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**Essays on the Political Economy of Debt
in Emerging Countries**

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Strategic Debt and Political Frictions in Small Open Economies*

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Abstract

In this paper we study the relationship between sovereign debt and political frictions. We model political frictions as a disagreement among parties about distribution of resources. When analyzing a small-open economy framework we find two important results. First, when considering standard utility function (CRRA with risk aversion parameter greater or equal to one) political frictions induce saving (not borrowing) incentives. Second, when introducing retrospective voting, for which electoral outcomes are affected by recent economic performance, we find that more severe political frictions indeed lead to stronger borrowing incentives. Then, we use the theoretical predictions of our model to structurally estimate the country-specific degree of retrospective voting using data on debt, quality of institutions, and election probability in 56 emerging and transition economies. We find that retrospective voting is strongly related to corruption indices.

JEL Classification: F3 - F41 - D72 - P16

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1 Introduction

“We all know what to do, we just don’t know how to get re-elected after we’ve done it”. Jean-Claude Juncker, Luxemburg prime minister, *The Economist*, 2007.

The macroeconomic literature has largely investigated the cross-country heterogeneity of macroeconomic variables, especially considering business cycle statistics, namely the variability of output, consumption, investment, and interest rates¹; however, the heterogeneity and the determinants of debt dynamics across countries is a much less examined issue². In this paper we provide evidence, both theoretical and empirical, that the interaction between political frictions and strategical political incentives to borrow is a key factor in explaining the cross-sectional differences in debt levels.

The literature about the cross-country variations of business cycle statistics is large: a line of research argues that business cycles in emerging countries can be explained well using a neoclassical model driven solely by shocks to total factor productivity (for example, [Aguiar and Gopinath \(2007\)](#)). Others have explained cross-country heterogeneity with the presence of frictions (financial friction as in [Garcia-Cicco et al. \(2010\)](#), labor market friction in [Boz et al. \(2012\)](#)). Finally, another branch of the literature have investigated the relationship between the main features of business cycles and the institutional and structural characteristics of countries (for example [Altug et al. \(2012\)](#)). This paper is related to the latter line of research.

Our contribution is both theoretical and empirical. From a theoretical point of view, we analyze what are the main political determinants of borrowing incentives. We show that for a large class of utility functions, political uncertainty *per-se* does not create borrowing incentives. However, the introduction of retrospective voting, which assumes that electoral outcomes are dependent upon recent economic performances, can revert that result, thus creating borrowing incentives. From an empirical point of view, we confirm our theoretical results by analyzing a cross-country dataset on debt, economic performances, and quality of governments. We use the predictions of our model to structurally estimate the unobserved degree of retrospective voting for 56 developing economies. We show that this feature, jointly with observable measure of political frictions, can explain a substantial fraction of the cross-sectional dispersion of the debt-to-GDP ratio that is unexplained by other macroeconomic factors. Finally, we find that the estimated measures of retrospective voting are strongly linked to indices of corruption. This finding can be related to the theoretical work of [Rogoff and Sibert \(1988\)](#) and [Rogoff \(1990a\)](#), where retrospective voting arises because politicians

¹See [Uribe \(2013\)](#) for a review.

²See [Semlali \(1997\)](#).

might have undesirable and unobserved characteristics.

Our theoretical result strongly depends on how political frictions are modelled. In [Amador and Aguiar \(2011\)](#) the benefit from being in power for an incumbent comes directly from her preferences and it is independent from the allocation of resources. In [Alesina and Tabellini \(1990a\)](#) two opposing parties aim to invest in two different public goods. In our model, similarly to [Alesina and Tabellini \(1990b\)](#), parties have preferences over distribution across different groups and decide the allocation of consumption according to these preferences. A single parameter, which we refer to as the degree of political frictions, determines how unequally the incumbent would like to split aggregate resources. As long as preferences are far from the case of zero inequality, the benefits from being in power are larger. We believe that the assumption on political frictions operating through redistribution of resources is realistic, in particular when considering emerging markets. There is broad evidence that economic inequality is also related to conflicting preferences over redistribution especially in countries where ethnic heterogeneity is large. For example, [Alesina et al. \(2001\)](#) argue that most of the differences in redistribution in U.S. and in Europe are a result of the racial heterogeneity in the U.S. political institutions; similar results hold also at cross-country level. Finally, [Horowitz \(1985\)](#) studies several cases where the strong relationship between ethnicity and redistribution is evident, thus concluding that:

“In much of Asia and Africa, it is only a modest hyperbole to assert that the Marxian prophecy has had an ethnic fulfillment”. Donald L. Horowitz, 1985.

We include political frictions described above in a standard small open-economy setting: an incumbent makes intertemporal consumption/saving decisions by borrowing or saving at a fixed international interest rate. Our first result is that when political uncertainty is characterized by a constant probability to be reelected, political frictions *per-se* are not necessarily able to produce borrowing incentives. For example, when the incumbent has Constant Relative Risk Aversion (CRRA) preferences with risk aversion coefficient greater than one, political uncertainty and political frictions induce precautionary savings. In fact, under this preferences, the incumbent would like to transfer resources from her incumbent-state to a possible future opposition-state, thus leading to incentives to postpone consumption. This finding appears to contradict the generally stated result in the literature (see [Alesina and Tabellini \(1990b\)](#)³) that political frictions generate borrowing incentives because an incumbent, when

³A similar framework is presented also in [Alesina and Tabellini \(1990a\)](#) in a more complex economy lasting T periods where the decision is about which kind of public good to finance. The mechanism that produce borrowing in this model is the same as in [Alesina and Tabellini \(1990b\)](#). The idea originated also independently in [Persson and Svensson \(1989\)](#).

in office, prefers to spend since political uncertainty does not guarantee that in the next period resources will be allocated according to her preferences. We point out that this result is valid, but only under certain values of the preference parameters (in the specific case of CRRA utility, it holds only when the degree of risk aversion is less than one). Since the microeconomics, macroeconomics, and finance literature all support estimates of the CRRA risk aversion coefficient greater than one (or equivalently of an intertemporal elasticity of substitution less than one)⁴, one goal of this paper is to introduce a new channel through which political frictions induce borrowing incentives also for less restrictive and more plausible assumptions about the properties of the utility function.

Then, as a second contribution, we introduce retrospective voting in our political economy framework. Specifically, we generalize the model described above assuming, in a reduced form, that an incumbent has a larger probability of being reelected if the population observes large consumption levels. Since in our model utility depends solely on consumption, higher aggregate consumption level improves the chances of an incumbent to retain office⁵. Empirical studies, such as Pacek and Radcliff (1995), Lewis-Beck and Stegmaier (2000), and Bartels (2013), support the notion that economic performance is a crucial determinant of electoral outcomes and political approval. Theoretically, retrospective voting has been first introduced by Nordhaus (1975) where voters myopically reappoint the incumbent conditionally on current economic conditions. Rogoff and Sibert (1988) and Rogoff (1990a) rationalized this behaviour in a rational expectation model by means of a multidimensional signalling game, where parties have time-persistent preferences and voters try to extract the competence of the incumbent by observing economic conditions. We are able to show that political uncertainty *together with* retrospective voting induces borrowing incentives for the incumbent. Intuitively, when the electorate is particularly sensitive to economic conditions, an incumbent is willing to borrow in order to increase current consumption to gain political advantage against the opposition. Interestingly, we also find that borrowing incentives are larger when the degree of retrospective

⁴There is a large amount of literature about possible estimates of the coefficient of CRRA preferences. Examples are Friend and Blume (1975) and Szpiro (1986) that estimate this parameter using cross sectional data and they find a degree of relative risk aversion between 1 and 2. Another branch of literature estimates the Elasticity of Intertemporal Substitution from the Euler equation using time series data. In the case of CRRA preferences the EIS is invertely related to the coefficient of relative risk aversion. Hansen and Singleton (1983), Hall (1988), Campbell and Mankiw (1989) conclude that consumption growth is not sensitive to variations in the interest rates, implying that EIS is close to 0 and the relative risk aversion should be very high. The real business cycle literature (e.g. Jones et al. (2000)) argues that to match US data, a level of EIS slightly greater than 1 is needed. Finally, the macro-finance literature shows that in order to explain the equity premium puzzle (see Mehra and Prescott (1985)) large values of risk aversion are needed. All these papers differ in the precise number that we should assign the coefficient of relative risk aversion, but there is almost perfect agreement about the fact that this number should be greater than 1.

⁵In our setting retrospective voting exists without rationalizing it formally, but the model could be extended by endogenizing the voting behaviour.

voting is larger.

As a third contribution, we use the theoretical predictions of our model to estimate the unobservable degree of retrospective voting. Recall the two main theoretical findings: first, without retrospective voting, stronger political frictions lead to larger *saving* incentives; second, when the degree of retrospective voting is instead high, stronger political frictions lead to larger *borrowing* incentives. These predictions act as identification assumptions on the country-specific degree of retrospective voting, when political frictions and debt levels are observed. Hence, in the empirical part of the paper, we structurally estimate the degree of retrospective voting for each country. We gather data about economic variables and quality of institutions for the period 1989-2010 for 56 emerging and transition economies. For each country, we measure the degree of political friction with an index that combines the degree of ethnic fractionalization and a measure of inequality. As discussed above, this measure has been already related in the literature to political frictions and it maps closely to our modelling assumptions. After taking into account the impact of macroeconomic factors (such as economic performance, demographics, financial development, and energy dependence) on debt levels, we estimate the degree of retrospective voting that is able to fit the model predictions. We show that our estimates can explain a significant portion of debt levels. Finally, we relate the estimated measures of degree of retrospective voting to corruption indices. The strong relationship between our estimates and observable corruption measures is striking and robust to many different specifications of the model. The rationale behind this link steams from the idea developed in [Shi and Svensson \(2006\)](#): when governments might have unobservable, and potentially undesirable, characteristics, voters must rely simply on economic conditions as a possible signal about the quality of the government. According to this theory, then, it should be the case that the larger is the uncertainty about the type of the government, the stronger is the degree of retrospective voting. Finally, we validate our theory showing that indeed corruption indices explain a large part of the cross-sectional debt heterogeneity only when they interact with observed measures of political frictions, in line with our theory.

The structure of the paper is as follows. In section 2 we validate the main theoretical results on the cross section of debt to gdp across countries. In section 3 we present our model and the political economy environment, In section 4 we derive analytical results for a two and three period model that abstracts from retrospective voting. In section 5 we introduce retrospective voting. In section 6 we conduct the empirical analysis and test the model. In section 7 we present the final remarks.

2 Determinants of Debt in the Cross-Section, Political Frictions, Corruption

In the introduction we argue that political frictions produces borrowing incentive only in presence of retrospective voting. Before showing this result with our model, in this section we demonstrate that corruption and political frictions drives debt exactly in the same direction as retrospective voting and political friction drives debt in our model. We can summarize the theoretical predictions of our model as follows: (1) absent retrospective voting, political frictions incentivize savings, (2) absent political frictions, retrospective voting has no effect on debt, (3) with retrospective voting, stronger political frictions incentivize borrowing.

We proxy political frictions (θ) for each country as a linear combination of Gini index and ethnic fractionalization⁶. The reason is that in the model we interpret political frictions as biased preferences over distribution of resources as in [Alesina and Tabellini \(1990a\)](#). Retrospective voting is unobservable and is proxied by Corruption Perception index since this voting behavior arises because politicians might have undesirable and unobserved characteristics. We investigate whether these predictions are satisfied when assuming that retrospective voting is proxied by corruption indices. We then estimate the following regression:

$$\bar{D}_i = \kappa_0 + \kappa_1\theta_i + \kappa_2(\theta_i\text{Corrupt}_i) + \kappa_3\text{Corrupt}_i + \kappa_J X_J \epsilon_i, \quad (1)$$

where X_J denotes possible additional regressors: *Pop>65* represents the share of the population over 65 years old, *Credit* is domestic credit provided by the banking sector, *GDPpc* is GDP per capita, *Openness* is the sum of export and imports over GDP, *Majoritarian* is the fraction of years in which the country had majoritarian system, *Energy* is per-capita energy production.

The estimates of this regression are reported in Table 1. The empirical predictions are consistent with our theory. First, as in prediction (1), the sign of the effect of political friction on debt is negative, although not significant. Second, as in prediction (2), when political friction are not present, corruption has no significant effect on debt, since its estimate is statistically not different from zero (Columns (1) - (5)). Finally, and most importantly, as in prediction (3), when corruption is large, stronger political friction implies higher debt. Notice that the estimate of this interaction is positive and significant. Notice that the results are strongly robust to including different regressors, when we include Continent dummies or when we change the sample period in which debt to gdp is calculated.

⁶See section 6 for data source

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Debt/Gdp	Debt/Gdp	Debt/Gdp	Debt/Gdp	Debt/Gdp	Debt/Gdp	Debt/Gdp	Debt/Gdp	Debt/Gdp
									(sample 1990-2010)
Constant	0.51*** (4.88)		2.03*** (5.59)		1.93*** (4.55)	2.60*** (5.05)			
Political Frictions	0.36 (0.82)	-0.26 (-0.39)	-0.03 (-0.06)	-0.25 (-0.45)	-0.02 (-0.04)	-2.48** (-2.55)	-0.97 (-0.59)	-1.05 (-0.62)	-0.33 (-0.17)
Corruption					0.01 (0.41)	-0.16** (-2.05)	-0.10 (-0.81)	-0.10 (-0.79)	-0.04 (-0.26)
Interaction						0.75** (2.42)	0.63** (2.29)	0.64** (2.37)	0.52* (1.69)
Pol.Friction^2							-3.17 (-1.21)	-3.13 (-1.14)	-4.48 (-1.31)
Corruption^2							0.00 0.03	0.00 -0.03	0.00 -0.10
Pop>65			-0.17 (-0.14)	0.81 (0.45)	-0.07 (-0.05)	-0.51 (-0.43)	1.24 (0.60)	1.59 (0.79)	2.10 (0.97)
Credit			0.14 (0.99)	0.21 (1.37)	0.16 (0.96)	0.19 (1.21)	0.36** (2.28)	0.35** (2.27)	0.42** (2.37)
GDPpc			-0.18*** (-3.67)	-0.21*** (-3.96)	-0.17*** (-3.60)	-0.18*** (-3.75)	-0.21*** (-4.30)	-0.21 (-3.28)	-0.24** (-2.70)
Openness			-0.22 (-1.78)	-0.11 (-0.78)	-0.21 (-1.62)	-0.22 (-1.58)	0.00 (0.19)	0.00 (0.19)	0.00 (-0.10)
Majoritarian							0.04 (0.36)	0.04 (0.36)	0.01 (0.09)
Energy							0.09 (0.46)	0.09 (0.46)	0.03 (0.16)
Continent Dummies	NO	YES	NO	YES	NO	NO	YES	YES	YES
R ²	0.01	0.19	0.32	0.39	0.32	0.37	0.46	0.46	0.53
R ² squared	-0.01	0.11	0.25	0.27	0.23	0.23	0.28	0.25	0.34
DW	1.91	1.91	2.03	2.05	2.04	1.90	2.00	2.07	2.09

Table 1: Debt, Corruption, and Political Frictions

Note: In this table we report the estimates of the panel regression in (1). The dependent variables is the debt-to-GDP ratio (external and internal) for each of the 56 countries reported in Table 3 for the period 1981 to 2010. Different specification accounts for several controls. t-statistics are reported in parenthesis. (*) indicates significance at 10 percent; (**) indicates significance at 5 percent; (***) indicates significance at 1 percent.

3 The Model

In this section we describe our economy of interest. Two are the most important features of the model. First, we consider political disagreement: as in REFERENCE, the economy is populated by several groups of domestic agents that are represented by political parties. The incentive of an incumbent to favour her group constitutes a political friction. The only uncertainty in our model is represented by the political uncertainty, since the re-election of an incumbent is a stochastic event. Second, in our more general framework we introduce the concept of corruption. We assume that corruption stem from the inability of voters to judge and assess politicians. Therefore, a corrupted system leads voters to reappoint an incumbent when her mandate was characterized by good economic performance, which in our model means higher aggregate consumption level and utility. In this sense, we generalize Amador and Aguiar (2011) by assuming that the probability of reelection is constant only in an economy where corruption is absent, and that it is instead a function of previous aggregate consumption levels in an economy where corruption is present.

3.1 Preferences

Consider a neoclassical small open economy model with $N + 1$ equally sized groups of domestic agents, each represented by a political party. Each period one of the $N + 1$ parties is in office and the incumbent party remains in power with a given probability $p(\cdot)$. Conditional on the incumbent losing the elections, each opponent party has equal probability $\frac{1-p(\cdot)}{N}$ of being elected. In a corrupted economy the probability of being reelected is a positive function of aggregate consumption, whereas in a non-corrupted economy, that probability is constant and fixed, as in Amador and Aguiar (2011). We model political disagreement by using the partisan approach; the party in power decide borrowing and consumption allocation to the different groups. Each political party i cares about all the agents in the economy, but gives higher weight to agent i , meaning that $\theta_{i,i} \geq \theta_{i,j}$. We define the utility at time t of party i when in power as:

$$\mathcal{U}^{i,i}(c_t^i) = \theta_{i,i}u(c_t^{ii}) + \sum_{q \neq i} \theta_{i,q}u(c_t^{i,q}), \quad (2)$$

where $\theta_{ij} \geq 0$, $\forall i, j$ s.t. $\sum_{j=1}^{N+1} \theta_{i,j} = 1$, is the weight that party i associates to the utility of party j , and $c_t^i = \{c_t^{i,1}, \dots, c_t^{i,N+1}\}$ is the consumption allocation. The instantaneous utility function $u(\cdot)$ satisfies the standard conditions, that is $u(\cdot)$ is uniformly continuous, twice continuously differentiable, strictly increasing in c , and satisfies the Inada conditions.

Instead, the utility of an opposition party r when party i is in power, is defined as:

$$\mathcal{U}^{i,r}(c_t^r) = \theta_{r,r}u(c_t^{ir}) + \sum_{q \neq r} \theta_{r,q}u(c_t^{r,q}).$$

Moreover, we assume no discrimination, i.e. each party weights equally the utility of other types of agents and likes to be in power as the other parties do. In this way we have simplified the problem by imposing symmetry, meaning that we are also going to restrict our attention to equilibria that are symmetric. The symmetry assumption imposes that $\theta_{i,i} = \theta \forall i$ and $\theta_{i,q} = \frac{1-\theta}{N}$ such that $\frac{1}{N} \leq \theta < 1$; hence, we can simply ignore the identity of the party in power and at the opposition. We exclude the case with $\theta = 1$ in order to avoid corner solutions⁷. Each party is born at 0 and lives for T periods and discounts future utility at rate β .

3.2 International Financial Market

The party in power (incumbent) has the ability to borrow or lend in a risk-free internationally traded one-period, non-contingent, real bond. Similarly to a small-open economy setting, the evolution of the debt position of the government is:

$$d_{t+1} - d_t = rd_t + c_t - y_t, \tag{3}$$

where d_t denotes the debt position assumed in period t , r denotes the fixed world interest rate, and y_t is an exogenous stochastic endowment.⁸ We assume that each party cannot renege the debt contract in each period even if it was stipulated by another party⁹. Since the economy ends at T it must be that $d_T = 0$.

In each period, the party in power (incumbent) decide the amount of borrowing (lending) in the one-period bond (d_{t+1}) and the allocations of consumptions across the different type of agents, such that $\sum_{i=1}^{N+1} c_t^i = c_t$.

3.3 Political Economy

We consider a political environment where political power fluctuates between the $N + 1$ parties (players). As in [Acemoglu et al. \(2011\)](#), the incumbent decides consumption allocation

⁷See [Alesina and Tabellini \(1990b\)](#) for a model where each party cares only about her personal consumption, in such a case the borrowing implications are very different

⁸Here we assume, for simplicity, that the interest rate is inelastic with respect to the debt position of the country.

⁹See [Cuadra and Sapriza \(2008\)](#) for a discussion of the case when the government can actually default.

between groups, but in our case the incumbent decides the amount of debt next period¹⁰. As in [Acemoglu et al. \(2011\)](#) the timing is as follows:

1. In each period t , we start with one party, i , in power.
2. Exogenous output y_t realizes.
3. Party i chooses the level of aggregate consumption c_t by choosing the quantity of debt to carry to the next period, d_{t+1} .
4. Given the level of aggregate consumption c_t , party i chooses consumption allocations for each type of agents, c_t^i , subject to the feasibility constraint $\sum_{j=1}^{N+1} c_t^j = c_t$.
5. In an economy without corruption, the re-election probability parameter p , which determines the likelihood that an incumbent will be in power also in the next period, is constant. Instead, when corruption is present, p follows a first order Markov process. In this case, then, the probability of party j to retain office in $t + 1$ depends on the level of aggregate consumption c_t , and it is equal to $p(c_t)$, where $p(\cdot)$ is a continuously differentiable and increasing function. If the incumbent j is not reappointed (event with probability $1 - p(c_t)$), then the opposition parties have equal probability of being in power. Hence, each opposition party will be in office in period $t + 1$ with probability $\frac{1-p(c_t)}{N}$. We define $\omega_t \in \mathfrak{R}^{N+1}$ as an index s.t. $w_{i,t} = 1$ if i is the incumbent at period t and 0 otherwise, and the evolution of this index is determined by the first order Markov process.

In [Appendix 8](#) we describe in detail the Symmetric Markov Perfect Equilibrium that arise from this political environment.

In our framework the political setup induces three kinds of frictions:

1. The uncertainty from the political election together with disagreement about redistribution (as in [Alesina and Tabellini \(1990a\)](#));
2. The time inconsistency problem that the policy maker faces driven by political uncertainty (as in [Amador \(2004\)](#) and [Battaglini and Coate \(2006\)](#)).
3. The strategic behaviour of the incumbent to increase her probability of re-election by increasing aggregate consumption via borrowing, when corruption is present. (see [Rogoff \(1990a\)](#) and [Rogoff and Sibert \(1988\)](#))

¹⁰[Acemoglu et al. \(2011\)](#) considers a closed economy with zero external borrowing.

In the next sections we show that with commonly used utility function the political uncertainty [1] and the associated time inconsistency problem [2] are not in general sufficient to create incentives for the incumbent to borrow. In contrast, the strategic behaviour induced by retrospective voting [3] might generate significant amount of borrowing in the economy. This result implies that retrospective voting together with the political conflict parameter θ can produce large heterogeneity in borrowing decisions that is observable in the data.

4 Savings, Political Uncertainty, and Time Inconsistency

In this section we analyze the role of the political uncertainty when corruption is absent, which means that the incumbent has a constant probability to be re-elected p , as in [Amador and Aguiar \(2011\)](#). We show two important results. First, by considering a simple two periods model, we find that political uncertainty alone induces more saving with respect to a frictionless economy. The degree of saving incentives depends on the properties of the utility function and on the degree of political friction. For commonly used utility functions (constant relative risk aversion with risk aversion parameter greater or equal to one) we show that political uncertainty does not generate borrowing incentives. Second, by extending the model to three-periods we show that, for the same class of utility, the time inconsistency arising from political uncertainty also is not able to generate borrowing incentives.

It is generally stated in the literature that political frictions produce borrow incentives since parties prefer to spend when they are in office since political uncertainty does not insure the incumbent that next period resources will be allocated according to her preferences. In section 4.2 we show that this explanation is valid whenever political frictions and preferences imply that the incumbent has larger marginal utility than the opponent. This is the case in the seminal paper by [Alesina and Tabellini \(1990b\)](#), where the incumbent decides how to allocate consumption between two parties in a similar framework to the one presented in the previous section. The same idea is present in [Alesina and Tabellini \(1990a\)](#) in a more complex economy lasting T periods where the decision concerns the type of public good to finance. A similar approach is followed also independently by [Persson and Svensson \(1989\)](#). In this section we claim that conditions for borrowing incentives are not satisfied when using logarithmic utility function and without retrospective voting. For a matter of presentation we assume that output is constant, thus leaving political uncertainty as the only source of uncertainty in the model.

4.1 The Benchmark Corruption-less Economy

In order to study the role of political frictions in consumption-saving decisions, we first isolate the effects resulting from political uncertainty arising from the disagreement about consumption distribution and from the time inconsistency that it generates. To provide with some theoretical results, in the first part of the paper we simplify the model assuming that the economy lasts only two periods, $t = 1, 2$, and that output, y , and the interest rate, r , are constants. Since the economy last only two periods, no borrowing is allowed in period $t = 2$ and it will be not optimal to save in the last period.

As a benchmark for comparison we consider the model where all political frictions are eliminated, which happens when a party weights equally the instantaneous utility of each group, i.e. when $\theta_{q,i} = \frac{1}{N+1} \forall q, i \in 1, \dots, N + 1$. In this case each party is indifferent to be in power or in opposition as that would imply an identical consumption distribution; hence, we have that: $U^I(c_t) = U^O(c_t) = u\left(\frac{c_t}{N+1}\right)$. As evident, in this case the political economy component of the model is shut down, since any incumbent will equally distribute aggregate consumption across agents, and, as a result, the political uncertainty does not play any role.

In the two period economy, the game is extremely simplified. Since at period 2 the total amount of debt must be fully repaid, the action of the incumbent in period 2 is completely determined in a symmetric equilibrium case. Since there is no disagreement there is no reason to deviate from the optimal equal sharing rule. Hence, the solution of the borrowing problem is determined by maximizing the intertemporal utility in (20), which in the frictionless economy becomes:

$$\begin{aligned} \max_{\{c_1, c_2, d_2\}} & u\left(\frac{c_1}{N+1}\right) + \beta u\left(\frac{c_2}{N+1}\right) \\ \text{s.t. } & d_2 = (1+r)d_1 + c_1 - y \quad \forall t, \end{aligned}$$

given d_1 . Assume that $\beta^{-1} = 1+r$ so that there is no other borrowing or lending incentive in the model other than the one resulting from political frictions. Hence, the equilibrium of the frictionless model is given by:

$$u'\left(\frac{y + d_1 - (1+r)d_2}{N+1}\right) = u'\left(\frac{y - (1+r)d_2}{N+1}\right). \quad (4)$$

This condition implicitly characterizes the optimal debt d_2^* in the frictionless economy as a function of the parameters d_1, r, N, y .

4.2 Savings and Political uncertainty

Let us now consider the economy with political uncertainty, where the incumbent i values the utility of his party $\theta_{i,i} = \theta > \frac{1}{N+1}$. In this section we abstract from retrospective voting by assuming that the probability of an incumbent to be reelected is a constant equal to p .

Given a level of aggregate consumption, we defined the incumbent's utility when the optimal sharing rule is applied as:

$$U^I(c) = \theta u(c^I) + (1 - \theta) u\left(\frac{c - c^I}{N}\right),$$

where c^i is the value of consumption held by the incumbent party. Define each opposition party's utility in the optimal distribution as:

$$U^O(c) = \frac{(1 - \theta)}{N} u(c^I) + \left(1 - \frac{(1 - \theta)}{N}\right) u\left(\frac{c - c^I}{N}\right),$$

since the opposition values θ his own instantaneous utility and $\frac{(1-\theta)}{N}$ the utility of the incumbent and of the other N opposition parties.

As before the problem can be solved by maximizing the intertemporal utility (20) with respect to d_1 , anticipating that the incumbent at period 2 will repay the public debt and implement the optimal sharing rule.¹¹

In period $t = 1$ the problem for the incumbent is then:

$$\begin{aligned} & \max_{\{c_1, c_2, d_2\}} U^I(c_1) + \beta [pU^I(c_2) + (1 - p)U^O(c_2)] \\ \text{s.t. } d_2 &= (1 + r)d_1 + c_1 - y \\ \text{and } \theta u'(c_t^I) &= \frac{(1 - \theta)}{N} u'\left(\frac{c_t - c_t^I}{N}\right), \forall t = 1, 2. \end{aligned}$$

The equilibrium condition of this problem is:

$$U^I'(y - (1 + r)d_1 + d_2) = [pU^I'(y - (1 + r)d_2) + (1 - p)U^O'(y - (1 + r)d_2)], \quad (5)$$

¹¹Suppose, instead, that the incumbent does not apply the optimal sharing rule. Then, the incumbent at period 2 could threaten the incumbent at period 1 by applying a more severe sharing to induce him not to overborrow. Such an equilibrium would not be sub-game perfect, since in the stage game the incumbent will never implement a different sharing rule. This kind of reasoning always applies with finite game.

where

$$U^I(c) = \theta u'(c^I) \frac{\partial c^I}{\partial c} + \frac{(1-\theta)}{N} u' \left(\frac{c-c^I}{N} \right) \left(1 - \frac{\partial c^I}{\partial c} \right) = \theta u'(c^I), \quad (6)$$

$$U^O(c) = \frac{(1-\theta)}{N} u'(c^O) \frac{\partial c^I}{\partial c} + \frac{1}{N} \left(1 - \frac{(1-\theta)}{N} \right) u' \left(\frac{c-c^I}{N} \right) \left(1 - \frac{\partial c^O}{\partial c} \right). \quad (7)$$

The equilibrium condition (5) defines the equilibrium level of debt in case of political uncertainty, \tilde{d}_2^* . Political uncertainty affects the intertemporal decision of the incumbent. When the incumbent is deciding the optimal level of debt, she takes into account that the marginal cost of an extra unit of debt in period 1 is the weighted average of the period 2 marginal utility of being incumbent and opponent. Depending on the relative size of these two marginal utilities, political frictions can generate more saving or more borrowing with respect to the frictionless case. Proposition (1) states the conditions for having more saving in a partisan economy with respect to the frictionless economy. The results that follow hold under the assumption that $\frac{\partial c^I}{\partial c}$ is constant. In the appendix we show that this holds for HARA preferences.

Proposition 1. *Political Uncertainty and Savings.* *Consider the political economy model as specified above; then the following statements are equivalent:*

(a) $\tilde{d}_2^* \leq d_2^*$.

(b) $U^I(c) \leq U^O(c)$

(c) $\theta \geq \frac{\partial c^I}{\partial c}$

(d) $\frac{u''(c^O)}{u''(c^I)} \leq \left(\frac{u'(c^O)}{u'(c^I)} \right)^2$

This is an interesting result coming from the partisan approach of modelling political friction. This result is in contrast with Amador and Aguiar (2011) that showed that political frictions generate incentive of borrowing. The reason for their result is that they modelled political frictions using the opportunistic approach where the incumbent has *per se* larger marginal utility than the opponent.

Proposition 1 states that political frictions induces saving only when the marginal utility of the incumbent is lower than the marginal utility of the opponent. This is an intuitive result: if that condition is satisfied, a unit of consumption is more valuable for the opposition than for the incumbent. Hence, a party is willing to move resources from the incumbent state to the opposition state. Given that in time $t = 1$ the decision maker is the incumbent and that there is some positive probability that at time $t = 2$ that agent will be at the opposition, she is then willing to move resources intertemporally from $t = 1$ to $t = 2$.

Notice that, as equations (6) and (7) show, the marginal utilities of the incumbent and opposition depend on the property of the utility function not only through its first derivative u' , but also from its second derivative through the sharing rule $\frac{\partial c^i}{\partial c}$. In fact, by using the implicit function theorem on equation (21), it is trivial to show that:

$$\frac{\partial c^I}{\partial c} = \frac{\frac{1-\theta}{N^2} u''\left(\frac{c-c^I}{N}\right)}{\theta u''(c^I) + \frac{1-\theta}{N^2} u''\left(\frac{c-c^I}{N}\right)}. \quad (8)$$

The shape of the utility function is then a crucial determinant on the role of political frictions. We can study if that condition is satisfied when considering commonly assumed utility functions, as provided in the next corollary.

Corollary 2. *Utility Functions and Savings.* *Consider the political economy model as specified above: if $u(c) = \frac{c^{1-\sigma}}{1-\sigma}$, and $\sigma > 1$ then $\tilde{d}_2^* < d_2^*$; if $u(c) = \log(c)$, then $\tilde{d}_2^* = d_2^*$. In addition, for these classes of utility:*

$$\frac{\partial c^I}{\partial c} = \psi.$$

where $\psi \in \mathbb{R}$

In the case of the CRRA utility function the saving condition is always satisfied whenever $\sigma \geq 1$. When $\sigma \rightarrow 1$ (log utility case) the marginal utility of the incumbent is equal to the marginal utility of the opposition party, and by Proposition 1 the equilibrium under political uncertainty is identical to the one in the frictionless economy, for any value of p or θ . Hence, when considering logarithm instantaneous utility, political uncertainty does not affect the consumption-saving decision.

As pointed out, the incentive for an incumbent to save relies on the willingness to bring resources from its incumbent state to a possible opposition states. When the latter is less likely, the saving incentive is reduced. The next corollary formally states this feature.

Corollary 3. *Political uncertainty and Savings.* *Assuming that the utility function is such that $U'^I(c) \leq U'^O(c)$, then $\frac{\partial \tilde{d}_2^*}{\partial p} > 0$ and $\tilde{d}_2^* = d_2^*$ when $p = 1$.*

The 2-period case that we have discussed in this section, had been already studied in Alesina and Tabellini (1990b). The authors studied the case with $1/2 < \theta < 1$ and derived the same condition for borrowing that is presented in proposition 1 in terms of ratios of the "concavity index" defined by Debreu and Koopmans (1982). As it is stated in our proposition 2 they argue that for the CRRA case, the borrowing condition is satisfied whenever $0 < \sigma < 1$. The problem is that this assumption makes it difficult to reconcile model predictions with

data. Indeed for the CRRA case, it is easy to show that the decision maker in the economy (i.e. the incumbent) has marginal utility

$$U^I(c) = \kappa(\sigma, \theta, N)c^{-\sigma}$$

From the Euler Equation it can be shown that the responsiveness of consumption growth to a variation of the interest rate is completely determined by $1/\sigma$ as in standard intertemporal model with CRRA utility functions. This means that with $\sigma < 1$ consumption growth is highly responsive to interest rate, an implication that the literature has largely showed that is irreconcilable in the data¹². Since the final goal is to use a model that has realistic implication in the quantitative analysis, we are not considering the case $\sigma < 1$, confirming the statement that without retrospective voting is extremely hard to generate an incentive to borrow. In Appendix ?? we show that the results presented in this section hold when considering an economy that lasts for more than two periods. In this case, political uncertainty creates another important determinant for consumption/saving decisions, which is time inconsistency.

5 Corruption and Borrowing Incentives

In the previous section we have pointed out that under the commonly used utility function political uncertainty alone does not generate borrowing incentives. In this section we now introduce an important feature of our model, retrospective voting, to show that retrospective voting is able to provide borrowing incentives. In what follows we modify the model presented above by assuming that the probability of being reelected is an increasing function of the aggregate consumption, $p(c)$. We focus our analysis in a simple framework that allows us to derive analytical results. We assume that the economy lasts only two periods $t = 1, 2$, and that the instantaneous utility function $u(\cdot)$ satisfies $\frac{\partial c^I}{\partial c} = \psi$.¹³ The problem for the incumbent is, then:

$$\max_{\{c_1, c_2, d_1\}} U^I(c_1) + \beta [p(c_1) U^I(c_2) + (1 - p(c_1)) U^O(c_2)] \quad (9)$$

$$\text{s.t. } d_2 = (1 + r) d_1 + c_1 - y \quad (10)$$

$$\text{and } \theta u'(c_t^I) = \frac{(1 - \theta)}{N} u' \left(\frac{c_t - c_t^I}{N} \right) \quad \forall t = 1, 2. \quad (11)$$

¹²Furthermore, in macro finance literature it is clear that $\sigma < 1$ doesn't provide any good result in explaining how agents face risky decisions.

¹³As shown in Corollary 2, CRRA and log utilities satisfy this property

The first order condition of this problem reads:

$$\left\{ \begin{array}{l} U'(c_1) + \\ + \beta p'(c_1) [U^I(c_2) - U^O(c_2)] \end{array} \right\} = \left\{ \begin{array}{l} p(c_1) U''(c_2) + \\ (1 - p(c_1)) U^{O'}(c_2) \end{array} \right\}. \quad (12)$$

The solution of this equilibrium condition delivers the optimal level of debt under retrospective voting, \hat{d}_2^* .

Comparing the equilibrium condition above with the equilibrium condition of the economy with constant probability of re-election (equation (5)), retrospective voting adds an additional term on the marginal benefit of borrowing, since increasing debt, and therefore aggregate consumption, now increases the probability of being re-elected by $p'(c)$. Having higher probability of being re-elected have a value equal to the difference in utility between the incumbent and the opposition at period 2. Since this difference is always positive, and since $p'(c) > 0$, this additional term increases the marginal utility of borrowing.

Before proving more formally this statement, notice that the first order condition in (12) could not be a sufficient condition for the equilibrium. In lemma 4 we define a sufficient condition for $p(c)$ to guarantee this result; if this condition is not satisfied (12) can also identify local maxima.

Lemma 4. *Under the "saving" conditions of proposition 1, if $\forall d_2$*

$$p'(c_1) < A_1(c_2) \quad (13)$$

$$p''(c_1) < A_2(c_2) \quad (14)$$

then the solution of (12) is a solution of (9)-(11) and it is unique. Here, $c_1 = y - (1+r)d_2$, $c_2 = y - (1+r)d_2$, $\tau = (N\theta - 1 + \theta)N^1$, and $A_1(c_2)$, $A_2(c_1, c_2)$ are:

$$A_1(c_2) = (1+r) \frac{\theta \psi^2 u''(\psi c_2) + (1-\theta) \left(\frac{1-\psi}{N}\right)^2 u''\left(\frac{1-\psi}{N} c_2\right)}{\tau \left[\psi u'(\psi c_2) - \frac{1-\psi}{N} u'\left(\frac{1-\psi}{N} c_2\right) \right]} > 0.$$

$$A_2(c_2) = -(2+r) \frac{\theta \psi^2 u''(\psi c_2) + (1-\theta) \left(\frac{1-\psi}{N}\right)^2 u''\left(\frac{1-\psi}{N} c_2\right)}{\beta \tau \left(u(\psi c_2) - u\left(\frac{1-\psi}{N} c_2\right) \right)} > 0.$$

When the unique solution of (12) characterizes the optimal level of debt, we can prove the following proposition.

Proposition 5. Retrospective Voting and Borrowing. *Assume condition (14) is satisfied. Define, \hat{d}_2^* the solution of the the two period model with retrospective voting that solves*

equation (12), and define \tilde{d}_2^* the solution of the model without retrospective voting that solves (5), then we have: $\tilde{d}_2^* < \hat{d}_2^*$, and

$$\frac{\partial \hat{d}_2^*}{\partial p'(\tilde{d}_2^*)} > 0.$$

Proposition 5 is a crucial result to link political friction to borrowing incentives. In fact, when local maxima of problem (9)-(11) are ruled out, we can formally prove that retrospective voting reduces the saving incentives generated by political uncertainty and that can create borrowing incentive if the sensitivity of the probability of being reelected is sensitive enough to aggregate consumption.

5.1 Debt and Retrospective voting with CRRA utility function

Several important questions are still open. Existency conditions of lemma 4 are not easy to interpret and to verify in most of the cases. An interesting goal is also to verify the borrowing condition of proposition 5 for a given functional form of the election probability, $p(c)$, which means identifying restrictions on the parameters that generate a positive level of debt. In addition, and more crucially for the empirical part of this paper, is to analyze which is the impact on borrowing of an increase of the political conflict parameter θ conditioned on the level of sensitiveness of voters to economic conditions. In fact, in the standard model with constant election probability, we have seen that an increase in θ generates more saving; is it possible to observe the opposite result when we have retrospective voting? In Appendix 10 we investigate analytically these questions for log utility function and linear probability, i.e. when $p(c) = \gamma + \alpha(c - \bar{c})$. In this specific case we can easily check that: (1) borrowing solutions always exist (2) we can always characterize a threshold level for $\tilde{\alpha}$ s.t. if $\alpha > \tilde{\alpha}$ we have positive level of debt (3) $\tilde{\alpha}$ is independent of θ (4) When utility is logarithmic then $\partial d_2 / \partial \theta > 0$ when $\alpha > \tilde{\alpha} = 0$.

Numerically we are able to show that these conditions hold also for the generic class of CRRA utility functions and also for non-linear probability functions. First, let assume that the probability of being re-elected is represented by the following linear functional form:

$$p(c) = \gamma + \alpha(c - \bar{c}). \tag{15}$$

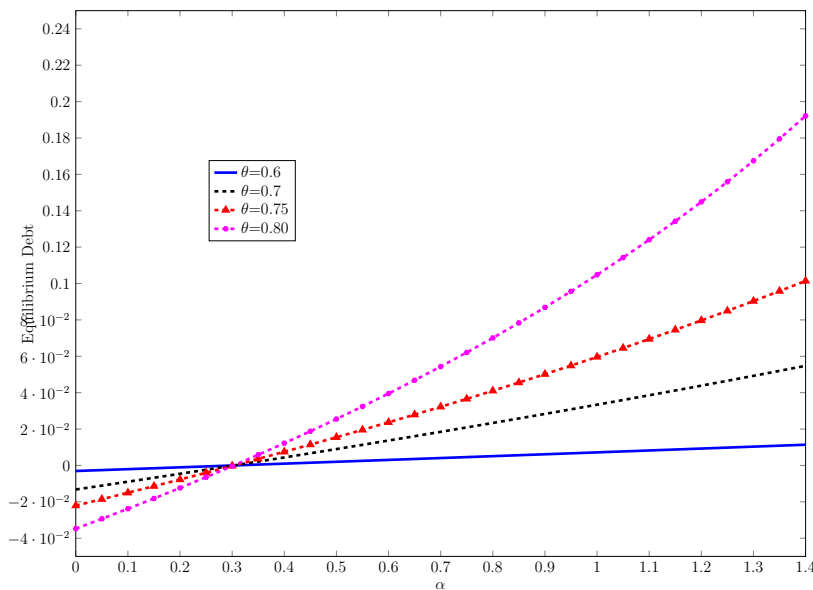
Although potentially this function could obtain values outside the $[0, 1]$ interval, in the following exercise we make sure that the realizations of the election probability lie in that interval.

Regarding the preference parameters, since our model is at annual frequencies, we fix the discount factor β to be equal to 0.9346. This value is consistent with an annual 7 percent world-

interest-rate, which corresponds to a basically null average real interest rate in the U.S. (-0.33 percent) in the period 1989-2010 and an average country premium of 7 percent, as reported in [Uribe and Yue \(2006\)](#). The coefficient of risk aversion, in the CRRA utility function, σ , is assumed to be equal to 5. Finally, we fix the level-parameter of the linear probability function γ , equal to 0.8.¹⁴ By assuring that the solution of the Euler Equation satisfies the second order condition, we derive numerically the shape of the period-1 equilibrium level of debt, d_1^* , as a function of (θ, α) . Figure 1 presents the results. Each line represents the relationship between the degree of retrospective voting, α , and equilibrium level of debt, for a specific value of political friction, θ . The first evidence that can be drawn from this exercise is that there exists a threshold level of α , $\tilde{\alpha}$ s.t.:

- $\alpha > \tilde{\alpha} \iff d_1^* > 0$
- $\tilde{\alpha}$ is independent from θ
- $\frac{\partial d_1^*}{\partial \theta} > 0 \iff \alpha > \tilde{\alpha}$ and viceversa

Figure 1: EQUILIBRIUM DEBT, RETROSPECTIVE VOTING, AND POLITICAL FRICTION



Note: This figure plots the equilibrium level of debt in a 2-period economy when assuming CRRA utility function and linear probability, for different values of degree of retrospective voting (α , x-axis) and degree of political friction, θ . The blue-solid line is associated to a low degree of political friction ($\theta=0.6$), the black-dotted line and the red-triangle-marked line are associated to moderate degrees of political friction ($\theta=0.7$ and 0.8 , respectively), and the pink-circle-marked line is associated to a high degree of political friction ($\theta=0.8$).

Specifically, when voters are sufficiently sensitive to economic conditions (α larger than $\tilde{\alpha}$), the economy experiences borrowing (as shown in the lemma 4) and political conflict, θ ,

¹⁴We have performed sensitivity-checks with respect to each of this parameter.

Table 2: Equilibrium Level of Debt in a T-period model

	α				
	0	0.5	1	1.5	2
$\theta=0.5$	0	0	0	0	0
$\theta=0.6$	-3.6	-0.4	0	0.2	2.0
$\theta=0.7$	-12.4	-2.9	0.2	10.3	14.0
$\theta=0.8$	-25.6	-8.0	2.7	39.9	63.8
$\theta=0.9$	-35.7	-14.3	7.7	58.1	110.5

Note: In this table we report the average level of debt (in percentage) in a T-period economy, with $T = 2250$, when assuming CRRA utility function and linear probability, for different values of degree of retrospective voting (α , x-axis) and degree of political friction, θ . Negative values denote savings.

has a positive impact on borrowing. Furthermore if α is too low the distortion arising from retrospective voting is not strong enough to cancel the saving incentive that we usually observe when the political uncertainty is exogenous. As a result, when the retrospective voting motive is weak, the economy saves. This is an important result that is testable in the data: our model, in fact, predicts that in countries where voters are really sensitive to economic conditions we should observe a positive correlation between debt to GDP and measures of political conflict (θ). This result is reversed when voters have weak retrospective voting. In Appendix 11 we show that this results hold also when considering a non-linear utility function.

5.2 Debt and Retrospective voting with in a T-period model

Here we generalize the model by considering an economy with T large. This generalization is important since one of our goal is to study the impact of political frictions on the level of debt of the economy. Since an analytic solution is not available when allowing for an arbitrarily large number of periods, we solve the problem of the incumbent by backward induction by assuming that each party plays Symmetric Markov Strategy. In this section we assume that the election probability is linear, as in (15). In Appendix 11 we show the robustness of our results when assuming a non-linear utility function. We performe comparative statics with respect to the two main parameters of interest: the degree of political friction, θ , and the degree of retrospective voting, α . The remaining parameters are calibrated as described in the previous section.

Table 2 shows how the average equilibrium level of debt (measured in percentage of the GDP, which is the constant endowment) varies with the degree of political friction, θ , and the degree of retrospective voting, α , when considering an economy that lasts for $T = 2250$

periods. Several results are worth noting. First notice that, not surprisingly, when political frictions are absent (i.e. $\theta = 0.5$) the economy experience no borrowing or saving, since in this case there is no incentive for the incumbent to distort voting; in other words the only uncertainty in the economy, which is political uncertainty, is irrelevant and, as a consequence, there are no incentive to save or borrow. In contrast, when political frictions arise (i.e. $\theta \neq 0.5$) Table 8 highlights two important features of the model.

1. Consistently with the analytical results derived for the two period model, for a given level of θ , the economy in average accumulates savings when the voters are mildly sensitive to their consumption level, i.e. for low values of α , and the economy in average accumulate debt when retrospective voting is strong (i.e. for large values of α). This finding is intuitive: in an economy characterized by mild retrospective voting, the political uncertainty induced by political frictions incentivizes precautionary savings. However, when retrospective voting becomes stronger, the incumbent's incentive to distort voting dominates.
2. Consistently with the analytical results derived for the two period model, the effect described above are more pronounced when political frictions are stronger. In fact, when θ increases, precautionary saving are larger when retrospective voting is mild, and borrowing incentives are stronger when retrospective voting increases.

These results show the consistency of the results for the T periods economy with the findings derived analytically when studying the three-periods model. Hence, we infer that most of our conclusions could be in general valid to more complex macroeconomic models. In particular, political frictions together with a different intensity of retrospective voting are able to generate cross-country heterogeneity in debt dynamics and strong political and ethnical conflicts can generate at the same time economic inequality, political instability, and large levels of sovereign debts if voters are sufficiently sensitive to economic conditions. At the same time, whenever voters are not influenced by economic performances, political conflicts and political uncertainty generates economic inequality and savings.

6 Structural Estimate of Retrospective Voting

The theoretical model we have presented in this paper features two important properties: first, political frictions alone do not induce borrowing incentives in a small-open economy setting, when considering CRRA preference with risk aversion larger than one, and, second, political frictions and retrospective voting can instead jointly create borrowing incentives. In

other words, for a given degree of political friction, difference in retrospective voting can induce either savings (with low degree of retrospective voting) or borrowing (with high degree of retrospective voting). Hence, assuming that political frictions are observable, the level of debt across country provides a source of identification for the unobservable degree of retrospective voting. In this section, we use this remark and we estimate the cross-sectional distribution of degree of retrospective voting from data on debt for a large set of small open economies. We then show that the implied degree of retrospective voting are closely related to measures of corruption, and we finally highlight that these measures are indeed an important determinant of the observed debt levels, only when interacted with observed political frictions, as predicted by our theoretical model.

6.1 Data

We consider 56 developing countries or transition economies, as listed in Table 3. Two are the main reasons to focus on this set of countries: first, in our model political frictions arise mainly from a redistribution channel, which is particularly important in developing economies; second, with this choice we insure that our results are not driven by other kinds of structural differences between developing and advanced economies, as already pointed out in the literature¹⁵.

Table 3: List of Countries

Algeria	Dominican Republic	Jordan	Panama	Taiwan
Argentina	Ecuador	Kenya	Papa New Guinea	Thailand
Bangladesh	Egypt	Korea	Paraguay	Tunisia
Bolivia	El Salvador	Latvia	Peru	Turkey
Brazil	Ethiopia	Malaysia	Philippines	Uruguay
Bulgaria	Ghana	Mauritius	Poland	Venezuela
Burundi	Guatemala	Mexico	Romania	Zambia
Cape Verde	Honduras	Morocco	Russia	Zimbabwe
Chile	Hungary	Namibia	Sierra Leone	
Colombia	India	Nepal	South Africa	
Costa Rica	Indonesia	Nigeria	Sri Lanka	
Czech Republic	Ivory Coast	Pakistan	Swaziland	

Note: In this table we list the emerging and transition economies included in the empirical analysis.

Our dataset is composed by annual observation from 1989 to 2010. Data on sovereign debt (external plus domestic debt) are in line with [Reinhart and Rogoff \(2010\)](#) and [Jaimovich](#)

¹⁵[Levine \(1997\)](#) underlined the role of financial development on the growth differential between countries. [Acemoglu et al. \(2001\)](#) focused instead on the colonial origins between different countries as an explanation for the existence of different institutions

and Panizza (2009)¹⁶. Economic data, namely GDP, consumption and Gini index, come from the World Bank database. Finally, institutional data are extracted from the Quality of Government dataset, which provides a wide range of series from different sources for the countries and sample of our interest.

6.2 Cross Country Level of Debt and Reelection Probability

The theoretical model presented in the previous section shows that the degree of retrospective is an important determinant of borrowing incentives as well as election probability. The main goal of this paper is to investigate the role of retrospective voting in explaining the cross-sectional variation of these two variables. Nevertheless, it is obvious that these two variables of interest also depend upon other factors that are not included in our simple model. Hence, as a first step of our quantitative analysis, we extract the component of debt levels and election probability that is not explained by other macroeconomic and institutional variables.

Regarding the level of debt, we regress the cross country observed debt-to-GDP ratio in a panel regression starting from 1981 to 2010 on a measure of economic performance (*Econ*, per-capita real GDP growth), a measure of energy dependence (*Energy*, per-capita energy production), a measure of demographic structure (*Demo*, percentage of the population over 65 years old) and a measure of financial development (*Financ*, domestic credit provided by the banking sector).¹⁷ These controls are included in order to take into account other specific factors that may affect optimal debt decision that are not included in our model. The regression equation is the following:

$$D_{i,t} = \beta_1 Econ_{i,t} + \beta_2 Energy_{i,t} + \beta_3 Demo_{i,t} + \beta_4 Financ_{i,t} + \delta_i + \epsilon_{i,t}^d. \quad (16)$$

The results of the regression are reported in Table 4. According to these estimates, a larger level of debt-to-GDP ratio is associated to poor economic performance; this relationship between debt and growth is not considered in our simple model where endowment is constant. Energy production reduces the dependency of the country from the rest of the world and reduces external debt. A larger share of elderly in the population is associated with larger debt level due to the impact of pensions on the central government balance sheet. Here the effect is not significant, but it is relevant in different specifications that we have used in

¹⁶The dataset from Jaimovich and Panizza (2009) allows us to increase the cross-sectional dimension at the cost of fewer observation in the time-dimension (until 2005). In fact, from this dataset we can also include the following countries: Bangladesh, Burundi, Cape Verde, Czech Republik, Ethiopia, Jordan, Latvia, Namibia, Nepal, Pakistan, Papua New Guinea, Sierra Leone, Swaziland. Unfortunately data are only available until 2005, but results are consistent with shorter sample size.

¹⁷These data are available for most of the countries in the World Bank dataset

the robustness analysis. Finally, a strong role of domestic banking sector in the economy is associated, in our regression, with larger level of debt; we interpret this link between financial development and debt level as an incentive device for foreign lenders to borrow from a more financially stable country, and it could be also related to a perceived lower default probability.

We then regress the estimated fixed effect in regression (16), δ_i , with a measure of the volatility of business cycle (i.e. the standard deviation of log deviation of output from its third-order polynomial trend, σ^y), by running $\bar{\delta}_i = \rho_0 + \rho_1 \sigma_i^y + \epsilon^{\delta_i}$. The results of this regressions are not reported, but we find a strong and significative negative relationship between volatility and debt. A larger volatility of the business cycle may produce, *ceteris paribus*, precautionary saving incentive that reduces the willingness to run large levels of debt. As a result, we interpret the estimated residual $\hat{\epsilon}^{\delta_i}$ as the average level of debt to GDP for country i that is not explained by important macroeconomic factors, which are not captured in our model. Denoting as $\bar{D}_i = \rho_0 + \hat{\epsilon}_i^{\delta}$, in the rest of the paper we are interested in assessing the ability of the interaction between political friction and retrospective voting to explain the dispersion of \bar{D}_i .

Table 4: Debt and Macro Factors

Dependent Variable	Debt to GDP ratio
real GDP growth per capita	-0.492*** (-2.61)
Energy production per capita	-0.891*** (-3.07)
Population	1.314 (0.87)
Domestic Credit	0.315*** (7.46)
N	1293
R^2	0.07

Note: In this table we report the estimates of the panel regression in (16). The dependent variables is the debt-to-GDP ratio (external and internal) for each of the 56 countries reported in Table 3 for the period 1981 to 2010. t-statistics are reported in parenthesis. (*) indicates significance at 10 percent; (**) indicates significance at 5 percent; (***) indicates significance at 1 percent.

Regarding the election probability, our model assumes a particular functional form for its specification, that is:

$$p_i(c) = \gamma_i + \alpha_i(c - \bar{c}_i).^{18} \tag{17}$$

¹⁸Although this functional form could potentially generate values of election probability outside the [0, 1]

Accordingly, the probability of election in a given country consists of two components: the first one, γ_i , is a scale effect that is independent from the degree of retrospective voting in the economy, and it might be associated to different types of institution in each country; the second component, $\alpha_i(c - \bar{c}_i)$, is the part of the election probability associated to the degree of retrospective voting in the economy. Our identifying assumption for the two parameters governing this probability function is the following: cross-sectional variation on institutions and form of government pin down the level effect, γ_i , and, for a given γ_i , the relationship between observed debt and degree of political friction pins down the degree of retrospective voting, α_i . Hence, the first step is to estimate the level effect, γ_i , for each country. For this purpose, we first consider an observed measure of election probability, P_i . Our benchmark choice is a measure of probability computed from the number of years in office of the chief executive (CEP), as described in [Beck et al. \(2000\)](#). We also consider an alternative probability measure computed from the number of years the party of the chief executive has been in office (PCEP). We then run the following regression:

$$P_i = \beta_0 + \beta X_i + \epsilon_i^p. \quad (18)$$

We consider the following two regressors: $X^{(1)}$ is an index about the type of institution, from more democratic to less democratic, as in [Cheibub et al. \(2010\)](#); $X^{(2)}$ is the fraction of years in the sample in which the country had majoritarian electoral system, as in [Norris \(2009\)](#). As displayed in [Table 5](#), the two regressors are an import determinant of the benchmark election probability: lower degree of democracy is associated with lower turnover and hence with longer spells for the governments; interestingly, majoritarian electoral systems are also associated to higher election probability. These two explanatory variables account for 40 percent of the variation in the observed re-election probability. Similar results are obtained when considering the alternative probability measure, PCEP. In the next section we will discuss the strategy to pin down the level effect of the re-election probability, γ_i , from the results of this regression.

6.3 Political Frictions: Ethnical Conflict and Economic Inequality

A key ingredient for the estimation of the degree of retrospective voting is a measure of political frictions in the economy. Our model, in line with [Alesina and Tabellini \(1990b\)](#) and [Amador and Aguiar \(2011\)](#), interprets political frictions as biased preferences over distribution

interval, throughout the paper we ensure that the model parameters deliver always probability value in the admissible range.

Table 5: Probability of Election and Institutions

Dependent Variable	CEP	PCEP
	(1)	(2)
Institution	0.046*** (5.78)	0.045*** (4.79)
Majoritarian electoral system	0.050*** (2.05)	0.003 (0.12)
Constant	0.704 (34.2)	0.763** (31.15)
N	56	56
R^2	0.407	0.295

Note: In this table we report the estimates of the cross-sectional regression in (18). The dependent variables is the average probability of reelection for each of the 56 countries reported in Table 3 for the period 1981 to 2010. Model (1) considers a probability based on the number of years in office of the chief executive (CEP), as described in Beck et al. (2000). Model (2) considers an alternative probability measure computed from the number of years the party of the chief executive has been in office (PCEP). t-statistics are reported in parenthesis. (*) indicates significance at 10 percent; (**) indicates significance at 5 percent; (***) indicates significance at 1 percent.

across different groups. We link this bias to two observable measures: an index of ethnic fractionalization and the Gini index. The first index, proposed by Alesina et al. (2003) reflects the probability that two randomly selected people from a given country will not belong to the same ethnolinguistic group: the higher the number, the more fractionalized society. This definition of ethnicity involves a combination of racial and linguistic characteristics and it captures preferences for the incumbent to allocate more resource to her own ethnic group. The second index is a measure of economic inequality, where greater values represent greater inequality, and it captures preferences for the incumbent to allocate more resource to particular advocacy groups, such as pressure groups, lobby groups, campaign groups, or special interest groups. In our benchmark specification the measure of political friction for each country is a linear combination (equally weighted) of the Gini index and of the ethnic fractionalization index: this specification allows to capture both source of biased preference over distribution of resources across groups.

6.4 Calibration and Structural Estimation of Retrospective Voting

Here we present the calibration for some structural parameter of the model. Regarding the preference parameters, since our model is at annual frequencies, we fix the discount factor β to be equal to 0.9346. This value is consistent with an annual 7 percent world-interest-rate,

which corresponds to a basically null average real interest rate in the U.S. (-0.33 percent) in the period 1989-2010 and an average country premium of 7 percent, as reported in [Uribe and Yue \(2006\)](#). The coefficient of risk aversion, σ , is assumed to be equal to 5. Regarding the function that determines the probability of reelection, we assume that the reference level of consumption, \bar{c} , above which retrospective motives increases the political outcome, is equal to 1; this value is identical to the exogenous endowment received by the agents in each period. Hence, if consumption in a given period is greater than the endowment, the electorate is more likely to vote for the incumbent, when retrospective voting is present ($\alpha > 0$).

The probability of election as in (17) is a function of two parameters: the degree of retrospective voting, α , and the level effect, γ , which determines the constant probability of reelection when retrospect voting is absent ($\alpha = 0$). Since we interpret γ as the component of the probability that is independent from retrospective voting, we assume that this parameters vary across country because of difference in institutions. Hence, we estimate γ_i as the component of the election probability that is explained by the institution variables as in the regression (18), i.e. $\hat{\gamma}_i = \hat{\beta}_0 + \hat{\beta}X_i$, where the set of estimates and the regressors are as reported in Table 5. We consider the following two regressors: $X^{(1)}$ is an index about the type of institution, from more democratic to less democratic, as in [Cheibub et al. \(2010\)](#); $X^{(2)}$ is the fraction of years in the sample in which the country had majoritarian electoral system, as in [Norris \(2009\)](#).

In order to estimate the degree of retrospective voting, α_i , we exploit the important theoretical relationship between degree of political friction, θ , the degree of retrospective voting, and the model implied level of debt. In fact, recall that the model presented in this paper implies that when retrospective voting is absent, higher political friction leads to larger saving incentives, whereas, with stronger retrospective voting motive, higher political friction leads to borrowing incentives. As an additional implication of the model, the degree of retrospective voting obviously affect the probability of election as in (17). Given these two predictions of the model, we estimate the country-specific degree of retrospective voting α_i , by matching the model implied level of debt and election probability (which are both functions of α_i) to their data counterparts, by using a Generalized Method of Moment approach. In particular, the estimated α_i are chosen to satisfy:

$$\hat{\alpha}_i = \arg \min_{\alpha} \left(g(Y_i, \alpha, \hat{\gamma}_i) \right)' \hat{W} \left(g(Y_i, \alpha, \hat{\gamma}_i) \right)', \quad (19)$$

where $g(Y_i; \alpha, \hat{\gamma}_i) = [d(\alpha, \hat{\gamma}_i) - \bar{D}_i \quad p(\alpha, \hat{\gamma}_i) - P_i]'$, and $Y_i = [\bar{D}_i \quad P_i]'$. Here, $d(\alpha, \hat{\gamma}_i)$ and $p(\alpha, \hat{\gamma}_i)$ denote, respectively, the model-implied level of debt for a given estimated $\hat{\gamma}_i$ and

for a given degree of retrospective voting, α ; \bar{D}_i denotes the average level of debt-to-GDP ratio that is unexplained by macroeconomic factors, as presented in the previous section; P_i denotes the election probability from the data. Finally, the estimates $\hat{\alpha}_i$ and the weighting matrix \hat{W} are computed by iterations: in the first step we assume that $\hat{W}_{(1)} = I$, where I is the identity function. From this step we obtain a first-iteration estimates $\hat{\alpha}_{i(1)}$; we then compute a second-iteration value for $\hat{W}_{(2)} = (g(Y_i, \hat{\alpha}_{i(1)}, \hat{\gamma}_i)g(Y_i, \hat{\alpha}_{i(1)}, \hat{\gamma}_i)')^{-1}$. This procedure is iterated until $|\hat{W}_{(i+1)} - \hat{W}_{(i)}| < \eta$, where η is some arbitrary small number. In Figure 2 we plot the relationship between the model implied level of debt and election probability (respectively in the left and right panel, x-axis) and their data counterpart. It is visually evident that our simple model, which includes only the retrospective voting as a possible cause of debt incentives, can capture a substantial portion of the cross-country heterogeneity of observed debt level. In particular, the model-implied level of debt explain 42 percent of the variation of \bar{D}_i (the level of debt-to-GDP ratio that is unexplained by macroeconomic factors) and the model implied election probability explains 68 percent of the variation of its data counterpart.

Figure 2: FIT OF DEBT AND ELECTION PROBABILITY

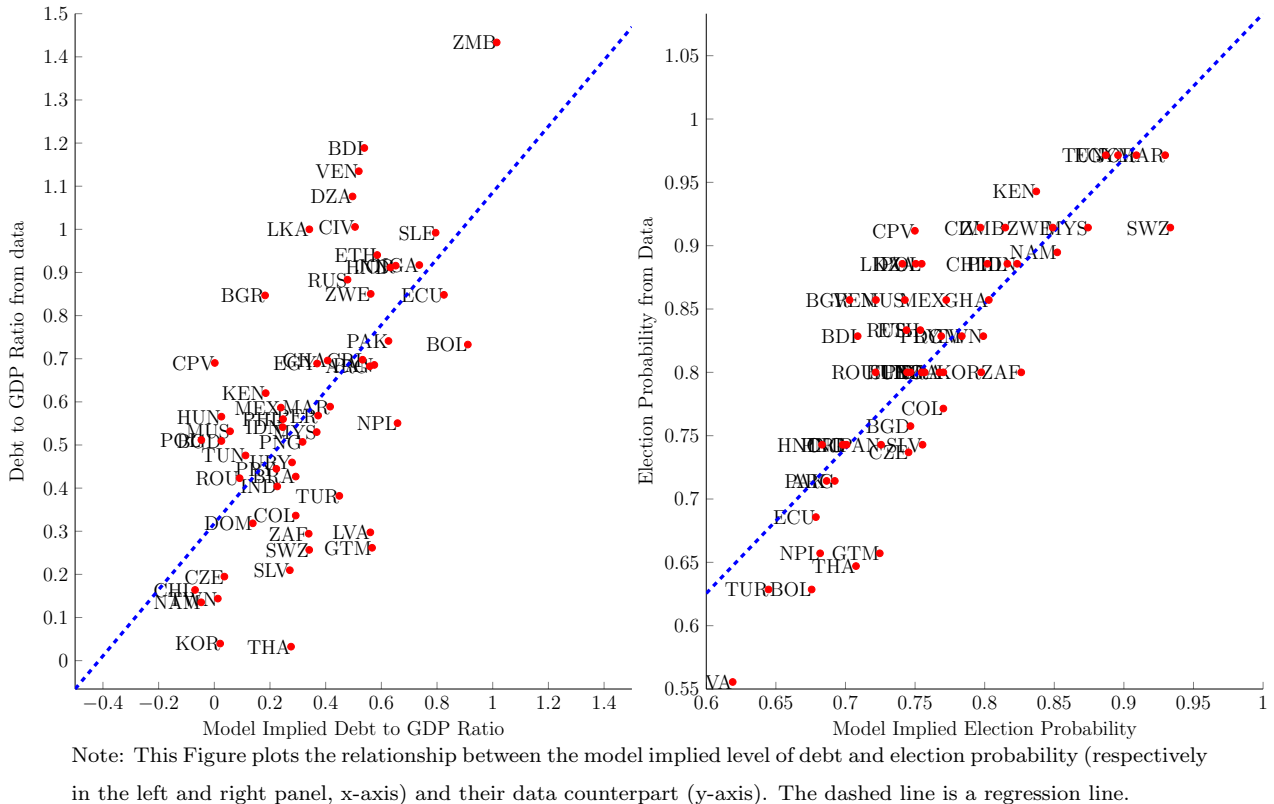


Figure 3 displays the relationship between the estimated degree of retrospective voting, $\hat{\alpha}_i$,

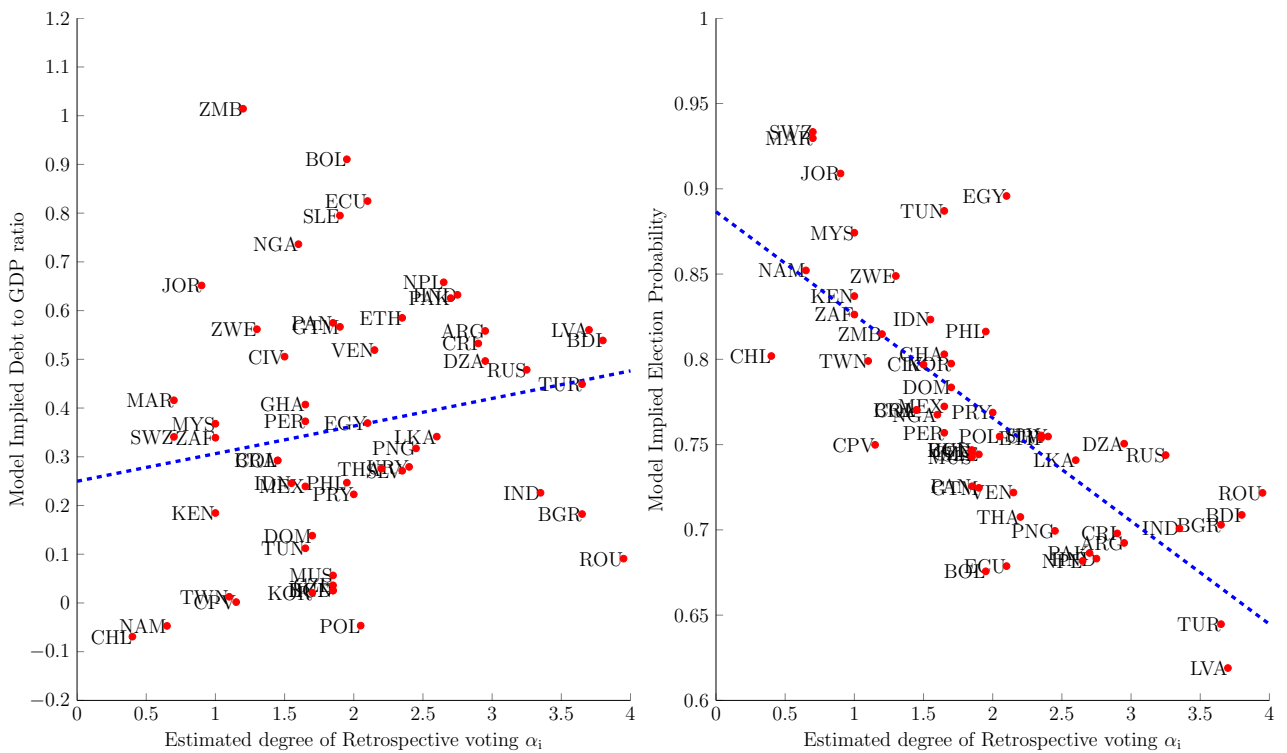
and the the model implied level of debt (left panel) and re-election probability (right panel). Notice that the model implies a strong negative relationship between the re-election probability and retrospective voting. This link is generated by the endogenous effect of retrospective voting: when retrospective voting is strong (higher α), incumbents have incentive to borrow to increase their chances to stay in office. However, the borrowing incentive in the long-run reduces the resources available in the economy because of the interest rate repayments. When the economy gets into a spiral where debt is large and resources are scarce, the high degree of retrospective voting leads to high political turnovers. In addition, notice that the estimated degree of retrospective voting does not strongly predicts debt levels. This is intuitive since, as stressed in the theoretical model, debt incentives are large only when high degree of retrospective voting is associated with high political frictions. Our model is able to capture this link, as shown in Table 6. Notice that when we simply regress the model implied debt level on the estimated degree of retrospective voting, the coefficient is not statistically significant and the coefficient of determination is extremely low (0.03) . However, when we also include the interaction between retrospective voting and political friction as an additional regressor, the results are exactly as predicted by the theory: when political friction are absent, higher retrospective voting implies lower debt, since it generates saving incentive, and when political frictions are higher, the level of debt increase with retrospective voting. In addition, when taking into account the interaction term, the coefficient of determination is rather high (0.69), thus confirming the the model generates a good fit with respect to the data.

Table 6: Model-Implied Debt levels and Retrospective voting

Dependent Variable	Model Implied level of Debt (1)	Model Implied level of Debt (2)
Retrospective Voting, $\hat{\alpha}_i$	0.056 (1.40)	-0.687*** (-5.83)
Interaction Retrospective Voting and Political Friction, $\theta_i * \hat{\alpha}_i$		1.204*** (6.533)
Constant	0.249*** (2.87)	0.038 (0.52)
N	56	56
R^2	0.03	0.69

Note: In this table we regress the model implied level of debt, $d(\hat{\alpha}_i, \hat{\gamma}_i)$ on the estimated degree of retrospective voting, $\hat{\alpha}_i$ and a constant. In model (2) we add as an additional regressor the interaction between the degree of retrospective Voting and of political friction, $\theta_i * \hat{\alpha}_i$. t-statistics are reported in parenthesis. (*) indicates significance at 10 percent; (**) indicates significance at 5 percent; (***) indicates significance at 1 percent.

Figure 3: MODEL-IMPLIED DEBT AND PROBABILITY AND RETROSPECTIVE VOTING ESTIMATES

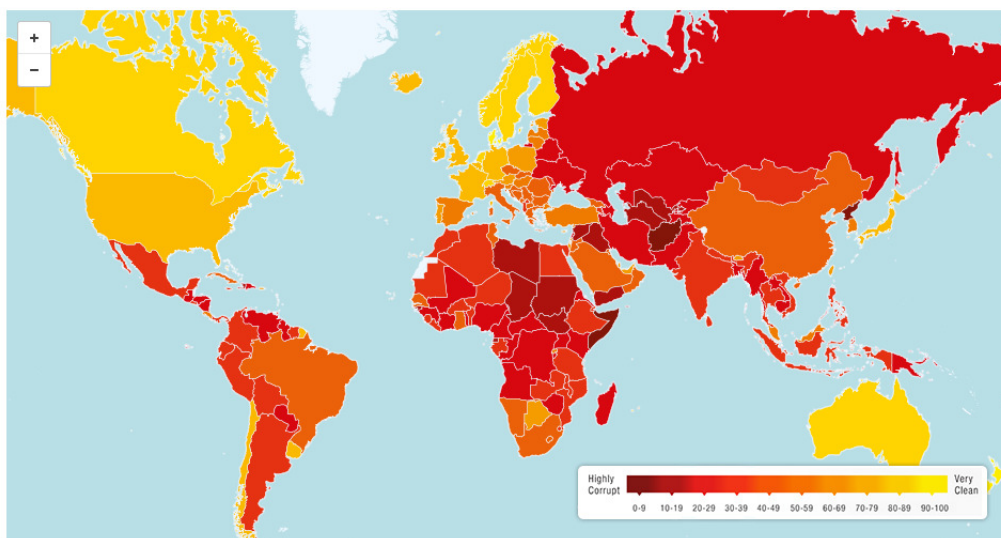


Note: This figure displays the relationship between the estimated degree of retrospective voting, $\hat{\alpha}_i$ (x-axis), and the the model implied level of debt (left panel) and re-election probability (right panel).

6.5 Interpreting the Degree of Retrospective Voting

In the previous section we have estimated the country specific degree of retrospective voting, $\hat{\alpha}_i$, by using the prediction of the theoretical model and the observed level of debt level, election probability, and political friction. In this section we propose an interpretation for the estimated degree of retrospective voting, and show that the model-implied $\hat{\alpha}_i$ are closely related to measures of corruption. We believe that this relationship has a very intuitive interpretation: in line with the theory proposed by Rogoff (1990b), higher corruption makes voters be more uncertain about the moral integrity (or ability) of the incumbent, and they will then based their political preference based on the observed level of their own consumption. To provide evidence for this relationship we consider three measures of corruption.

Figure 4: Corruption perception



Note: This figure displays the Corruption Perception Index (CPI) across countries from Transparency International. Darker countries are the more corrupted.

The first index (benchmark) is the Corruption Perceptions Index (CPI) as measured by Transparency International.¹⁹ This variable focuses on corruption in the public sector and defines corruption as the abuse of public office for private gain. The surveys used in compiling the CPI tend to ask questions in line with the misuse of public power for private benefit, with a focus, for example, on bribe-taking by public officials in public procurement. The sources do not distinguish between administrative and political corruption. The CPI variable relates to perceptions of the degree of corruption as seen by business people, risk analysts and the general public. Figure 4 displays the corruption index across countries. The second index is the Control of Corruption index (CoC) from Kaufmann et al. (2009). This index measures perceptions of corruption, conventionally defined as the exercise of public power for private

¹⁹<http://www.transparency.org>

gain. Finally, the third index is the Functioning of Government (FOG) from the Freedom House organisation.²⁰ This variable examines in what extent the freely elected head of government and a national legislative representative determine the policies of the government; if the government is free from pervasive corruption; and if the government is accountable to the electorate between elections and operates with openness and transparency. All the three indices are rescaled so that countries are graded from less corrupted (low values) to more corrupted (high values). Table 7 presents the resulting regressions for different specifications of the model. Our benchmark model consider the following specification: as corruption index we consider the CPI index: model (8) and model (9) in Table 7 assess the robustness of the results when considering the two alternative corruption indices (CoC and FOG). As a measure of political friction, we use an equally weighted (EW) average of the country ethnic fractionalization and Gini index; alternatively, model (5) assigns full weight only to the ethnic fractionalization, whereas model (6) assigns full weight to the Gini index. As a measure of election probability from the data, our benchmark variable is the Chief Election Probability (CEP); in model (7) we consider the Party of the Chief Election Probability (PCEP). Finally, as benchmark regressors, we control for an index that measure the degree of conflict in the country, as in [Gleditsch et al. \(2002\)](#), and a measure of democratisation, as in [Vanhanen \(2014\)](#). These variables are highly significant in the vast majority of the regressions and they have some intuitive interpretation: larger exposure of a country to conflicts increase the degree of retrospective voting, whereas less democratic countries have lower degree of retrospective voting, since most likely voters have less power on determining the governors. In model (2), model (3), and model (4) we consider three additional regressors: first we add a measure of the scale of the economy comparable across countries, which is the GDP (in logarithm) based on purchasing power parity converted to international U.S. dollars²¹; then we also consider a measure of standard of living, which is the real GDP per capita (in logarithm); then we consider also a measure of education, which is gross enrolment rate as the number of pupils enrolled at a given level of education, from the UNESCO Institute for Statistics.²² We obtain that these three additional regressors are not statistically significant, but the sign of the coefficient are also intuitive: the richer and the more educated a country, the lower is the degree of retrospective voting. The main result of this empirical exercise is that measure of corruptions are highly statistically significant for explaining the heterogeneity of estimated degree of retrospective voting.

²⁰<http://www.freedomhouse.org>

²¹Source: World Bank, World Development Indicators

²²<http://www.uis.unesco.org>

Table 7: Regression Analysis: Retrospective voting on Corruption.

Dependent Variable	Estimated Degree of Retrospective Voting: $\hat{\alpha}_i$											
	CPI EW CEP	(1) (2)	CPI EW CEP	(3) (4)	CPI EW CEP	(4) 5	Eth.Frac. CEP	CPI Gini CEP	(6) (7)	CPI EW PCEP	(8) (9)	CoC EW CEP
Corruption Index	1.207*** (3.52)	0.154 (0.41)	1.699 (1.23)	0.200 0.17	2.522 (1.47)	0.540 (1.05)	0.749* (1.75)	0.119 (0.26)	0.326 (0.856)	0.544 (1.44)		
Political Friction	0.242** (2.47)	0.301*** (3.38)	0.304*** (3.43)	0.299*** (3.10)	0.290*** (3.22)	0.235* (1.91)	0.238** (2.32)	0.241** (2.41)	0.484*** (2.76)	0.08** (-2.17)		
Election Probability	0.319*** (2.91)	0.359*** (3.14)	0.319*** (2.88)	0.364*** (3.17)	0.119 (0.78)	0.554*** (4.38)	0.328*** (2.68)	0.369*** (3.29)	0.402*** (3.62)			
Conflict	0.045*** (4.73)	0.049*** (4.85)	0.045*** (4.08)	0.048*** (4.81)	0.050*** (3.81)	0.020* (1.83)	0.045*** (3.92)	0.049*** (4.51)	0.049*** (4.20)			
Democratization	-0.065 (-1.16)	-0.065 (-1.16)	-0.060 (-1.05)									
real GDP												
real GDP per capita												
Education												
N	56	56	56	56	56	56	56	56	56	56	56	56
R ²	0.102	0.438	0.452	0.438	0.460	0.237	0.401	0.423	0.421	0.371	0.371	0.371

Note: In this table we regress the estimated degree of retrospective voting, $\hat{\alpha}_i$, on different corruption indices and for several specifications of the regression. Our benchmark model consider the following specification: as corruption index we consider the CPI index: in model (8) and model (9) we consider two alternative corruption indices (CoC and FOG). As a measure of political friction, we use an equally weighted (EW) average of the country ethnic fractionalization and Gini index; alternatively, model (5) assigns full weight only to the ethnic fractionalization, whereas model (6) assigns full weight to the Gini index. As a measure of election probability from the data, our benchmark variable is the Chief Election Probability (CEP); in model (7) we consider the Party of the Chief Election Probability (PCEP). As benchmark regressors, we control for an index that measure the degree of conflict in the country, and a measure of democratization. In model (2), model (3), and model (4) we consider three additional regressors: real GDP (in logarithm) based on purchasing power parity converted to international U.S. dollars, real GDP per capita (in logarithm), and a measure of education. t-statistics are reported in parenthesis. (*) indicates significance at 10 percent; (**) indicates significance at 5 percent; (***) indicates significance at 1 percent.

6.5.1 Estimates of Retrospective Voting and Political Turnover

In this section, we validate our estimates of retrospective voting, $\hat{\alpha}_i$ by showing that these measures are consistent with the sensitivity of voters to economic conditions as observed in the data, i.e. the sensitivity of voters from economic conditions. Recall that, our theory predicts that when the degree of retrospective voting increases, voters are more sensitive to fluctuations in the business cycle. To verify this, we first identify country-specific recession as periods when the deviation of consumption is one standard deviation below from its trend²³. Since we have time series measures of re-election probabilities, we can compute the frequency of government turnovers in recession periods. Our theory predicts that countries that have stronger retrospective voting are more likely to experience political turnovers during a recession. Hence, we group the 56 countries in our sample in four categories depending on their estimated degree of retrospective voting (low $\hat{\alpha}_i$, medium-low $\hat{\alpha}_i$, medium-high $\hat{\alpha}_i$, high $\hat{\alpha}_i$). For each group we computed the average frequency of political turnover in the group for our benchmark measure of election probability (Chief Executive probability, CEP). The results are presented in figure 5. We observe that in countries with larger estimated retrospective voting $\hat{\alpha}_i$, government turnover is more likely. observe larger probability of government change in the period that follows a crisis. In fact, countries with the lowest degree of retrospective voting have a turnover of 5 percent in recession, whereas in countries with the highest degree of retrospective voting alphas, this turnover jumps to over 20 percent for government change. This simple evidence highlights that the our estimates of retrospective voting, derived from our theoretical model, are consistent with the degree of political turnover determined by fluctuations in consumption²⁴.

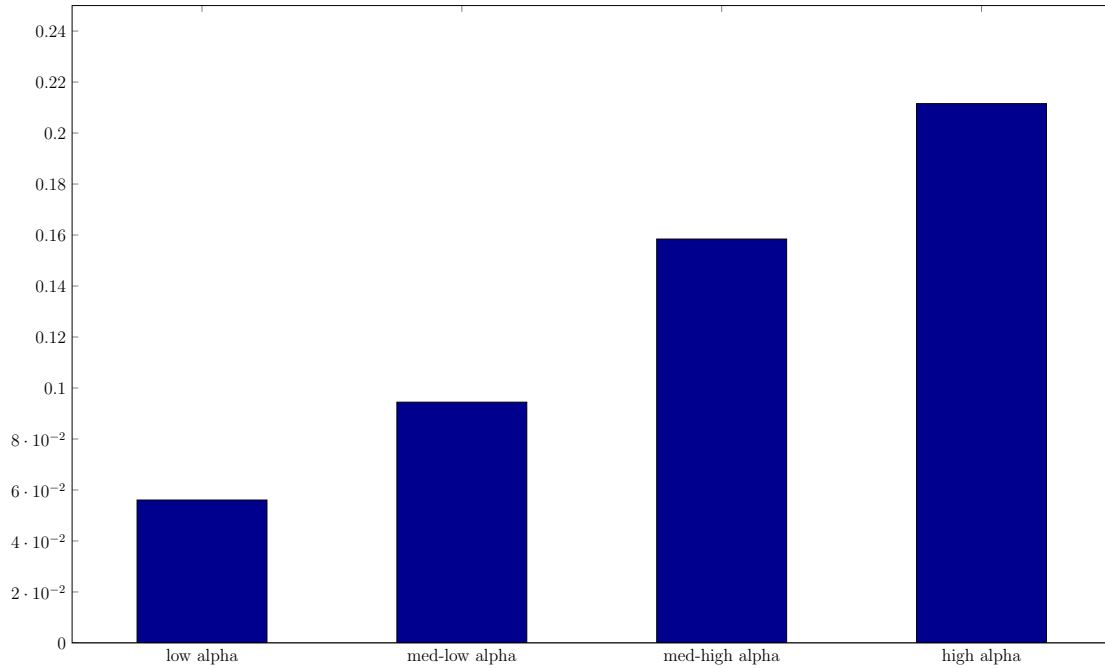
7 Conclusion

In this paper we study the relationship between cross-country sovereign debt and political frictions. Our first set of results is theoretical. We model political friction by assuming, similarly to [Alesina and Tabellini \(1990b\)](#), that parties have preferences over distribution across different groups and decide the allocation of consumption according to these preferences. A single parameter, which we refer as the degree of political frictions, determines how unequally the incumbent would like to split aggregate resources. As long as preferences are far from the case of zero inequality the benefits from being in power is larger. We merge this political economy environment in a standard small open-economy setting: an incumbent has to

²³The trend has been estimated using HP filter

²⁴Similar results hold when taking log deviation of real GDP

Figure 5: POLITICAL TURNOVER IN RECESSION AND ESTIMATED RETROSPECTIVE VOTING



Note: In this figure we plot the average frequency of government turnover after a recession for four categories of countries identified by their level of our estimate retrospective voting $\hat{\alpha}_i$. Government turnover is identified using the Chief Executive probability, CEP.

make intertemporal consumption/saving decisions in an open economy setting, where she can borrow or save at a fixed international interest rate. Our first result is that when political uncertainty is characterized by a given and constant probability to be reelected, political frictions per-se are not always able to produce borrowing incentives. For example, when the incumbent has CRRA utility function with coefficient of risk aversion greater than one, she would like to transfer resources from her incumbent-state to a possible future opposition-state, which leads to incentives to postpone consumption. The instrument to substitute present consumption for future consumption is savings. Moreover, the higher the degree of political friction, the larger is the saving incentive.

As second result of our paper, we show that, instead, political frictions lead to borrowing incentives, when introducing retrospective voting. In particular, we generalize the model described above by assuming that an incumbent has a larger probability of being reelected if the population enjoys higher utility in the current period. Intuitively, when the electorate is particularly sensitive to economic condition, an incumbent is willing to borrow in order to bust current consumption to gain political advantage against the opposition. Interestingly, we also find that borrowing incentives are larger when the degree of retrospective voting for voters is larger.

Our third contribution is empirical. In fact, we use the theoretical prediction of our model to estimate the degree of the unobserved retrospective voting that explain the cross-sectional heterogeneity of debt levels. We consider data on debt, election probabilities, economic variables, and quality of institutions for 56 developing and transition economics in the period 1989-2010. We measure the degree of political friction with an index of ethnic fractionalization and inequality for each country; this measure has been already related in the literature to political frictions and it maps closely to our modelling assumptions. We then estimate the degree of retrospective voting by matching the observed level of debt and reelection probability across countries. We find that the model can fit rather well the data and we obtain estimates of the country-specific retrospective voting. We then show that these estimates are closely related to corruption indices and we finally validate our empirical results by showing that indeed corruption is a good proxy for retrospective voting, since it is able to explain the debt levels heterogeneity only when interacted with political frictions, exactly as predicted by our model.

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8 Appendix: Equilibrium

We describe the game as follows. We define the state vector $k \in K \in \mathbb{R}^4$ where $k_t = (t, d_t, y_t, \omega_t)$.²⁵ Output y_t evolves exogenously, d_t is the level of debt inherited from past period, and ω_t is determined by the endogenous political markov process. Notice that the evolution of the state vector is independent by assumptions regarding how aggregate consumption is shared across parties.

In this dynamic game, at each stage t of the game, the incumbent decides an action $a_{it} \in A^i(k_t)$ where $a_{it} = \left(d_{t+1}, c_t^{i,i}, \left\{ c_t^{i,j} \right\}_{i \neq j} \right)$ if $\omega_{it} = 1$ and subject to the budget constraint in (3); instead the action profile of the opponents at t is empty: $a_{j,t} = A^j(k_t) = \emptyset$. Define an history $h^t \in \mathcal{H}^t$ as $h^t = (a_0, k_0, \dots, a_t, k_t)$. A pure strategy for party i as incumbent I at time t is a function

$$\sigma_{i,t} : \mathcal{H}^t \times K \rightarrow A_t$$

i.e. a mapping from the entire history and the current state space to each party actions at time t . We define as $\sigma_i = (\sigma_{i,1}, \dots, \sigma_{i,T})$ the strategy profile of party i in the finite game, and $\sigma_i[t] = (\sigma_{i,t}, \dots, \sigma_{i,T})$ the continuation strategy at time t . To be general let's define the intertemporal utility of party i in t as a function of the continuation strategy $W(\sigma_i[t], \sigma_{-i}[t])$. Defining S_i the set of all feasible σ_i , the strategy space of the infinite game is $S = \prod_{j=1}^{N+1} S_j$. We define the best response correspondence as:

$$BR(\sigma_i[t]|h^{t-1}, k_t) = \{\sigma_i[t] \in S_i[t]\},$$

such that

$$\sigma_i[t] \text{ maximizes } W(\sigma_i[t], \sigma_{-i}[t]),$$

given $\sigma_{-i}[t] \in S_{-i}[t]$.

A Sub-game Perfect Equilibrium of this game is defined as follows:

Definition 1. A **Sub-game Perfect Equilibrium** is a strategy profile $\sigma^* = (\sigma_1^*, \dots, \sigma_{N+1}^*) \in S$ s.t. $\sigma_i^*[t] \in BR(\sigma_i[t]|h^{t-1}, k_t)$ for all (k_t, h^{t-1}) , for all t and i .

In the rest of the paper we consider the more specific class of Markov Perfect Equilibria (MPE), where we restrict the strategies to be based only on *payoff-relevant* state, and not on the entire history of the game. In particular a Markov strategy is a mapping $\sigma \in \hat{S} \subset S$ s.t. $\sigma_i(k, h^{t-1}) = \sigma_i(k, h^{t-1}) \quad \forall h^{t-1} \in \mathcal{H}^{t-1}$.

Given the assumption of no discrimination and given that borrowing is completely independent from consumption allocation, it is natural to restrict our attention to the class of Symmetric MPE. In such a case the consumption level decided by the incumbent doesn't change with the her identity, furthermore there is no discrimination between different groups at the opposition. We can then define the solution of the distribution problem as $c^*(c) = (c^I(c), c^O(c))$, that is the consumption assigned to the incumbent and to any opposition member. We can then define the instantaneous utility evaluated in $c^*(c)$ as $U^I(c_t) = \mathcal{U}^{i,i}(c_t^*)$ and $U^O(c_t) = \mathcal{U}^{i,r}(c_t^*)$. This implies that the intertemporal utility of party i can be defined in a clean way. Defining as $\bar{p}_{t,s}$ the conditional probability for the party being in power at t to be in power also in s , the discounted utility is defined as

²⁵The time index t enters in the state representation because we are focusing on finite horizon

$$W(\sigma[t]) = \mathbb{E}_t \left[\sum_{s=t}^T \beta^s \{ \bar{p}_{t,s} U^I(c_t) + (1 - \bar{p}_{t,s}) U^O(c_t) \} \right] \quad (20)$$

Definition 2. A **Symmetric Markov Perfect Equilibrium** is a strategy profile $\sigma^* = (\sigma_1^*, \dots, \sigma_{N+1}^*) \in \hat{S}$ s.t.

1. $\sigma_i^*[t] \in BR(\sigma_i[t]|h^{t-1}, k_t)$ for all (k_t, h^{t-1}) , for all t and i ,
2. $\forall k, \tilde{k} \in K$ s.t. $k = (t, b, y, \omega)$ and $\tilde{k} = (t, b, y, \tilde{\omega})$, where $\omega \neq \tilde{\omega}$, $\Rightarrow \sigma_{i,t}(k) = \sigma_{j,t}(\tilde{k}) \in \hat{S}$ where $\omega_i = \tilde{\omega}_j = 1$.

Conditions 1 and 2 state that only output realization at t and debt level d_t matter for defining the equilibrium. This assumption clearly reduces the dimensionality of the problem by excluding past history and by eliminating ω from the state space. Now we can easily characterize the equilibrium. Since we are considering Symmetric MPE with our set of assumptions, we can solve the sharing static problem given the total amount of resources available in the economy for consumption c . Given the definition of $U^I(c)$ as in (2), we can also define as c_t^I the consumption assigned to the incumbent party I at time t and as $c_t^O = \frac{c_t - c_t^I}{N}$ the consumption level assigned to every opponent party. The sharing rule solves:

$$\max_{c_t^I} \left[\theta u(c_t^I) + \sum_{j \neq I} \frac{1 - \theta}{N} u\left(\frac{c_t - c_t^I}{N}\right) \right],$$

s.t. $c_t = c_t^I + N c_t^O$. The following first order condition characterizes the optimal allocation:

$$\theta u'(c^I) = \frac{(1 - \theta)}{N} u'\left(\frac{c_t - c_t^I}{N}\right). \quad (21)$$

The sharing rule is independent from the intertemporal decision due to the time-separability of the objective function of the incumbent and due to the fact that in a SPE following a different rule from (21) is a dominant strategy in the stage game. In the following we disregards the possibility of cooperation between parties. Since the optimal sharing rule is only a function of the aggregate consumption, then the action space can be reduced to the pair $a_{it} = (b_{t+1}, c_t)$ if $\omega_{it} = 1$. Given that (3) must be satisfied, the incumbent has only to decide the level of debt to carry to next period, $b_{t+1}(b_t, y_t)$, as a function of b_t and y_t .

In this setting political power fluctuates between groups according to an endogenous Markov process that the incumbent can influence. In this model the political setup induces frictions, that could potentially influence the decision maker on many dimension. We restrict our attention to the impact of these frictions on borrowing decisions.

9 Appendix: Time Inconsistency

The political uncertainty is a crucial determinant of the borrowing decision of the incumbent, as we have seen in the previous section in a two-period model. When allowing for an economy lasting more than two periods, political uncertainty creates another important determinant for consumption/saving decisions, which is time inconsistency. To explain the mechanism that generates time inconsistency, consider the probability

that a party in power at time t is also in power at time $t + s$ with $s \geq 0$, defined as $\bar{p}_{t,t+s}$. The dynamic equation describing $\bar{p}_{t,t+s}$ is

$$\bar{p}_{t,t+s+1} = p(c_{t+s})\bar{p}_{t,t+s} + \frac{1-p(c_{t+s})}{N}(1-\bar{p}_{t,t+s}) \quad (22)$$

$$= \underbrace{\bar{p}_{t,t+s} \left(p(c_{t+s}) - \frac{1-p(c_{t+s})}{N} \right)}_{f_s} + \underbrace{\frac{1-p(c_{t+s})}{N}}_{g_s}. \quad (23)$$

The solution of this difference equation is presented in the following proposition

Proposition 6. *Evolution of the Probability* Consider the evolution of the conditional probability of being in power at $t + s$ specified in 22. Then the solution of the difference equation as a function of the per-period probability $\{p(c_t)\}_{t,\dots,t+s-1}$ is

$$\bar{p}_{t,t+s} = \left(\prod_{k=t}^{t+s-1} \frac{(N+1)p(c_k) - 1}{N} \right) \left(1 + \sum_{m=t}^{t+s-1} \frac{\frac{1-p(c_m)}{N}}{\prod_{k=t}^m \frac{(N+1)p(c_k) - 1}{N}} \right). \quad (24)$$

There are three important features to be noticed. First, the crucial component of the compounded probability in (24) is not simply the per-period probability $p(c)$, but the incumbent advantage $\delta(c) = \frac{(N+1)p(c)-1}{N}$; this term is positive whenever the incumbent has larger probability to be in power than any other opponent. Second, a clear implication of retrospective voting is that any consumption decision taken at any period will affect not only the probability of being elected next period but also the probability of being in power at all the future periods. Third, the evolution of the ‘‘compounded probability’’ in (24) is a key factor in creating dynamic inconsistency in the incumbent decision, since it affects the degree by which she discounts future utility.

By defining this probability we are now able to write the intertemporal utility of an agent in the economy conditionally on his incumbency status at time 0 as

$$\sum_{t=0}^{\infty} \beta^t (p_{0,t} U^I(c_t) + (1 - p_{0,t}) U^O(c_t))$$

It is easy to notice that, even in the simplest case where²⁶ $p(c_t) = p$, it is not possible to derive a standard recursive formulation of the agent problem that would help in solving the problem. The reason is that even in the presence of exponential discounting, political uncertainty generates a time dependency of the policy functions. In the case with no political uncertainty, because of exponential discounting, the optimal consumption path decided at time 0 with associated initial conditions coincides with the optimal solution of the same problem starting at any period $\tau \geq 0$ with initial conditions consistent with the original plan. When we add political uncertainty this correspondence breaks down. In order to understand better we consider the simple case of the 3 periods economy.

In order to understand the role of time inconsistency created by political uncertainty consider a three period economy that lasts for $t = 0, 1, 2$, where the probability of re-election p is a constant (no retrospective voting) and where there are only two parties, $N = 1$. These assumptions will simplify the notation, and the results are robust to relaxing them. Consider two scenarios. In the first scenario (scenario A) the incumbent at time 0 will surely be in power at time 1, that is $p_1 = 1$, and there is a strictly positive probability $p_2 > 0$

²⁶As in Amador and Aguiar (2011)

that the incumbent at time 1 will be also in power at time 2. Hence, in this scenario political uncertainty is present only from period 1 to 2.

Since we focus our attention in a symmetric Markov sub-game perfect equilibrium, the incumbent at time $t = 0$ realizes that the future incumbent will solve a similar problem. Therefore, we can write the problem of the incumbent at time $t = 0$ as:

$$\begin{aligned} & \max_{\{c_0, c_1, c_2, d_1, d_2\}} \left\{ \begin{array}{l} U^I(c_0) + \beta U^I(c_1) \\ + \beta^2 [p_{0,2} U^I(c_2) + (1 - p_{0,2}) U^O(c_2)] \end{array} \right\} \\ \text{s.t. } d_1 &= (1 + r) d_0 + c_0 - y d_2 = (1 + r) d_1 + c_1 - y, \quad 0 = (1 + r) d_2 + c_2 \\ \text{and } \theta u'(c_t^I) &= \frac{(1 - \theta)}{N} u' \left(\frac{c_t - c_t^I}{N} \right) \quad \forall t = 0, 1, 2. \end{aligned}$$

Notice that in this scenario $p_{0,2} = p_2$ since $p_1 = 1$. Let's define d_2 and d_1 the solutions of this problem. Solving backward the model, it is trivial to show that the solution for d_2 is equivalent to the solution of (5), \tilde{d}_2^* . Define, \tilde{d}_1^{A*} the solution for d_1 , where the superscript A refers to the solution of the problem in scenario A , and it is given by:

$$U^{I'}(c_0) = U^{I'}(c_1) \quad (25)$$

or

$$U^{I'}(\tilde{d}_1^{A*} - (1 + r) d_0 + y) = U^{I'}(\tilde{d}_2^* - (1 + r) \tilde{d}_1^{A*} + y).$$

Now, instead, consider an alternative scenario (scenario B) where political uncertainty is present in both periods. That means that the incumbent in period $t = 0$ will be in power in period $t = 1$ with probability p_1 and the incumbent in period $t = 1$ will be in power in period $t = 2$ with probability p_2 . Without loss of generality assume that $p_1 = p_2 = p$. Notice that the model in scenario B has higher political uncertainty than in scenario A .

The problem of the incumbent at time $t = 0$ is:

$$\begin{aligned} & \max_{\{c_0, c_1, c_2, d_1, d_2\}} \left\{ \begin{array}{l} U^I(c_0) + \beta [p U^I(c_1) + (1 - p) U^O(c_1)] \\ + \beta^2 [p_{0,2} U^I(c_2) + (1 - p_{0,2}) U^O(c_2)] \end{array} \right\} \\ \text{s.t. } d_1 &= (1 + r) d_0 + c_0 - y, \quad d_2 = (1 + r) d_1 + c_1 - y, \quad 0 = (1 + r) d_2 + c_2 \\ \text{and } \theta u'(c_t^I) &= \frac{(1 - \theta)}{N} u' \left(\frac{c_t - c_t^I}{N} \right) \quad \forall t = 0, 1, 2. \end{aligned}$$

Notice that in this case the compounded probability $p_{0,2}$ is

$$p_{0,2} = \frac{(N + 1)p^2 - 2p + 1}{N}$$

Once again, it is obvious that the solution for d_2 is equivalent to the solution of (5), \tilde{d}_2^* . The Equilibrium condition for the optimal d_1 is instead given by:

$$\begin{aligned} U^{I'}(c_0) &= \{p U^{I'}(c_1) + (1 - p) U^{O'}(c_1)\} + \\ &\quad - \frac{\partial d_2}{\partial d_1} \beta \left\{ [p U^{I'}(c_1) + (1 - p) U^{O'}(c_1)] - [p_{0,2} U^{I'}(c_2) + (1 - p_{0,2}) U^{O'}(c_2)] \right\}. \end{aligned} \quad (26)$$

Notice that the terms in brackets in the right hand side is not zero, since it is not equivalent to (5).

In fact, when political uncertainty affects each single period, political incumbents discount between today and next period at a higher rate than they discount between two periods in the future. This implies that political incumbents behave similarly to a quasi-hyperbolic (or quasi-geometric) agent as in [Laibson \(1997\)](#). This feature is similar to the one proposed by [Amador and Aguiar \(2011\)](#). Let us define as \tilde{d}_1^{B*} the solution of (26). We have the following result.

Proposition 7. *Time-Inconsistency and Savings.* *Consider the three periods political economy model presented above. Assume that the utility function satisfies $U^I(c) \leq U^O(c)$. Define \tilde{d}_1^{A*} the optimal period debt that an incumbent chooses at time $t = 0$ when political uncertainty is present only in period 2 (scenario A) and it is a solution of (25). Define \tilde{d}_1^{B*} the optimal period debt that an incumbent chooses at time $t = 0$ when political uncertainty is present at both periods 1 and 2 (scenario B) and it is a solution of (26). Then, $\tilde{d}_1^{A*} < \tilde{d}_1^{B*} \leq 0$.*

This result is important because highlight two important features of time inconsistency. First, then condition $U^I(c) \leq U^O(c)$ is also a necessary condition for having saving incentives when the economy lasts more than two periods: hence, time inconsistency does not revert the saving incentive result found in the two period model. Second, when political uncertainty is present in each period, the incumbent discounts differently the utility between today and tomorrow with respect to two periods in the future, because of the compounded probability that makes more unlikely to be in power in the distant future. Therefore, even though the model in scenario A is characterized by higher overall political uncertainty, the incumbent at time $t = 0$ has less incentive to save with respect to the model where there is no political uncertainty in the first period. Hence, time inconsistency reduces the incentive to save.

In summary, in this section we have showed a key important results. When using a general class of utility function such that the marginal utility of the opposition is higher than the marginal utility of the incumbent, political uncertainty alone is not able to generate borrowing incentives. In the next section, we show that introducing retrospective voting might revert this result.

10 Appendix: Proofs

In the following most of the proofs consider the family of utility functions s.t. ψ is constant (log utility, CRRA). Proposition 8 tells that this condition holds for any utility in the HARA class. Results can be generalized also to ψ not constant as in [Alesina and Tabellini \(1990b\)](#).

Proposition 8. *Linear Sharing rule* *For any $u(c)$ in the class of HARA utility functions, i.e.*

$$u(c) = \frac{\sigma}{1-\sigma} \left(\frac{ac}{\sigma} + b \right)^{1-\sigma}$$

with $a > 0$ and $\frac{ac}{\sigma} + b > 0$ we have that

$$c^I = \frac{\left(\frac{\theta}{1-\theta} \right)^{\frac{1}{\sigma}}}{1 + \left(\frac{\theta}{1-\theta} \right)^{\frac{1}{\sigma}}} c + \frac{b \left(\frac{\theta}{1-\theta} \right)^{\frac{1}{\sigma}} - 1}{a \left(1 + \left(\frac{\theta}{1-\theta} \right)^{\frac{1}{\sigma}} \right)}$$

Proof. We are considering the case of $N = 1$. Applying (21) for our specific utility function we have that

$$\theta \left(\frac{ac^I}{\sigma} + b \right)^{-\sigma} = (1 - \theta) \left(\frac{a(c - c^I)}{\sigma} + b \right)^{-\sigma}$$

Rearranging terms for c^I we obtain the result of the proof. \square

Proposition 1

Proof.

$$(a \Leftrightarrow c)$$

The RHS of the euler equation can be written in this way

$$\begin{aligned} \left[\begin{array}{l} pU^{i'}(y - (1+r)d_2^*) + \\ + (1-p)U^{o'}(y - (1+r)d_2^*) \end{array} \right] &= \left\{ \begin{array}{l} p \left(\theta u'(c_2^{i*}) \frac{\partial c^i(c_2^*)}{\partial c} + \frac{(1-\theta)}{N} u'(c_2^{o*}) \left(1 - \frac{\partial c^i(c_2^*)}{\partial c} \right) \right) + \\ (1-p) \left(\frac{1}{N} \left(1 - \frac{1-\theta}{N} \right) u'(c_2^{o*}) \left(1 - \frac{\partial c^i(c_2^*)}{\partial c} \right) + \frac{(1-\theta)}{N} u'(c_2^{i*}) \frac{\partial c^i(c_2^*)}{\partial c} \right) \end{array} \right\} \\ &= \frac{\partial c^i(c_2^*)}{\partial c} \underbrace{\left(p\theta + (1-p)\frac{1-\theta}{N} \right)}_{\gamma} u'(c_2^{i*}) \\ &\quad + \left(1 - \frac{\partial c^i(c_2^*)}{\partial c} \right) \left(\frac{1-\gamma}{N} \right) u'(c_2^{o*}) \\ &= \frac{\partial c^i(c_2^*)}{\partial c} \gamma u'(c_2^{i*}) + \left(1 - \frac{\partial c^i(c_2^*)}{\partial c} \right) \frac{(1-\gamma)}{N} u'(c_2^{o*}) \end{aligned}$$

Instead the LHS is

$$\frac{\partial c^i(c_2^*)}{\partial c} \theta u'(c_2^{i*}) + \left(1 - \frac{\partial c^i(c_2^*)}{\partial c} \right) \frac{(1-\theta)}{N} u'(c_2^{o*})$$

Notice that the weight in RHS (γ) and LHS (θ) do not sum up to the same number except for the case $N = 1$ (this doesn't affect the results). Notice that $\frac{\partial c^I}{\partial c}$ can be derived by applying the implicit function theorem

$$\psi = \frac{\partial c^I}{\partial c} = \frac{\frac{1-\theta}{N^2} u'' \left(\frac{c-c^i}{N} \right)}{\theta u''(c^I) + \frac{1-\theta}{N^2} u'' \left(\frac{c-c^i}{N} \right)}.$$

From this expression it is clear that $0 \leq \frac{\partial c^I}{\partial c} \leq 1$. Due to this it is clear that the marginal utility of the incumbent and of the opposition are always increasing. In Alesina and Tabellini (1990b) the second order conditions are stated for general utility functions. For ψ constant it is easy to check that the second order condition are satisfied.

Evaluating the solution in d_2^* , since the utility functions are concave we have an incentive to save if and only if

$$\psi \gamma u'(c^{i*}) + (1-\psi) \frac{(1-\gamma)}{N} u'(c^{o*}) \geq \psi \theta u'(c^{i*}) + (1-\psi) \frac{(1-\theta)}{N} u'(c^{o*})$$

that becomes

$$\underbrace{(\theta - \gamma)}_{\geq 0} \left((1-\psi) u'(c^{o*}) - N \psi u'(c^{i*}) \right) \geq 0$$

By the sharing rule $u'(c^{o*}) = \frac{N\theta}{1-\theta} u'(c^{i*})$

$$(\theta - \gamma) u'(c^{i*}) N \left((1 - \psi) \frac{\theta}{1 - \theta} - \psi \right) \geq 0$$

That is positive if and only if $\theta > \psi$.

$$(c \Leftrightarrow b)$$

$$U^I(c) \leq U^O(c)$$

$$\begin{aligned} \theta u'(c^{i*}) \psi + \frac{1 - \theta}{N} u' \left(\frac{c - c^{i*}}{N} \right) (1 - \psi) - \left(\frac{1 - \theta}{N} u'(c^{i*}) \psi + \frac{1}{N} \left(1 - \frac{1 - \theta}{N} \right) u' \left(\frac{c - c^{i*}}{N} \right) (1 - \psi) \right) \leq 0 \\ \frac{N\theta - 1 + \theta}{N} (u'(c^{o*})(1 - \psi) - u'(c^I)\psi) \leq 0 \end{aligned}$$

Since $\theta \geq (N + 1)^{-1}$, the condition is satisfied if the second term in brackets is positive. As we have seen in the previous part we can use the sharing rule and state that the condition is satisfied if and only if $\theta \geq \psi$.

$$(c \Leftrightarrow d)$$

$$\begin{aligned} \theta \geq \frac{\partial c^I}{\partial c} = \frac{\frac{1 - \theta}{N^2} u'' \left(\frac{c - c^i}{N} \right)}{\theta u''(c^I) + \frac{1 - \theta}{N^2} u'' \left(\frac{c - c^i}{N} \right)} \\ \theta^2 u''(c^i) \leq \left(\frac{1 - \theta}{N} \right)^2 u''(c^o) \end{aligned}$$

Substituting the RHS by using the sharing rule we have that

$$\frac{u''(c^o)}{u''(c^i)} \leq \left(\frac{u'(c^o)}{u'(c^i)} \right)^2$$

□

Corollary 2

Proof. In case of CRRA utility, it can be easily that the sharing rule is the following $c^i = \nu c$ and $c^o = \frac{(1-\nu)}{N} c$ where $0 \leq \nu \leq 1$

$$\nu = \frac{\left(\frac{\theta}{1 - \theta} \right)^{\frac{1}{\sigma}} N^{\frac{1 - \sigma}{\sigma}}}{1 + \left(\frac{\theta}{1 - \theta} \right)^{\frac{1}{\sigma}} N^{\frac{1 - \sigma}{\sigma}}}$$

It can be easily checked that $\theta \geq \nu$ is satisfied whenever

$$1 - \left(\frac{N\theta}{1 - \theta} \right)^{\frac{1 - \sigma}{\sigma}} \geq 0$$

This means that the condition is satisfied with strict inequality for $\sigma > 1$. In the log case ($\sigma = 1$) we have equality. It can be easily checked that the second order conditions of the maximization problem are satisfied since ψ is constant. Due to proposition 1, it is true that $\theta \geq \psi$ if and only if $\tilde{d}_2^* \leq d_2^*$. □

Corollary 3

Proof. To prove the claim we apply the implicit function theorem to the Euler equation

$$\theta u' \left(c^{i*}(y + \tilde{d}_2 + d_1) \right) = \psi \gamma u' \left(c^{i*}(y - \tilde{d}_2(1+r)) \right) + (1-\psi) \frac{(1-\gamma)}{N} u' \left(c^{o*}(y - \tilde{d}_2(1+r)) \right)$$

We prove the claim for the class of utility functions such that $\psi \in \mathbb{R}$.

$$\theta u''(c_1^i) \frac{\partial \tilde{d}_2}{\partial p} = \frac{\partial \gamma}{\partial p} \left(\psi u'(c_2^i) - \frac{1-\psi}{N} u'(c_2^o) \right) - (1+r) \frac{\partial \tilde{d}_2}{\partial p} \left(\psi \gamma u''(c_2^i) + (1-\psi) \frac{1-\gamma}{N} u''(c_2^o) \right)$$

$$\frac{\partial \tilde{d}_2}{\partial p} = \frac{\frac{\partial \gamma}{\partial p} \left(\psi u'(c_2^i) - \frac{1-\psi}{N} u'(c_2^o) \right)}{\theta u''(c_1^i) + (1+r) \left(\psi \gamma u''(c_2^i) + (1-\psi) \frac{1-\gamma}{N} u''(c_2^o) \right)}$$

Notice that the denominator is negative; $\frac{\partial \gamma}{\partial p} > 0$ whenever $\theta > (N+1)^{-1}$. Finally notice that the term in brackets at the numerator is negative whenever $\theta > \psi$. In order to see that, compare this term with the sharing rule and notice that if $\theta > \psi$ this term must be negative. Hence if $\theta > \psi$ an increase in p reduces the saving incentive. As in [Alesina and Tabellini \(1990a\)](#), when $\psi > \theta$ the sign changes, but the implication is the same: an increase in p reduces the borrowing incentive. \square

Proposition 6

Proof. To explain the mechanism that generates time inconsistency, consider the probability that a party in power at time t is also in power at time $t+s$ with $s \geq 0$ defined as $\bar{p}_{t,t+s}$. The dynamic equation describing $\bar{p}_{t,t+s}$ is

$$\begin{aligned} \bar{p}_{t,t+s+1} &= p(c_{t+s}) \bar{p}_{t,t+s} + \frac{1-p(c_{t+s})}{N} (1 - \bar{p}_{t,t+s}) \\ &= \bar{p}_{t,t+s} \underbrace{\left(p(c_{t+s}) - \frac{1-p(c_{t+s})}{N} \right)}_{f_s} + \underbrace{\frac{1-p(c_{t+s})}{N}}_{g_s}. \end{aligned}$$

Solving the difference equation $\bar{p}_{t,t+s+1} - f_s \bar{p}_{t,t+s} = g_s$.

$$\frac{\bar{p}_{t,t+s+1}}{\prod_{k=t}^s f_k} - \frac{f_s \bar{p}_{t,t+s}}{\prod_{k=t}^s f_k} = \frac{\bar{p}_{t,t+s+1}}{\prod_{k=t}^s f_k} - \frac{\bar{p}_{t,t+s}}{\prod_{k=t}^{s-1} f_k} = \frac{g_s}{\prod_{k=t}^s f_k}.$$

Define $A_s \equiv \frac{\bar{p}_{t,t+s}}{\prod_{k=t}^{s-1} f_k}$, then the difference equation becomes:

$$A_{s+1} - A_s = \frac{g_s}{\prod_{k=t}^s f_k}.$$

Summing the last equation from period t to period $t+s$ we have:

$$A_s = A_t + \sum_{m=t}^{t+s-1} \frac{g_m}{\prod_{k=t}^m f_k}.$$

where A_t is the initial condition that since $\bar{p}_{t,t} = 1$, then $A_t = 1$. Finally the evolution of the probability is

$$\bar{p}_{t,t+s} = \left(\prod_{k=t}^{t+s-1} \frac{(N+1)p(c_k) - 1}{N} \right) \left(1 + \sum_{m=t}^{t+s-1} \frac{\frac{1-p(c_m)}{N}}{\prod_{k=t}^m \frac{(N+1)p(c_k) - 1}{N}} \right). \quad (27)$$

□

Proposition 7

Proof. Observing the Euler Equation of Scenario B (26) we can notice that the first part is the problem that the incumbent faces in Scenario A that would generate the level of debt equal to \tilde{d}_2 if it would be the only term in the equation. We are studying the second term in curly brackets coming from time-inconsistency.

The derivative of optimal debt at period 2 wrt debt at period 1 can be derived by applying the implicit function thorem to the Euler equation of the second period

$$\frac{\partial d_2^*}{\partial d_1} = (1+r) \frac{U''^I(c_1)}{U''^I(c_1) + \beta(1+r)(pU''^I(c_2) + (1-p)U''^O(c_2))} = \xi(c^*)(1+r)$$

where $0 \leq \xi(c^*) \leq 1$. The term inside curly brackets in 26 can be rearranged in this way

$$\begin{aligned} & \left[pU'^I(c_1) + (1-p)U'^O(c_1) \right] - \left[p_{0,2}U'^I(c_2) + (1-p_{0,2})U'^O(c_2) \right] = \\ (1-p) \left[U'^O(c_1) - U'^I(c_1) \right] - (p-p_{0,2}) \left[U'^O(c_2) - U'^I(c_2) \right] + \underbrace{U'^I(c_1) - \left[pU'^I(c_2) + (1-p)U'^O(c_2) \right]}_{=0} & = \end{aligned}$$

It can be shown²⁷ that $p - p_{0,2} = (1-p) \left(p - \frac{1}{N+1} \right)$. Since we are evaluating this term in $d_1^* = d_2^* = 0$ the last expression can be rewritten in the following way

$$(1-p) \left[U'^O(c^*) - U'^I(c^*) \right] \frac{(N+1)(1-p) + 1}{N+1}$$

Notice that this term is always positive when $\theta > \psi$. Since we have a minus in front of the time inconsistency term, it means that the incumbent in Scenario B weights marginal utility of tomorrow less than the incumbent in scenario A. We showed that $\tilde{d}_1^{A*} < \tilde{d}_1^{B*}$.

We show now that $\tilde{d}_1^{B*} < 0$, i.e. also with time inconsistency we have an incentive to save. We are considering the case with ψ constant. Let's rewrite the difference between the LHS and the RHS evaluated in the optimal $d_1^* = d_2^* = 0$ In the following we are assuming that ψ is a constant. The difference between RHS and LHS, z , in the optimal policy $d^* = 0$ can be expressed as

$$\begin{aligned} z = & -U'^I(c^*) + \left(pU'^I(c^*) + (1-p)U'^O(c^*) \right) \\ & - (1+r)\xi(c^*)\beta(1-p) \left[U'^O(c^*) - U'^I(c^*) \right] \frac{(N+1)(1-p) + 1}{N+1} \geq 0 \end{aligned}$$

²⁷Using the definition of $p_{0,2}$, we obtain that

$$p - p_{0,2} = \frac{N+1}{N}p^2 - \frac{N+2}{N}p + \frac{1-p}{N} = 0$$

The polynomial has roots $p = 1$ and $p = 1/(N+1)$

$$\beta(1-p) \left[U'^O(c^*) - U'^I(c^*) \right] \left(1 - \xi(c^*) \frac{(N+1)(1-p)+1}{N+1} \right) \geq 0 \quad (28)$$

We need to show whether there exists a set of parameters value such that the last expression is negative. This is true whenever

$$1 - \xi(c^*) \frac{N+1(1-p)+1}{N+1} < 0$$

$$p \leq \frac{1}{N+1} + \frac{\xi(c^*) - 1}{\xi(c^*)}$$

It can be checked that

$$\frac{\xi(c^*) - 1}{\xi(c^*)} = - \frac{pU''^I(c^*) + (1-p)U''^O(c^*)}{U''^I(c^*)} = -(p(1 - \chi(c^*)) + \chi(c^*))$$

Substituting and rearranging terms

$$p \underbrace{(2 - \chi(c^*))}_q < \underbrace{\left(\frac{1}{N+1} - \chi(c^*) \right)}_s$$

we define the threshold as the value of p that equalizes 28

$$\tilde{p}(\theta) = (2 - \chi(c^*))^{-1} \left(\frac{1}{N+1} - \chi(c^*) \right)$$

Notice first that

$$q > 0 \Leftrightarrow \chi(c^*) < 2$$

$$s > 0 \Leftrightarrow \chi(c^*) < \frac{1}{N+1}$$

Hence, the condition for borrowing is the following

$$p < \tilde{p}(\theta) \quad \chi(c^*) < 2$$

$$p > \tilde{p}(\theta) \quad \chi(c^*) > 2$$

The next question is to find condition for having

$$0 \leq \tilde{p}(\theta) \leq 1$$

$$0 \leq \tilde{p}(\theta) \Leftrightarrow \chi(c^*) > 2 \cup \chi(c^*) < \frac{1}{N+1}$$

$$\tilde{p}(\theta) = (2 - \chi(c^*))^{-1} \left(\frac{1}{N+1} - \chi(c^*) \right) < 1$$

It can be easily checked that the last condition is always satisfied if the denominator is positive ($r < 2$); if it is not the case, the condition is never satisfied. Aggregating these results we have that

$$\chi(c^*) > 2 \Leftrightarrow p > \tilde{p}(\theta) > 1 \Leftrightarrow \text{No borrowing}$$

$$\frac{1}{N+1} \leq \chi(c^*) \leq 2 \Leftrightarrow p < \tilde{p}(\theta) < 0 \Leftrightarrow \text{No borrowing}$$

$$\frac{1}{N+1} > \chi(c^*) \Leftrightarrow p < \tilde{p}(\theta), \quad 0 \leq \tilde{p}(\theta) \leq 1 \Leftrightarrow \text{Borrowing}$$

We are showing now that if $\theta > \psi \Rightarrow \chi(c^*) > (N+1)^{-1}$, hence we never have an incentive to borrow. We have already showed that $\theta > \psi$ is sufficient to guarantee that the marginal utility of the opponent is larger than the marginal utility of the incumbent. Since $U''^I(c), U''^O(c) < 0$, we have that

$$\frac{1}{N+1} > \chi(c^*) \Leftrightarrow U''^O(c^*) > \frac{U''^I(c^*)}{N+1}$$

$$\left(\frac{1-\psi}{N}\right)^2 u''(c^O) \left(\frac{N^2 + \theta(1+2N) - (N+1)}{N(N+1)}\right) > \psi^2 u''(c^I) \left(\frac{\theta(1+2N) - (N+1)}{N(N+1)}\right)$$

Notice that $N^2 + \theta(1+2N) - (N+1) > 0$ for $\theta > (N+1)^{-1}$. The condition can be rearranged in this way

$$\frac{u''(c^O)(1-\psi)^2}{u''(c^I)\psi^2 N^2} < \frac{\theta(1+2N) - (N+1)}{N^2 + \theta(1+2N) - (N+1)}$$

Using the definition of ψ we have that

$$\frac{u''(c^O)}{u''(c^I)} = \frac{\psi N^2}{(1-\psi)(1-\theta)}$$

substituting back we have that $\chi(c^*) < (N+1)^{-1}$ is satisfied when

$$\frac{\theta(1-\psi)}{(1-\theta)\psi} < \frac{\theta(1+2N) - (N+1)}{N^2 + \theta(1+2N) - (N+1)}$$

Since the LHS is larger than 1 when $\theta > \psi$ and the RHS is smaller than 0, this condition is never satisfied. Finally we can argue that an incentive to borrow can never arise under $\theta > \psi$. \square

Lemma 4

Proof. A sufficient condition for unicity and existency is that the RHS is increasing in d_2 and the LHS decreasing in d_2 . Notice that $U'^I(c) - U'^O(c) = \tau \left(u'(\psi c_1) - u' \left(\frac{1-\psi}{N} c_1 \right) \right)$

$$\frac{\partial RHS}{\partial d_2} = -(1+r) \left(\theta \psi^2 u''(\psi c_2) + (1-\theta) \left(\frac{1-\psi}{N} \right)^2 u'' \left(\frac{1-\psi}{N} c_2 \right) \right) + \underbrace{\tau p'(c_1)}_{\gamma'(c_1)} \left[\psi u'(\psi c_2) - \frac{1-\psi}{N} u' \left(\frac{1-\psi}{N} c_2 \right) \right] > 0$$

$$\begin{aligned} \frac{\partial LHS}{\partial d_2} &= \theta \psi^2 u''(\psi c_1) + (1-\theta) \left(\frac{1-\psi}{N} \right)^2 u'' \left(\frac{1-\psi}{N} c_1 \right) + \\ &+ \tau p'(c_1) \left[\psi u(\psi c_2) - \frac{1-\psi}{N} u \left(\frac{1-\psi}{N} c_2 \right) \right] + \beta \tau p''(c_1) \left[u(\psi c_2) - u \left(\frac{1-\psi}{N} c_2 \right) \right] < 0 \end{aligned}$$

Notice that from the first inequality we derive directly the conditions for $p'(\cdot)$. Rearranging the second inequality and using the first condition to determine an upper bound for $p'(c_1)$ we obtain also the condition for $p''(\cdot)$

□

Proposition 5

Proof. If condition (14) is satisfied, the equilibrium is given by equating the LHS and RHS. Defining z the difference between RHS and LSH and evaluating at d_2^* :

$$z = (\theta - \gamma(c_1^*)) N \left[(1 - \psi) \frac{\theta}{(1 - \theta)} - \psi \right] u'(c_1^{i*}) - p'(c_1^*) \left(\frac{N\theta - 1 + \theta}{N} \right) [u(c_2^{i*}) - u(c_2^{o*})]$$

Obviously, $\frac{\partial z}{\partial p'(c_1^*)} < 0$. Since z is monotone, the solution of $z = 0$, \hat{d}_2^* , increases with $p'(c_1^*)$.

Moreover, the condition for having savings $z > 0$, now becomes:

$$\begin{aligned} p'(c_1) \left(\frac{N\theta - 1 + \theta}{N} \right) [u(c_1^{i*}) - u(c_1^{o*})] &< N(\theta - \gamma) \left[(1 - \psi) \frac{\theta}{(1 - \theta)} - \psi \right] u'(c_1^{i*}) \\ p'(c_1) &< \frac{N^2(\theta - \gamma)(\theta - \psi) u'(c_1^{i*})}{(1 - \theta)(N\theta - 1 + \theta) [u(c_1^{i*}) - u(c_1^{o*})]}. \end{aligned}$$

□

The log-utility case with linear probability In the log case we have already seen that there is no saving incentive for any level of θ when the probability of being re-elected is exogenous. Indeed in this case $\psi = \theta$ and $U^I(c) = U^O(c) = 1/c$. It is easy to notice also that $U^I(c) - U^O(c) = (2\theta - 1) [\log \theta - \log(1 - \theta)]$. The Euler Equation 12 becomes

$$(y + d_1)^{-1} + p'(d_1)\beta(2\theta - 1) [\log \theta - \log(1 - \theta)] = (y - d_1(1 + r))^{-1}$$

The second order condition are satisfied whenever

$$p''(d_1) < \frac{(y + d_1)^{-2} + (y - d_1(1 + r))^{-1}}{\beta(2\theta - 1) [\log \theta - \log(1 - \theta)]}$$

In the case of linear probability $p''(d_1) = 0$ hence SOC is always satisfied whenever $\theta > 1/2$ (i.e. there is political conflict). In the linear probability case where $p'(d_1) = \alpha$ the level of debt can be easily characterized by solving 29. In particular, since the rhs of 29 is always positive, then \tilde{d}_1 satisfying 29 is always positive. Since we have linear probability the optimal debt level of debt is

$$d_1^* = \begin{cases} \tilde{d}_1 & \tilde{d}_1 < \frac{1-\gamma}{\alpha} \\ 0 & \tilde{d}_1 \geq \frac{1-\gamma}{\alpha} \end{cases}$$

$$\frac{d_1(2 + r)}{(y + d_1)(y - d_1(1 + r))} = \alpha\beta(2\theta - 1) [\log \theta - \log(1 - \theta)] \quad (29)$$

Notice that as far as $\alpha > 0$ we have borrowing in this economy. Notice that this threshold level of α that is zero in the log-utility case, is independent from θ . The same result can be shown analytically also for the general HARA utility function with linear probability; in particular we can characterize a threshold level for

α , $\bar{\alpha}$ s.t. when $\alpha > \bar{\alpha}$ we have borrowing and $\bar{\alpha}$ is independent from θ . In the body we showed numerically that this result is robust also to a more general form of probability function .

In the log-utility case we can compute the derivative of d_1^* wrt to θ by applying the implicit function theorem to the euler equation.

$$\frac{\partial d_1^*}{\partial \theta} = \alpha\beta \left[2(\log \theta - \log(1 - \theta)) + \frac{2\theta - 1}{\theta(1 - \theta)} \right] \frac{(y + d)^2(y - d(1 + r))^2}{(2 + r)(y^2 + d^2(1 + r))} \quad \text{if } d_1^* < \frac{1 - \gamma}{\alpha}$$

Conditionally on $\alpha > 0$ the derivative of borrowing is increasing in θ .

11 Appendix: Equilibrium Debt and Non-linear Probability

Here we consider the following non-linear probability function: We assume that the probability of being re-elected is represented by the following functional form:

$$p(c) = \text{atan} \left(\frac{\alpha(c - \bar{c}) + \gamma}{\pi} \right) + \frac{1}{2}. \quad (30)$$

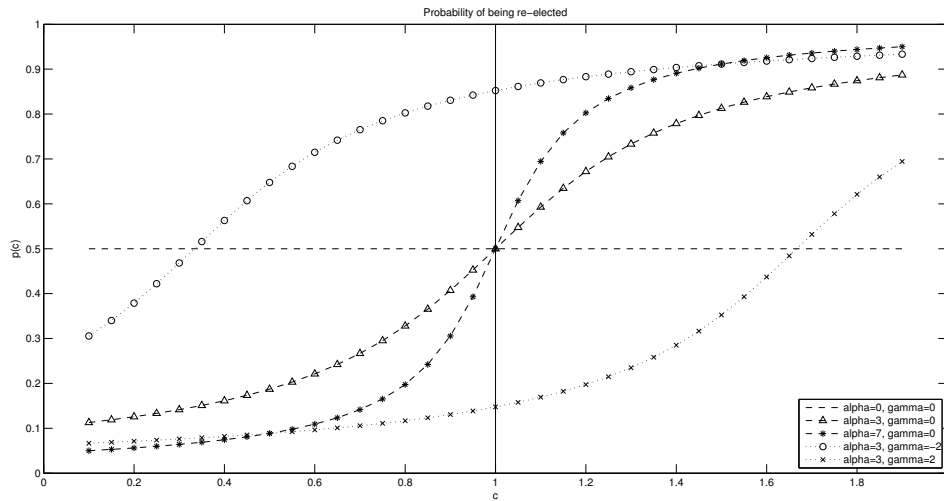
Figure 6 visualizes this probability function for different parameter values. Here, α affects the sensitivity (slope) of the probability function, whereas γ determines its level. By increasing α the probability becomes steeper around the flex. When α is very large the probability function is close to a step function. If γ is zero, the function is centered in \bar{c} . Adopting the function in (30) we assume that voters are more sensitive to economic conditions at the flex point. The flex point of the curve is shifted to the left (right) with respect to \bar{c} when $\gamma > 0 (< 0)$. This function is bounded between 0 and 1 for any realization of consumption. The calibration of the model is as presented in In Figure 6 we plot the equilibrium level of debt for different combinations of θ and α in a 2-period model with CRRA utility function. In Table 8 we report the average equilibrium level of debt for different combinations of θ and α in a T-period model (with $T=2250$).

Table 8: Equilibrium Level of Debt in a T-period economy: Non-linear Probability

	α				
	0	1	3	5	7
$\theta=0.5$	0	0	0	0	0
$\theta=0.6$	-1.2	0	0.4	5.1	9.9
$\theta=0.7$	-4.3	-0.2	11.4	23.3	30.6
$\theta=0.8$	-2.3	0.8	30.3	30.9	98.1
$\theta=0.9$	-4.8	-1.2	9.3	256.7	440.4

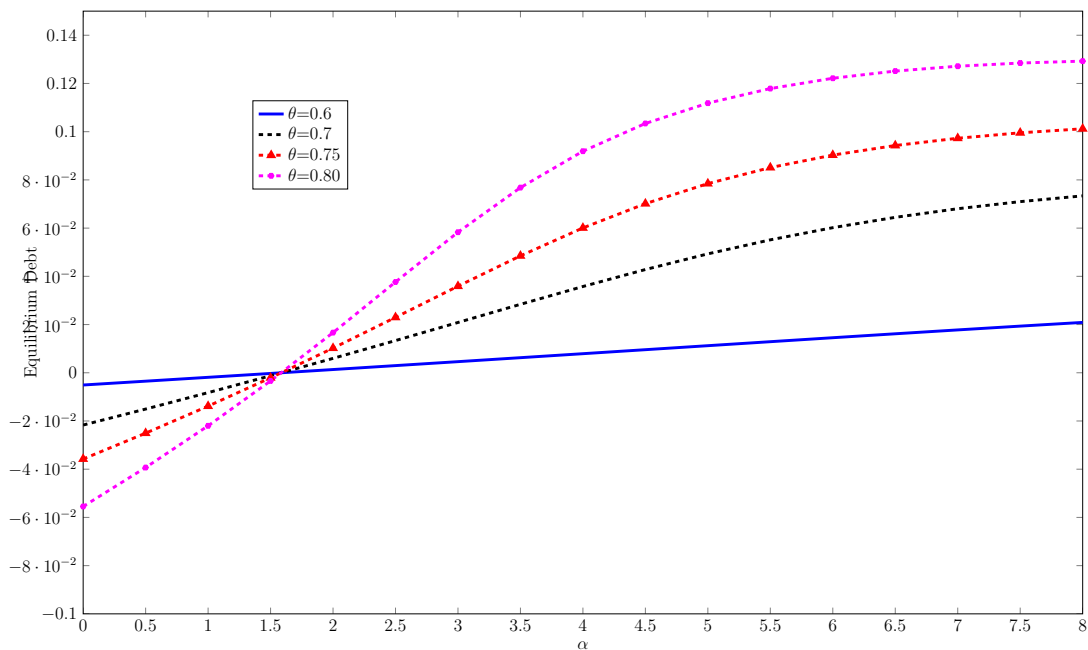
Note: In this table we report the average level of debt (in percentage) in a T-period economy, with $T = 2250$, when assuming CRRA utility function and non-linear probability, for different values of degree of retrospective voting (α , x-axis) and degree of political friction, θ . Negative values denote savings.

Figure 6: Non-linear Probability function



Note: In this figure we display of the probability function in equation (30) for different pairs of sensitivity (α) and the level parameter (γ).

Figure 7: EQUILIBRIUM DEBT, RETROSPECTIVE VOTING, AND POLITICAL FRICTION: NON-LINEAR PROBABILITY



Note: This figure plots the equilibrium level of debt in a 2-period economy when assuming CRRA utility function and non-linear probability, for different values of degree of retrospective voting (α , x-axis) and degree of political friction, θ . The blue-solid line is associated to a low degree of political friction ($\theta=0.6$), the black-dotted line and the red-triangle-marked line are associated to moderate degrees of political friction ($\theta=0.7$ and 0.8 , respectively), and the pink-circle-marked line is associated to a high degree of political friction ($\theta=0.8$).

Political Cost of Default and Business Cycle in Emerging Countries*

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This Draft: April 2015

Abstract

Sovereign default models that study how income fluctuations and the level of debt affect default risk when sovereign debt is non contingent, are successful in explaining business cycle in emerging economies by matching the stylized facts of main economic aggregates in normal and default periods but they fail in reproducing jointly the large levels of debt and spread observed in the data. I introduce political uncertainty in the standard default model of [Arellano \(2008\)](#): the incumbent has an exogenous probability of not being reappointed in the next period, but in the case she decides to default, there is a larger probability of losing power. Calibrating political uncertainty on Argentinian polls data, the model generates realistic levels of debt to gdp and spread without affecting the performance on the other business cycle statistics. JEL Classification: F3 - F41 - D72 - P16 - E32

Keywords: Public debt, Political uncertainty, Small open economy, Sovereign Default

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1 Introduction

Some stylized facts about business cycle and sovereign defaults in emerging economies have been established by the literature, but some of these facts have not been considered in quantitative models. The first fact is that there is limited support for theories that explain the feasibility of sovereign debt based on external sanctions or exclusion from international markets (as in [Arellano \(2008\)](#)) and more support for internal factors. Secondly, there is growing agreement that default events in many emerging economies have been triggered by political motives ([Balkan \(1992\)](#), [Panizza et al. \(2009\)](#), [Hatchondo et al. \(2009\)](#), [Hatchondo and Martinez \(2010\)](#), [Cuadra and Saprizza \(2008\)](#)). In this paper we present a quantitative model of default with political uncertainty that accounts for these facts, that closely match relevant business cycle statistics and the level of debt to gdp, default likelihood and spread that we observe in the data.

Regarding external sanctions, many empirical papers focus on evaluating the cost of default for a country. According to [Gelos et al. \(2008\)](#), that defined market access from bond issuance, exclusion from capital markets lasted 4 years on average after default event during the 80's, but this duration drops to 0.3 years during the 90's. [Richmond and Dias \(2009\)](#) measured market access as positive net transfers. In this way they measured that it took 5.5 years on average to exit from default during the 80's, 4.1 during the 90's and 2.5 years after 2000. These results show that relying on market exclusion to explain political cost of default is not a realistic representation of reality. In [Arellano \(2008\)](#) calibration, exclusion from capital markets lasts 2.5 years on average after default. [Mendoza and Yue \(2012\)](#) calibrate re-entry probability according to the estimates of [Richmond and Dias \(2009\)](#), implying 10 years of exclusion from capital markets on average. Exclusion from capital markets is costly for the government because of the inability to smooth consumption, but according to [Lucas \(1987\)](#), [Aguiar and Gopinath \(2007\)](#) and [Otrok \(2001\)](#) welfare cost of business cycle is relatively small. In addition traditional models of sovereign defaults assume that output drops in default periods, but they do not deal with the simultaneity issue that defaults occur more likely during recessions.

Instead there seems to be more support for a political explanation of the default. Politicians in several economies seem to postpone for a long time unavoidable defaults. One possible explanation

for this is that they want to avoid to be replaced in office. By looking at post-election results, there seems to be clear evidence that after a default the incumbent loses political support. There is not a large body of literature on estimating the political cost of default. [Borensztein and Panizza \(2009\)](#) calculated the loss in the vote share for the ruling part after a default; across countries the incumbent loses on average 16% of electoral supports. There is much more evidence on the political cost of currency devaluation. [Cooper \(1971\)](#) and was the first to illustrate the political cost of devaluations by showing that devaluations more than double (from 14 to 30 percent) the probability of a political crisis and a government change within the next 12 months. [Frankel \(2005\)](#) updated the results of [Cooper \(1971\)](#) and found that in the 1971 - 2003 period devaluations increased the probability of a change in the chief of the executive in the following 12 months from 20 to 29 percent. In this paper we do not provide an explanation for why voters are more likely to substitute the incumbent in case of default and in some specific cases it could also be that the incumbent does not face this risk (See Greek elections in 2015). But this argument finds sufficient support for Argentinian default of 2001.

In this paper we present a model of sovereign default with political uncertainty. The agent has an exogenous probability of being replaced in the following period after default decision is taken. In case of default this probability rises, making default more costly from a political point of view since the incumbent can “fall” in the opposition state where she benefits of lower intertemporal utility. The existence of political uncertainty *per se* produces borrowing incentive as in the political economy literature ([Alesina and Tabellini \(1990\)](#), [Amador \(2004\)](#), [Amador and Aguiar \(2011\)](#)). Nevertheless previous papers have not considered the enforceability of debt contracts: even if ex-ante the government has an incentive to raise more debt it does not imply repayment ex-post. The existence of larger political uncertainty associated to default events improves the incentive to repay by producing larger debt levels in equilibrium. The model is calibrated to Argentina, where I show that the model can fairly well match debt levels observed in reality, in contrast with the inability of previous papers on this dimension. This paper is closely related to [Amador \(2004\)](#) that shows that because of political uncertainty that generates borrowing incentive the replication strategy that is central in [Bulow and Rogoff \(1989\)](#) is not efficient. As a result we can also observe

positive amount of debt without default. In this paper we focus on the quantitative implication of political uncertainty and we argue that political uncertainty in “normal” times is not sufficient to reproduce the large level of debt observed in the data.

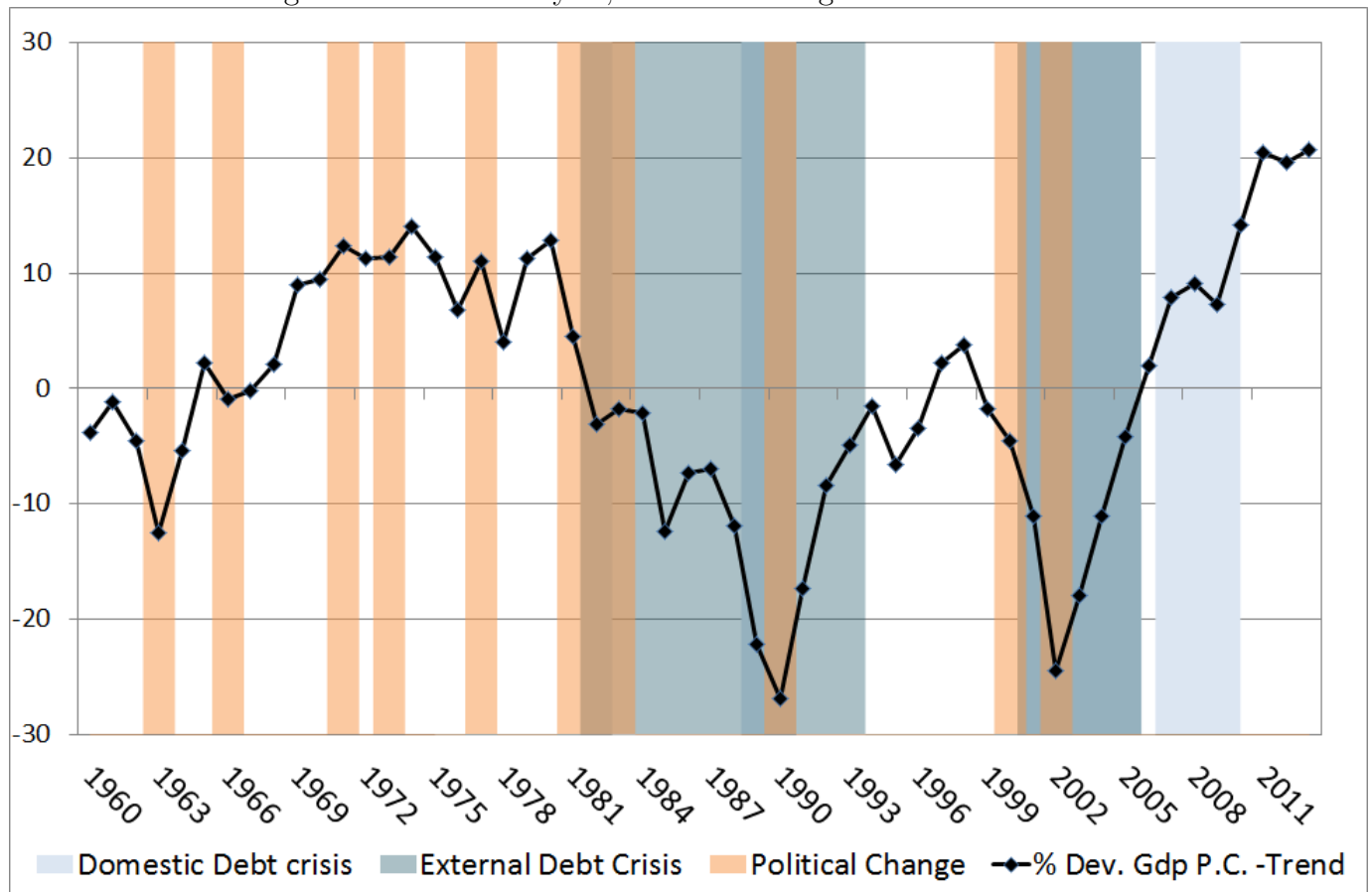
Since we calibrate our model on the Argentinian economy, it is important to understand if political factors played an important role in recent defaults. During the last 60 years we observed in Argentina several episodes of political instability and debt crisis. In figure 1 we represent business cycle measured as percentage deviation from linear trend of GDP per capita¹, together with domestic and external debt crisis bars identified by Reinhart and Rogoff (2010) starting from 1975 and political events². Several things can be observed from this plot. First of all, there is strong coincidence between political events (defined as change in political leader/party), debt crisis and recessions. Second, political changes occurred more frequently in the first part of the sample than in the second part. From 1960 to 1980 in Argentina it was a long period of political instability, several governments alternated in power in this period with the support of military power. In the second part of the sample, government changes occurred less frequently and in coincidence with default and recessions. This strongly suggests that there may be a link between default events and political turnover in Argentina.

There is also strong anecdotal evidence that during the Argentinian debt crises, the government was reluctant to restructure the debt and devaluating the pesos. This was particularly relevant for domestic reasons since many Argentinians borrowed in dollars in that period. Blustein (2006) reported that even Wall Street bankers had to work hard to persuade the policymaking authorities to accept reality and initiate a debt restructuring. In the presidential campaign of 1999, the two main candidates expressed opposing positions as to whether the future government should declare a moratorium on its foreign debt. The Economist (1999) wrote that “while Eduardo Duhalde, his Peronist opponent, has made rash public-spending promises, and suggested that Argentina should default on its foreign debt, it has been Mr. de la Rúa who has responsibly promised to maintain the main thrust of current economic policies, including convertibility”. This policy stance was reinforced by de la Ruas statement that “... there’ll be no default and no devaluation. Our effort

¹Output data are constant prices in local currency and are taken from World Bank.

²See section 4.2 for the definition of political events.

Figure 1: Business Cycle, Political Changes and Debt Crisis



is to reactivate the internal market, which needs lower interest rates. It could be necessary to lower the costs of the debt, but we will comply with our obligations” (see The Economist [2001]).

The paper is organized as follows. In section 2 we present a toy model of default and political uncertainty where we show how political uncertainty can increase the incentive to default even when debt contracts are not enforceable. In section 3 we present the extended infinite horizon model and we show theoretical results and policy functions using calibrated versions of the model. In section 4 we present our calibration strategy of the political parameters of our model and we show moments of simulated series from benchmark calibrations compared to the data.

2 A Toy Model of Political Default

In this section we show with a simple toy model that political uncertainty *per se* does not increase debt to gdp in equilibrium when repayment is not enforceable, but it does when it is associated with lower re-election probability in case of default. Consider a 2 periods economy where the incumbent at period 1 has to decide the amount of borrowing for next period, b' . She benefits from a constant stream of output y and initial assets $b_0 = 0$. The agent can default after borrowing decision. After default decision is taken, a political shock realizes: the agent is reappointed with probability γ in case of no-default, and probability $\gamma - \psi$ in case of default. In case of default and the agent is reappointed, she consumes output in case of default y^{def} . If the agent is not reappointed, he gets utility \tilde{W} . Interest rates are endogenously determined in the model according to default incentives. The agent discounts period 2 utility at rate β . The intertemporal problem of the agent is the following

$$\max_{b'} \quad u(c) + \beta \left\{ (1 - \mathcal{I}_{Def}(b')) \left(\gamma u(c') + (1 - \gamma) \tilde{W} \right) + \mathcal{I}_{Def}(b') \left((\gamma - \psi) u(y^{def}) + (1 - \gamma - \psi) \tilde{W} \right) \right\} \quad (1)$$

$$c = y - q(b')b' \quad c' = y + b'$$

where $\mathcal{I}_{Def}(b')$ is an indicator function that determines whether the agent defaults or not. The agent repays the debt in period 2 if utility in period 2 in case of not-default is larger than \tilde{W} .

$$\gamma u(c') + (1 - \gamma)\tilde{W} \geq (\gamma - \psi)u(y^{def}) + (1 - \gamma + \psi)\tilde{W}$$

$$u(y + b') \geq \frac{\gamma - \psi}{\gamma}u(y^{def}) + \frac{\psi}{\gamma}\tilde{W} \quad (2)$$

When this inequality is binding, we can determine a threshold level \tilde{b} s.t if $b < \tilde{b}$ the agent default and vice versa ($\mathcal{I}_{Def}(b')$ is piecewise linear). The agent chooses b' to maximize intertemporal utility and considers incentive compatible constraint. Investors are risk neutral and I assume without loss of generality that they discount future period with the same rate of the domestic agent; this implies that the stochastic discount factor is $m(y) = \beta$. The reason for this assumption is that I want to shut down any borrowing/saving incentive that derives from assuming different discount factors between the domestic and foreign agent that is not relevant in this simple setting. Define b^* the solution of the maximization problem, the price of the bond is

$$q(b) = \begin{cases} \beta & b^* \geq \tilde{b} \\ 0 & b^* < \tilde{b} \end{cases}$$

If $b^* \geq \tilde{b}$, b^* is the solution of the following equation

$$-q(b^*)u'(y - q(b^*)b^*) = \gamma\beta u'(y + b^*) \Leftrightarrow u'(y - \beta b^*) = \gamma u'(y + b^*) \quad (3)$$

If $b^* < \tilde{b} < 0$ we have that:

$$u'(y - q(\tilde{b})\tilde{b}) > \gamma u'(y + \tilde{b}) \quad (4)$$

Let's now consider 3 possible cases:

2.1 Case 1: Never Default

Suppose for simplicity that the output cost of default is large, $y^{def} = 0$ and $\tilde{W} = 0$, this implies that $\tilde{b} = -y$. Except in the case where the agent borrows his endowment, the agent always

repays. The amount of borrowing is determined by 3. Notice that if $\gamma = 1$, the optimal amount of borrowing is 0, while if $\gamma < 1$, $u'(y - q(b^*)b^*) < u'(y + b^*)$ that implies $b^* < 0$. The reason is simple, political uncertainty makes the agent more impatient, since in period 2 she does not bear the cost of extra borrowing with probability $1 - \gamma$. This is a standard effect of political uncertainty on debt incentive.

2.2 Case 2: No political cost of default

Suppose there is no output cost of default $y^{def} = y$ and no cost of default $\psi = 0$. Since the right hand side of 2 is simply $u(y)$, it is straightforward to check that repayment set requires the amount of assets to be positive in equilibrium, $\tilde{b} \geq 0$. When $\gamma < 1$, optimal borrowing b^* from 3 is negative, but this would contradict incentive compatibility. This is to show that the existence of political uncertainty, in a context where agents can default does not imply larger level of debt in equilibrium, because markets anticipate default in the following period.

2.3 Case 3: Political Cost of Default

Suppose now $0 < \psi < \gamma$ and $y^{def} = y$ it is easy to check that $\tilde{b} > 0$ as far as $u(y^{def}) > \tilde{W}$. To verify this we only need to check that

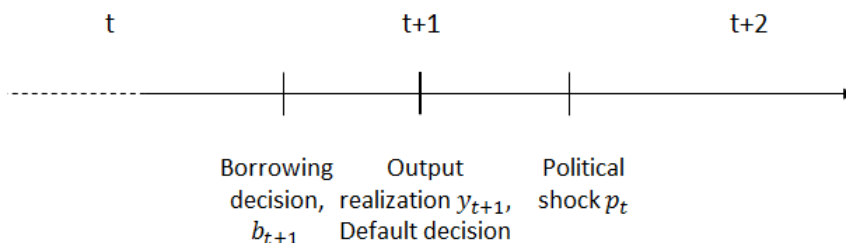
$$\frac{\gamma - \psi}{\gamma} u(y^{def}) + \frac{\psi}{\gamma} \tilde{W} > u(y^{def})$$

$$\frac{\psi}{\gamma} (\tilde{W} - u(y)) < 0$$

This implies that the existence of political uncertainty produce large borrowing levels only if default has a negative impact on the probability to be in power next period.

In the next section, we present an infinite horizon model where we show that the same results hold in a more complex economy.

Figure 2: Timeline in the Political Default Model



3 The Model

Consider a small open economy that receives a stochastic stream of income. We assume that the government of the economy trades bonds with foreign creditors that are not enforceable and the government can choose to default on its debt at any time. There are n types of agents with homogeneous preferences. In each point in time, one of these agents is appointed and makes consumption decisions for himself and can raise debt that will be paid by the agents that will be in power in the following period. After consumption and borrowing decision, the government observes income shock for next period and decides whether to default or not. After default decision a political shock realizes. The probability to be in power next period p is equal to γ if the government does not default and is equal to $\gamma - \psi$ in default state. If the government is replaced, the other agents in the economy have equal probability to be reappointed. We assume that $n \rightarrow \infty$, that implies that the opposition state is an absorbing state. This is the new feature of the model compared with previous literature; the cost of default for the government comes from lower probability of being re-elected next period. This is a cost only if the agent has lower utility in the opposition state. We assume that in the opposition state the agent gains an intertemporal utility $\tilde{W} \leq V(b, y)$, where $V(b, y)$ is the intertemporal utility of the government. For the sake of simplicity we have not explicitly modelled the cost of being at the opposition. The timeline of the events in our economy is summarized in figure 2.

Together with the novel source of default cost, as in Arellano we also assume that if the government defaults, it is temporarily excluded from international intertemporal trading and to incur direct output costs. As in Arellano (2008) we assume that when the government defaults, the debt is erased from the budget constraint and the agent cannot access to further borrowing

until the economy is in default state. This implies that the incumbent consumes his entire output in default state, $c = y^{def}$. As in [Arellano \(2008\)](#) we assume that output cost is larger when output is large, hence

$$y^{def} = \begin{cases} \hat{y} & y \geq \hat{y} \\ y & y \leq \hat{y} \end{cases}$$

As in [Arellano \(2008\)](#) exclusion from capital markets is determined by a random shock. The country can exit from default at the beginning of each period with probability μ .

The price of each bond available to the government reflects the likelihood of default events, such that creditors break even in expected value. When in power agents maximize expected utility

$$E_0 \sum_t \beta^t u(c_t)$$

where $\beta < 1$ and $u(c)$ is increasing and concave, y is stochastic output, where output shocks follow a Markov chain with transition $f(y', y)$. The price of a bond is $q(b', y)$, where b' is the value of the asset. Budget constraint is

$$c + q(b', y)b' = y + b$$

Lenders are risk averse and price the sovereign bond in the following way

$$q(b, y) = \int_{A(b')} m(y') f(y', y) dy$$

where $A(b')$ is the repayment set (see below). We assume that the agent has the following discount factor $m(y') = 1/(1+r) - \lambda \epsilon_{t+1}$. When $\lambda = 0$, the agent is risk neutral and the price of the bond is simply

$$q(b', y) = \frac{1 - P(b', y)}{1 + r}$$

where $P(b', y)$ is the endogenous probability of default.

I write the model in a recursive form. Let's define $V^c(b, y)$ as the value function of the govern-

ment in case of no-default. This value function satisfies

$$V^c(b, y) = \max_{b'} u(y - q(b', y)b' + b) + \beta \int V^o(b', y') f(y', y) dy \quad (5)$$

We define the value of the option to default as

$$V^0(b, y) = \max \{V^{nd}(b, y), V^d(y)\} \quad (6)$$

where $V^{nd}(b, y)$ is the value of not defaulting after observing output realization y and before observing political shock, while $V^d(y)$ is the same object in case of default.

$$V^{nd}(b, y) = \gamma V^c(b, y) + (1 - \gamma)\tilde{W} \quad (7)$$

$$\begin{aligned} V^d(y) = & (\gamma - \psi) \left(u(y^{def}) + \beta \left(\mu \int V^c(0, y') f(y', y) dy' + \right. \right. \\ & \left. \left. + (1 - \mu) \int V^d(y') f(y', y) dy' \right) \right) + (1 - \gamma + \psi)\tilde{W} \end{aligned} \quad (8)$$

From these definitions we can further define a repayment set $A(b)$ and a default set $B(b)$

$$A(b) = \{y \in Y | V^{nd}(b, y) \geq V^d(y)\}$$

$$B(b) = \{y \in Y | V^{nd}(b, y) < V^d(y)\}$$

As in [Arellano \(2008\)](#) we can easily prove that default set is shrinking in asset size.

Proposition 1 *For all $b_1 \leq b_2$, if default is optimal for b_2 , in some states y , then default will be optimal for b_1 for the same states y*

Proof. If default is optimal for b_2 in some states y then $V^d(y) > V^{nd}(b_2, y)$, that implies

$$\gamma V^c(b_2, y) + (1 - \gamma)\tilde{W} = \gamma (u(y - q(b', y)b' + b_2) + \beta EV^o(b', y')) + (1 - \gamma)\tilde{W} < V^d(y)$$

Since $u(y - q(b', y)b' + b_1) < u(y - q(b', y)b' + b_2)$, we have that

$$\gamma(u(y - q(b', y)b' + b_1) + \beta EV^o(b', y')) + (1 - \gamma)\tilde{W} < V^d(y)$$

■

Proposition 2 *Output shocks are iid. If, for some b , the default set is nonempty, then there are no contracts available $\{q(b), b\}$ such that the economy can experience capital inflows, $b - q(b)b' > 0$*

Proof. As in [Arellano \(2008\)](#). ■

Proposition 3 *Output shocks are iid. Default incentives are stronger the lower the endowment.*

Proof. As in [Arellano \(2008\)](#). ■

To solve the model I assume that utility function is CRRA. Output shock is modelled as Markov Chain with 21 states. To calibrate the intertemporal value at the opposition state, we have considered, as a benchmark, the utility of an agent consuming a constant flow of output $\bar{y} = E[y]$

$$\bar{V} = \sum_{t=0}^{\infty} \beta^t \frac{\bar{y}^{1-\sigma}}{1-\sigma}$$

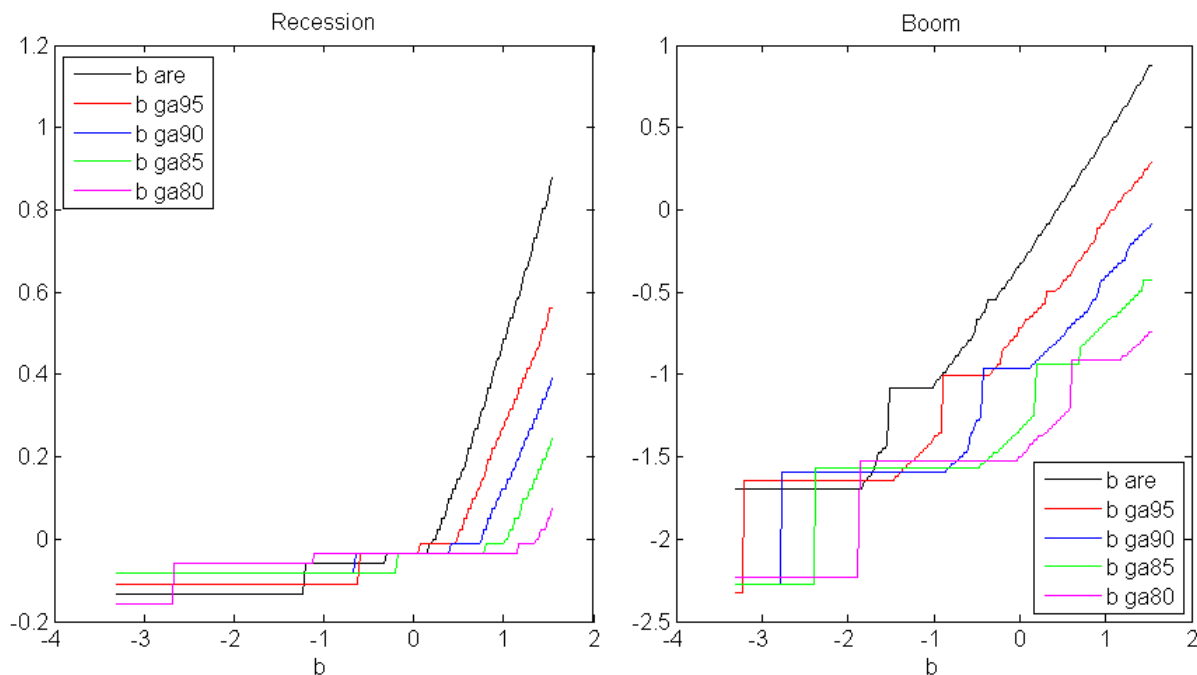
This agent has larger utility than any other agent of this economy. The value at the opposition state is then defined according to this value $\tilde{W} = \epsilon \bar{V}$. Since $V^c(b, y)$, $V^{nd}(b, y)$, $V^d(b, y)$ are larger than $\tilde{W} \forall (b, y)$, this requires $\epsilon > 1$ (since utility is negative) to be large enough in the application.

3.1 Policy functions

In this paragraph I comment the policy functions deriving from our model, to show that in the extended model we have the same features that we have presented in the toy model.

In figure 3 I show the saving functions of the model for different values of political uncertainty γ but with no political cost $\psi = 0$ compared with policy functions of the Arellano model. The toy model suggests that in case of political uncertainty but no political cost, larger borrowing incentives do not imply larger borrowing levels in equilibrium since incentive compatibility is binding. This is confirmed by figure 3. On the left hand side the saving functions in recessions do not imply

Figure 3: Saving function in booms and recession state for different values of γ and $\psi = 0$



Standard parameters are calibrated as in the Arellano paper, while $\epsilon = 1.1$. Boom and recession are defined as 7% deviation of output from trend.

larger borrowing levels in equilibrium, since repayment set is binding in recession. In booms, on the right hand side, the policy maker can borrow more because the likelihood of default is lower. In figure 4 and 5 we present policy function of the model with $\gamma = 0.95$ and different values of γ . Both on the right hand side and lhs of figure 4 it is clear that larger political uncertainty in default periods creates an incentive to accumulate more debt even in crisis period. Figure 5 shows that the likelihood of default decreases when ψ increases for a fixed level of γ .

3.2 Borrowing under political uncertainty

When the incumbent faces political uncertainty, in particular during default periods, she has an incentive to accumulate debt without defaulting on it. In figure 6 we present different values of the average simulated debt to gdp deriving from different calibrations of γ and ψ in the model (using the calibration of Arellano for standard parameters). When ψ is low (e.g. close to zero) the existence of political uncertainty does not affect the level of debt to gdp in equilibrium. Consistently with the policy function, the reason is that increasing political uncertainty gives an additional incentive

Figure 4: Saving function in booms and recession state for different values of γ and ψ

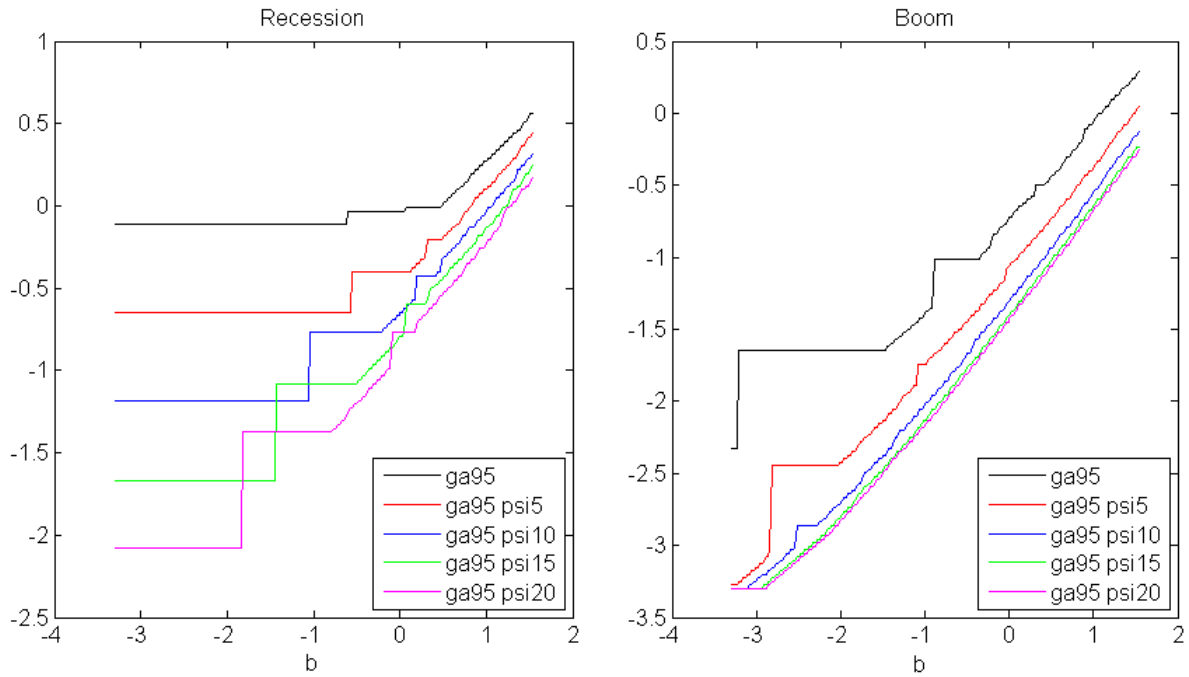
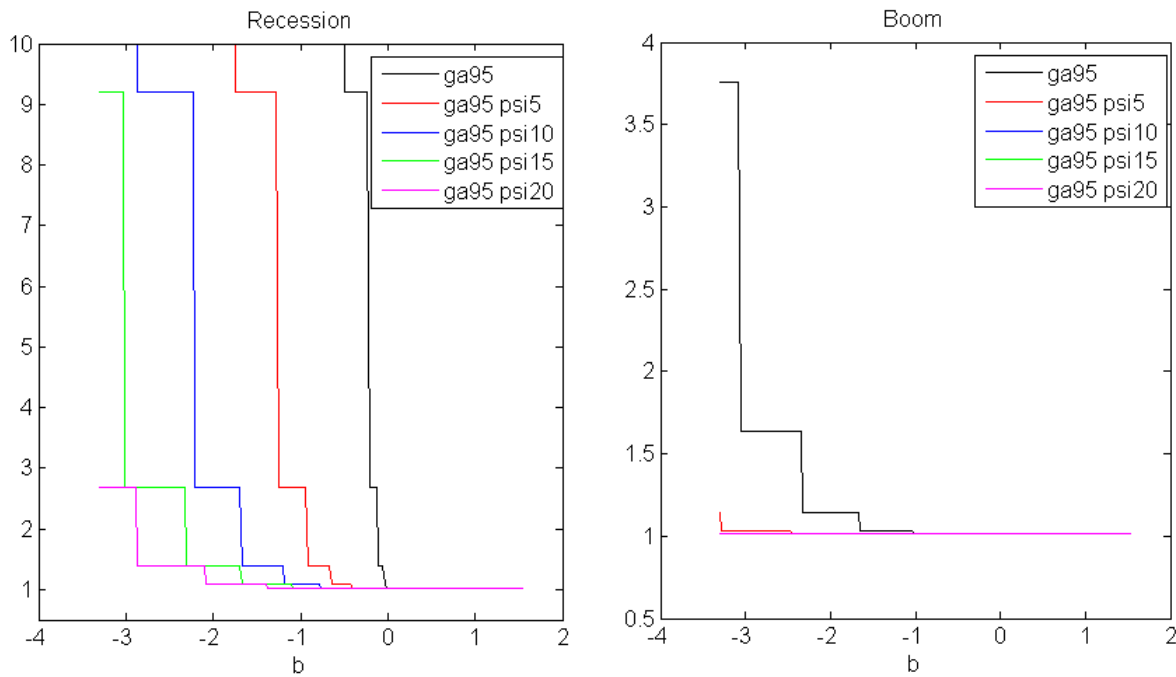


Figure 5: Interest Rates (%) in booms and recession state for different values of γ and ψ



Standard parameters are calibrated as in the Arellano paper, while $\epsilon = 1.1$. Boom and recession are defined as 7% deviation of output from trend.

to accumulate debt but it does not affect the incentive to default in equilibrium. This is confirmed by table 1, when $\psi = 0$ and γ decreases, not only debt to gdp but also default frequency increases. Instead when the political cost of default is large the economy will support much larger levels of debt. When $\gamma = 1$ and ψ increases, the level of debt increases by a lot, and default frequency goes to zero and no defaults occur in equilibrium. When γ is low this incentive is reduced.

		Default Frequency			
		ψ			
		0	0.1	0.2	0.3
γ	0.5	0.41	0.15	0.07	0.03
	0.7	0.34	0.07	0.04	0.02
	0.8	0.28	0.04	0.01	0.01
	0.9	0.16	0.01	NaN	NaN
	1	0.03	NaN	NaN	NaN
		Mean Debt to Gdp			
		ψ			
		0	0.1	0.2	0.3
γ	0.5	7.24	20.91	28.24	30.67
	0.6	7.28	21.32	28.87	31.01
	0.7	8.92	22.81	30.14	31.75
	0.8	8.55	25.77	31.64	32.55
	0.9	7.47	31.10	33.43	NaN
	1	4.56	NaN	NaN	NaN

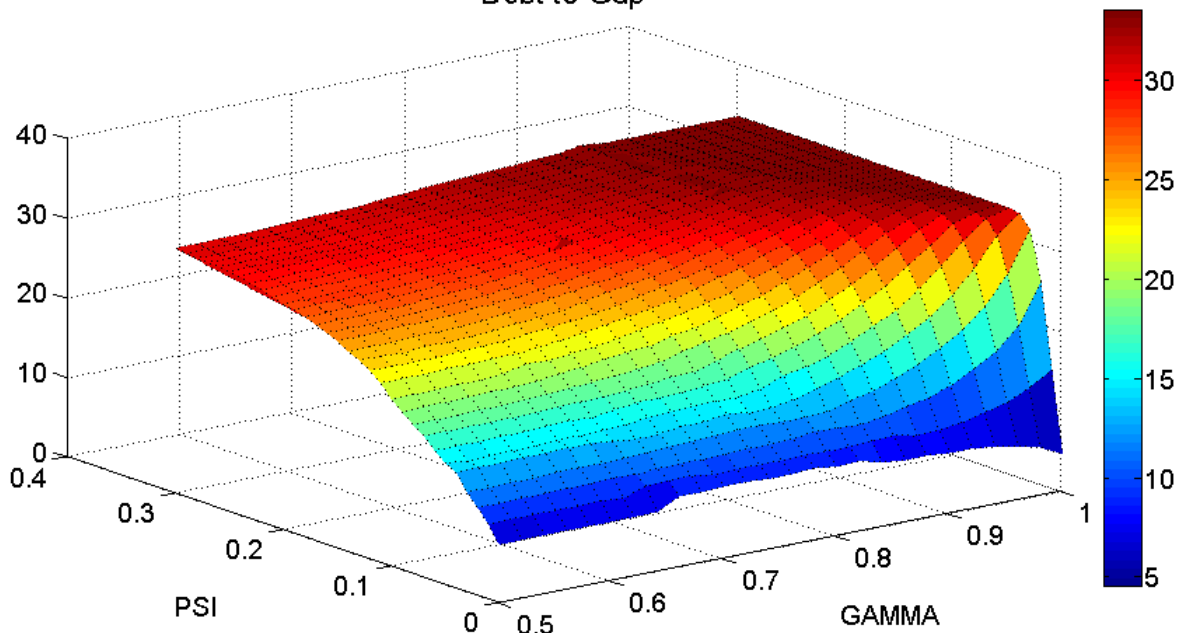
Table 1: Debt to Gdp and Default Frequency under Political Uncertainty NaNs corresponds to combinations of γ and ψ that deliver zero probability of default in equilibrium

4 Quantitative Analysis

4.1 Data

Macroeconomic data are extracted directly from [Arellano \(2008\)](#). National accounting data are quarterly real series, seasonally adjusted, and are taken from the Ministry of Finance (MECON) and include all the data available up to the default episode, 2001Q4. Output and consumption data are log and filtered with a linear trend; the series start in 1980. The trade balance data are reported as a percentage of output and the series start in 1993. The interest rate series are

Figure 6: Comparative Static of Debt to Gdp for different values of γ and ψ



taken from EMBI dataset and start in the third quarter of 1983. Since EMBI time series are composed of long term securities, the interest rate spread is the difference between the interest rate for Argentina and the yield of the five-year US Treasury bond.

4.2 Political Uncertainty in Argentina

Calibrating political uncertainty in the model is crucial for the results of this model. In practice, we need to find an estimate of the probability to stay in power in a specific year when no default occur (γ) and the political loss in default periods expressed as the reduction of this probability (ψ). To estimate γ I have used informations available on government changes. We define a change in the government when we have a change in the President or Dictator of elections or military coups. We used the Database of Political Institutions from World Bank to identify political episodes.

In table 2 I summarize main political events from 1955 to 2008. Some of the event listed in table 2 are not considered as a change in the ruling party/leader; this happens when the son/daughter succeed the father (this happens in 1975 with the election of Miss Peron and 2008 with Miss

Kirchner). In our sample we observe many military coups in Argentina: I have considered these events as government changes. According to this data from 1955 to 2008, I have estimated the probability of being in power as the ratio between the total number of political events over the total time span (53 years) that is equal to 78% ($\gamma = 0.78$).

Table 2: Political Events in Argentina from 1955 to 2008

1955	Military Coup: Peron's Exile	GC
1958	Election of Frondizi	GC
1963	Election of Illia after Military Coup in 1962	GC
1966	Military Coup: Onganía	GC
1971	Lanusse	GC
1973	Election of Peron	GC
1975	Isabel Peron succeeded Peron after his death	
1977	Military Coup: Dictatorship of Videla. National Reorganization Process.	GC
1981	Dictatorship of Viola	GC
1982	Dictatorship of Galtieri	GC
1983	Alfonsín Election	GC
1990	Menem Election	GC
2000	De La Rúa Election	GC
2002	Duhalde substituted De La Rúa	GC
2003	Mr. Kirchner Election	
2007	Ms. Kirchner Election	

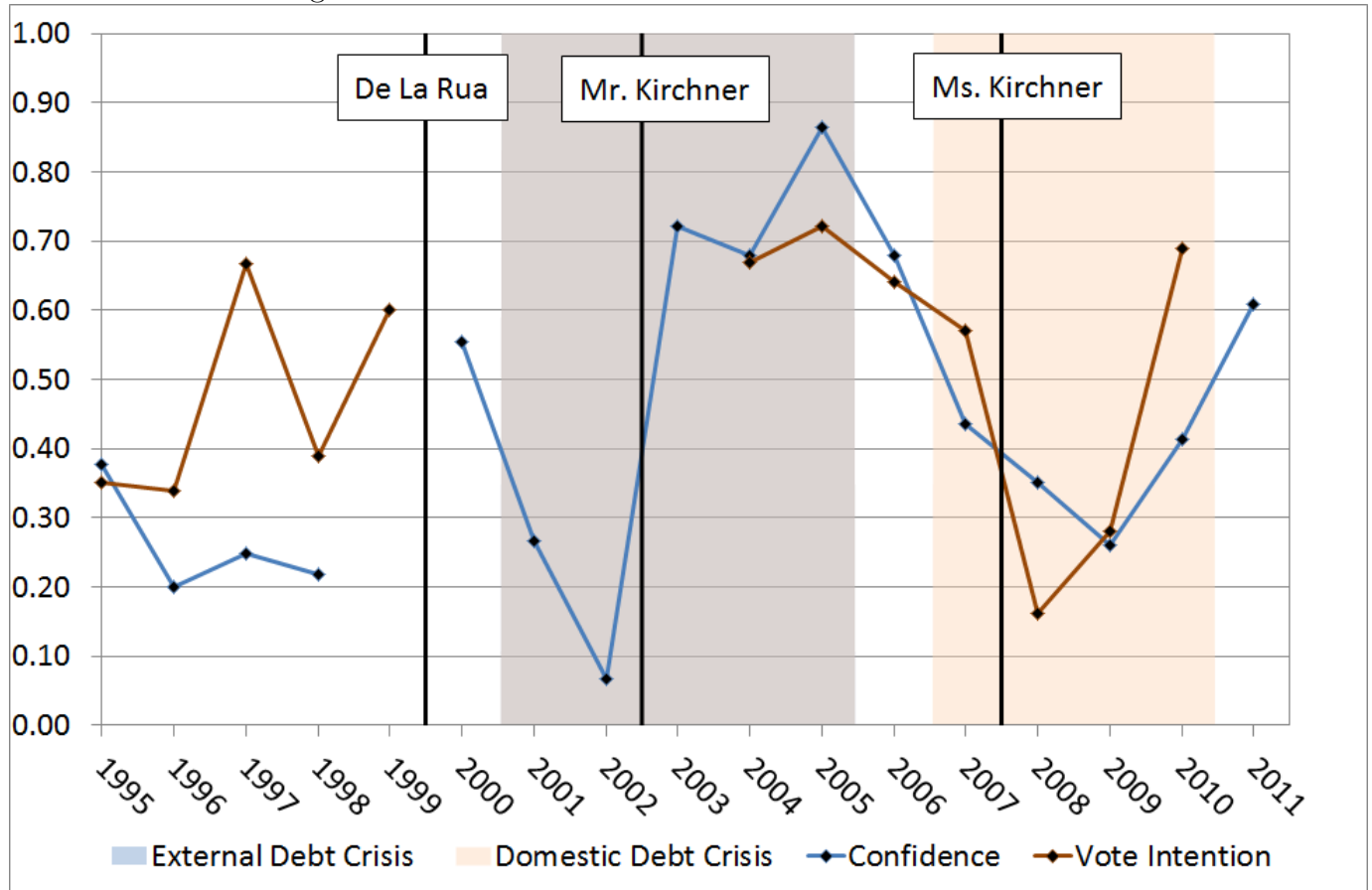
To calibrate the model we should measure political support in the period before and after default occurred in 2001. Since elections take place every four years, we can not rely on regular elections to measure political support for the government especially during the default event of 2001. I preferred to use Latinobarometro survey data on confidence or vote intentions. Latinobarometro survey started to collect data in 1995, by interviewing around 1000 units every year ³. Unfortunately, questions usually change across years; in particular Latinobarometro stopped collecting data on voting intention from 2000 to 2003, which is the period of interest of our analysis. We decide to measure political support from confidence in the President; in particular we observe answers to the following question:

How much confidence you have in the President: a lot, some, a little or no confidence?

I measured political support as the fraction of respondent that have “a lot” or “some” confidence in the President. Political loss is calculated in the following way. I took the ratio, ϕ between

³<http://www.latinobarometro.org>

Figure 7: Confidence in the President and Vote Intention



confidence in default years (2001-2003) and in non-default years from 1995. Surveys in 2001 and 2002 occurred in the months of April to May, while in 2003 they occurred in July-August. Even if De La Rúa resigned in December 2001 and elections of Kirchner occurred in April 2003, I have considered a longer transitory period to have a more conservative estimate of ψ . From this ratio I measured political loss as $\psi = \gamma(1 - \phi)$. In this way I have estimated ψ to be around 18%. This result is consistent with [Borensztein and Panizza \(2009\)](#) that have found that after the default in 2001 the party lost 20.6% of political support from previous elections.

In figure 7 I plot the time series of the confidence in the President compared with the share of individuals that would vote for the Government's party in the following elections. As we can notice these two series are positively correlated. Confidence increased in 1999 after the election of De La Rúa, while it dropped dramatically in 2000 and 2001 and 2002 after Duhalde took his place. Confidence increased only after the election of Mr. Kirchner in 2003.

4.3 The Model without Risk Aversion

I present a first calibration of the model, to show that the inclusion of political features can actually produce large levels of borrowing without affecting default frequency. The main problem of the Arellano model is that you cannot produce such large levels of borrowing without obtaining very low levels of the probability of default. I solve the model using a global solution method. Output gap is assumed to be AR(1) process. The estimated values of the coefficients and standard deviation are as in [Arellano \(2008\)](#): persistency is equal to 0.945 and standard deviation of the error term is 0.025. The shock is discretized into a 21-state Markov Chain using the Tauchen procedure. Asset space is discretized in a grid of 200 points equally spaced ranging from -3.3 to 1.5.

We set the parameters of the model in following way. Risk aversion of the domestic agent and the risk free rate are set as in [Arellano \(2008\)](#) since these are standard. Furthermore also the output loss of default, θ and the probability of re-entry μ are set as in Arellano, in particular to match re-entry in the model as in the data, but we will perform sensitivity analysis to show that these parameters do not affect the results in a sensible way. Risk aversion is set to zero, since we want to show, first that we do not face any tradeoff between default frequency and borrowing level. Regarding the remaining parameters, β and ϵ we set these parameters in order to match moments in the data. The calibration of ϵ seems to be crucial for the results and in particular for default frequency (see figure 8), since intertemporal utility is negative when ϵ increases, the difference between the value function of the incumbent and the value function of the opponent becomes larger, then defaulting is more costly. We set β in order to match trade balance volatility, that is also a target moment in Arellano. This calibration is summarized in table 3, Column (1).

Business cycle statistics of this model are presented in table 4 (column 1) compared to the results of the Arellano model (column 6). The model produces more realistic results regarding the level of debt to gdp, 30%, close to 35% that we observe in the data. The model produces realistic levels of debt to gdp also for wide range of β and ϵ , for given calibration of the additional parameters. Compared to Arellano the model also is more successful in matching comovements

Figure 8: Comparative Static of Default Frequency

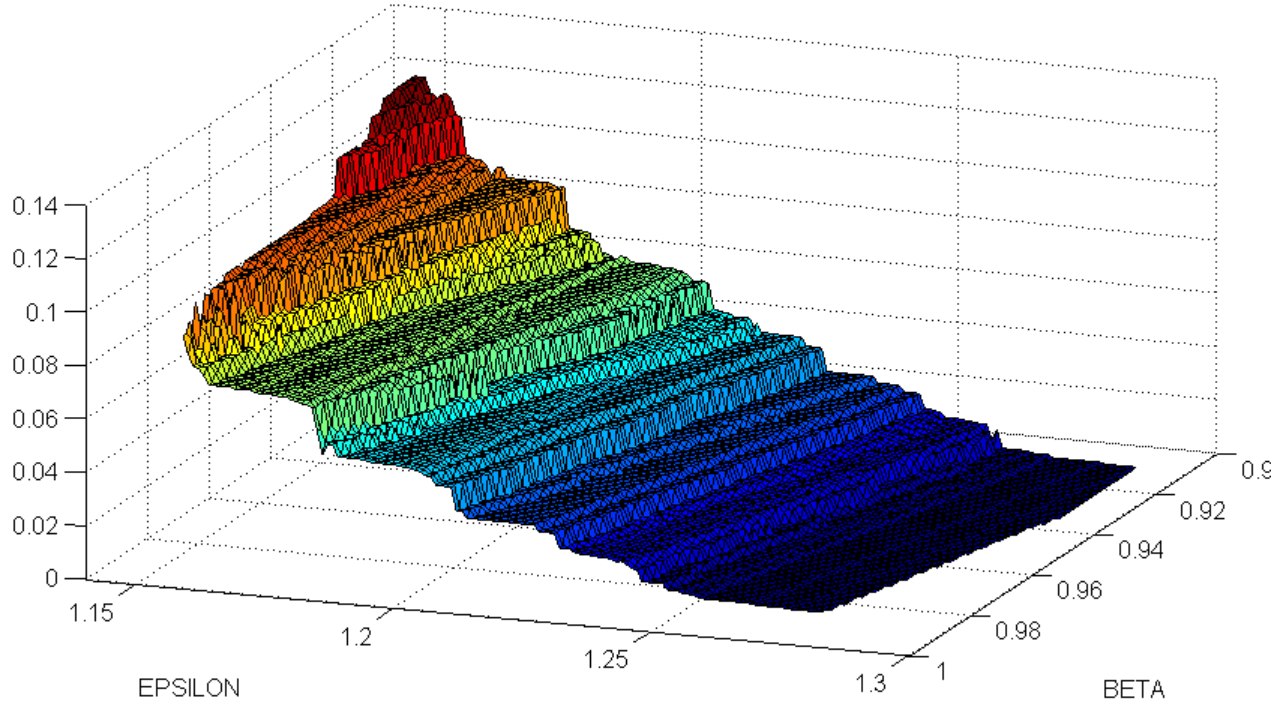
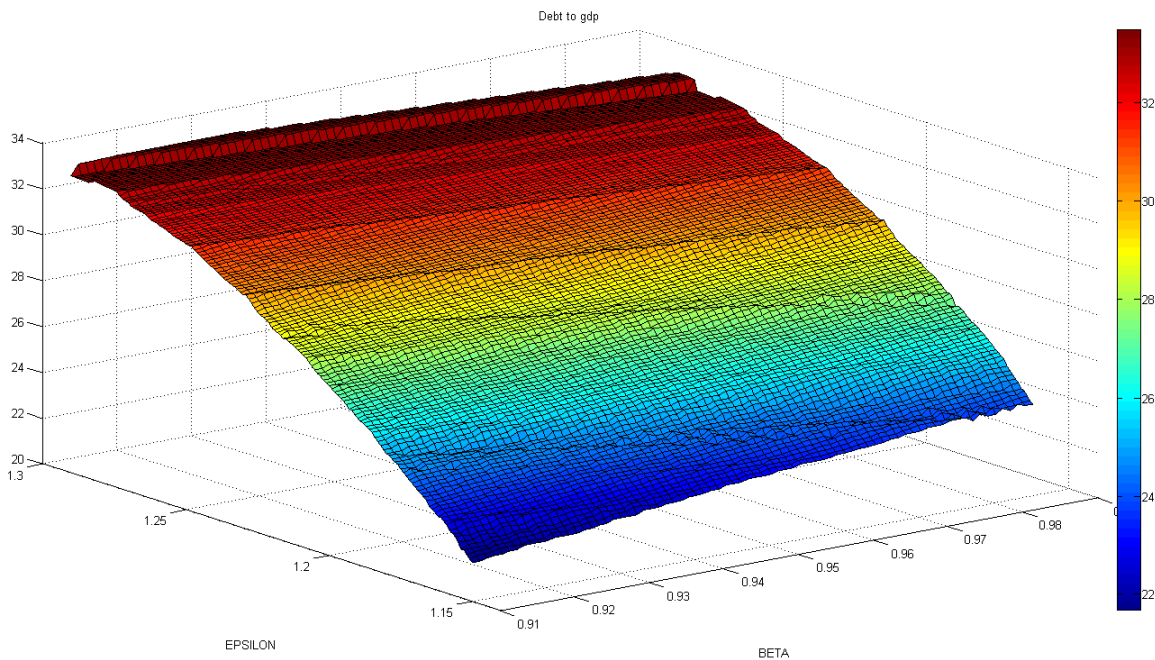


Table 3: Calibrations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Benchmark No RA				Benchmark RA	Arellano	Arellano RA
β	0.91	0.91	0.91	0.91	0.935	0.953	0.882
λ	0	0	0	0	29.8	0	24*
ϵ	1.225	1.225	1.225	1.225	1.18	-	-
μ	0.282	0.282	1	1	0.282	0.282	0.282
γ	0.78	0.78	0.78	0.78	0.78	1	1
ψ	0.18	0.18	0.18	0.18	0.18	0	0
σ	2	2	2	2	2	2	2
r^f	0.017	0.017	0.017	0.017	0.017	0.017	0.017
θ	0.969	∞	0.969	∞	0.969	0.969	0.969

Figure 9: Comparative Static of Debt to Gdp



between the variables, especially between spreads and output and consumption⁴. Furthermore, the model predicts larger deviations of output and consumption in default times, much closer to the data. This happens essentially because the incumbent decides to default only when she faces very sharp economic downturns compared to the Arellano model, because she does not want to face political risk. The model matches almost exactly default frequency in the data, as a result because of investors' risk neutrality, the spread is much lower compared to what we observe in the data. In contrast with Arellano, even if target trade balance volatility, we are not able to match closely this moment. Since the correlation between output and consumption remains the same, this happens essentially because of larger consumption volatility. Regarding the other moments we are in line with the findings of the standard Arellano paper.

In figure 10 I present a simulation of output, consumption debt to gdp and debt over a period that lasts 75 quarters before a default event (that occurs at the end of the simulation). Consumption is closely correlated to consumption over time and overreacts to drastic drops in output because in this periods spreads jump to large levels and interest rate over the following periods

⁴Tomz and Wright (2007) argue that actually the correlation between output fluctuation and default event is negative but surprisingly lower.

needs to be repaid. Spread is very often at 0 but jumps when output is below trend. Debt to Gdp fluctuates around 30% and trends upward at the end of the period. Nevertheless spread only reacts at the very last period and not in the periods before. As we can see the default event happens in a period when output is below trend but not at the lowest level of the simulation. This suggests that the model produces a spread that is strongly sensitive to output fluctuations. Spread is also sensitive to the debt level, but following a “threshold” mechanism: indeed the probability of default jumps to abnormal levels when the debt level crosses some specific threshold. This behavior of the spread, which is also present in the Arellano model⁵, is also confirmed by looking at the policy functions in Figure 11. The plot on the left hand side compares the saving function of the Arellano model and of the benchmark model. In the benchmark model the policy maker will always select much lower levels of debt for any starting value of debt. On the right hand side we compare the return on debt ($1/q(b, y)$) of the two different models. In the benchmark model, we observe lower level of returns than the Arellano model, reflecting lower probability of default that the benchmark model generates.

⁵ See [Wright \(2011\)](#)

Figure 10: Variable simulation in the benchmark model

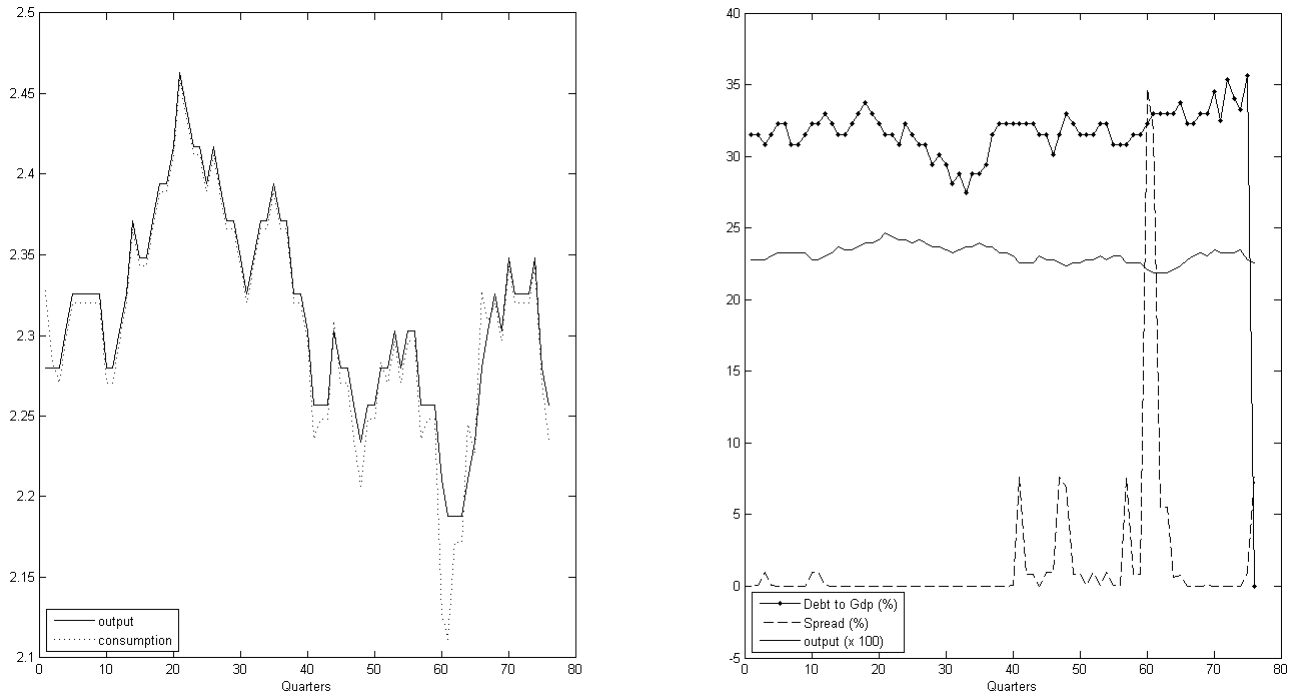


Figure 11: Policy Function in the benchmark model and in Arellano model

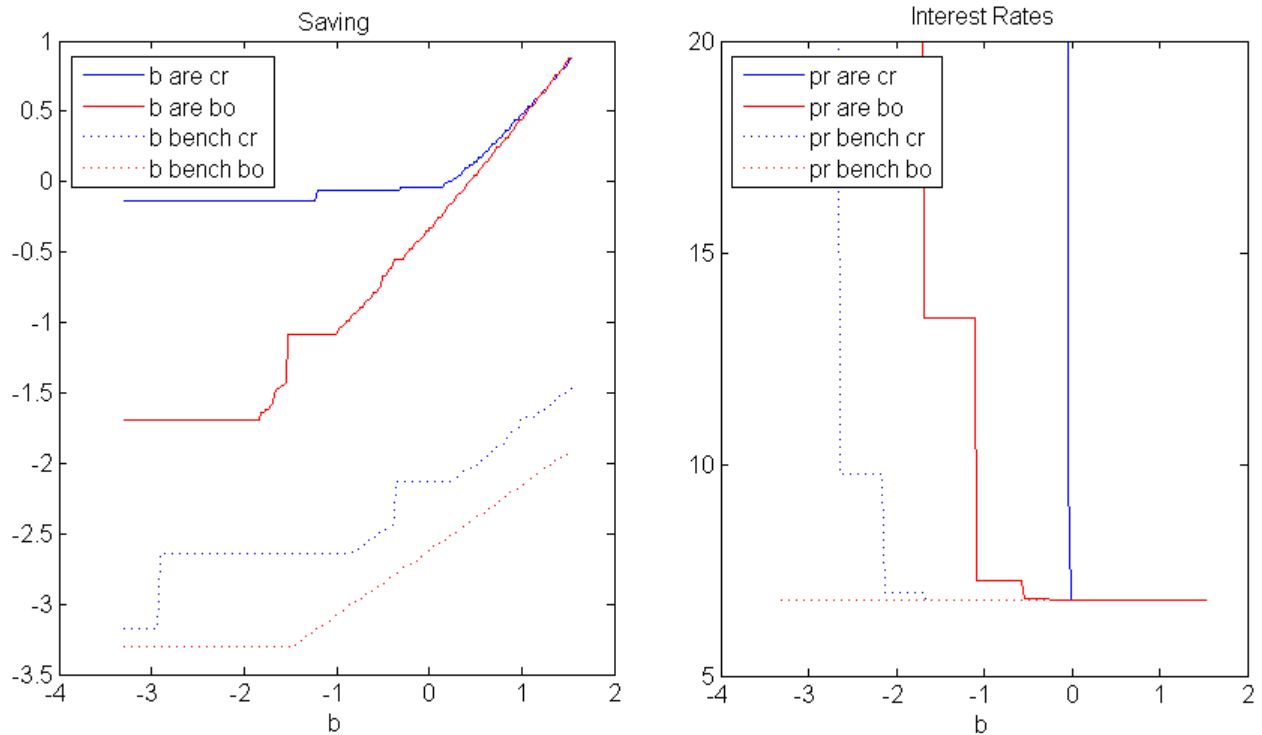


Table 4: Business cycle statistics from selected models

data	Benchmark No RA	Benchmark RA	Arellano	Arellano RA			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Default Frequency	0.04	0.04	0.02	0.02	0.03	0.03	0.03
Trade Balance volatility	3.12	3.12	10.47	8.06	13.46	1.50	2.89
$Sd(C)/Sd(Y)$	1.10	1.10	1.21	1.18	1.29	1.10	1.22
Spread	10.25	2.59	5.80	6.42	10.18	3.58	10.40
Debt/gdp	35.00	29.62	20.10	19.55	22.89	5.95	5.95
Std (Y)	7.78	5.72	5.60	5.57	5.77	5.81	5.90
Std (C)	8.59	6.53	7.11	6.85	7.60	6.38	7.17
Std(Spread)	5.58	6.65	11.09	11.93	23.97	6.36	10.65
$corr(Y, C)$	0.98	0.97	0.92	0.93	0.91	0.97	0.91
$corr(Spread, Y)$	-0.88	-0.48	-0.39	-0.34	-0.37	-0.29	-0.22
$corr(Spread, C)$	-0.89	-0.62	-0.62	-0.56	-0.61	-0.36	-0.24
$corr(TB, Y)$	-0.64	-0.31	-0.18	-0.18	-0.18	-0.25	-0.15
Output Deviation default	-14.21	-12.55	-11.65	-10.83	-12.39	-8.13	-7.21
Cons. Deviation default	-16.01	-12.01	-11.24	-10.45	-11.61		
Average Gov. Duration	2.63	3.48	3.50	3.49	3.50		

Columns (2)-(4) of Table 4 show another important result. The absence of default cost as introduced in the Arellano model are not relevant for explaining large levels of debt to gdp. In calibration (2) we shut down output cost in default state ($\theta \rightarrow \infty$) and this has a negligible impact on simulated moments. In calibration (3) and (4) I have eliminated exclusion cost: when a default occurs exclusion from capital markets only lasts for one quarter. This is beneficial for the incumbent since the period where the probability of being re-elected drops down is shorter. As a result debt to gdp is lower than the benchmark, defaults occur more rarely, and spreads are larger. This shows that our results do not rely on standard default cost identified by previous contributions, which have proven to be not relevant in the empirical literature.

4.4 The Model with Risk Aversion

As pointed out by [Arellano \(2008\)](#) and [Arellano and Ramanarayanan \(2012\)](#), risk aversion is a necessary ingredient to match the behavior of spread. Without risk aversion, spread is tight to default frequency, for this reason is hard to explain what we see in the data, where default frequency is 3% and spread is 10.75%. Furthermore, in absence of risk aversion, in periods where probability of default is zero, the model would predict constant 0 spread. Furthermore [Borri and Verdelhan \(2011\)](#) show that average sovereign bond excess returns compensate investors for taking on aggregate risk and this new determinant of sovereign bond prices is relevant for pricing.

Column (5) of table 4 summarizes the results of the calibration of the benchmark model with risk aversion. In this specific case we used the following calibration strategy. We set ϵ , β and λ to match default frequency and the spread. As we can see, even in presence of risk aversion the model is able to match spread, default frequency and predict a large level of debt to gdp. The level of debt to gdp is lower than in the case of no risk aversion (Column (1)) because larger price of risk produces a large interest rate that reduces the incentive to accumulate debt. As in the benchmark model (1) trade balance is much more volatile than what we observe in the data (this is also a result in the Arellano model with risk aversion). Furthermore spread volatility is also high, as in Arellano model with risk aversion. This is explained by the “threshold” behavior of default probability, that increases when debt increases above specified thresholds. This is a

problem that is not specific to our model but is also present in standard quantitative default models. [Arellano and Ramanarayanan \(2012\)](#) introduce recovery rates in reduced form in order to match the quantitative behavior of spread. [Yue \(2010\)](#) shows that, in a model in which the debt recovery rate is endogenously determined by a bargaining process between lenders and a defaulting borrower, the recovery rate is decreasing and convex in debt. By introducing recovery rates, the transition from low to high default risk is slow, accounting for a much stable behavior of sovereign spreads.

[Arellano and Ramanarayanan \(2012\)](#) pointed out that the level of the spread is strongly influenced by the degree of risk aversion of the agent but the volatility of the spread is influenced by the time variation of default probability. This is also confirmed in our model. In our benchmark calibration, the risk neutral price has a standard deviation of 0.17; instead the standard deviation of the component of the price related to risk aversion is 0.06.

5 Conclusions

In this paper we presented a model of sovereign default where the government can face a political shock and be replaced by another agent in the economy. Political uncertainty is larger in times of default, for this reason the government is more reluctant to default compared to a setting where political frictions are not considered. Calibrating political parameters using election data and political surveys for Argentina, I show that the model can match the level of debt to gdp when investors are risk neutral, in contrast with the standard model of [Arellano \(2008\)](#). By introducing risk adverse investors, I am also able to jointly match the spreads and still predict fairly large levels of debt to gdp.

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