0.039)	(0.155)	(0.046)	(0.035)	(0.060)
Rep. incumbent=1 × $L.\sigma^g$	-0.2158***	-0.4104	-0.3251***	-0.0503	0.2709**
	(0.063)	(0.253)	(0.074)	(0.058)	(0.098)
R-Squared	0.51	0.58	0.69	0.59	0.73
Observations	27	27	27	27	27