ESSAYS ON THE POLITICAL ECONOMY OF
SOVEREIGN DEBT AND DEFAULT

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ABSTRACT OF THE DISSERTATION

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Roberto Chang

This dissertation studies the relation between political factors (political instability, political fragmentation, policy gridlock and the political color of parties) and fiscal policy outcomes (tax rates, debt levels, default episodes). The second chapter studies the empirical aspects of the aforementioned relation. The third chapter studies how policy gridlock affects tax policy and sovereign default. The last chapter studies the relation between political instability and fragmentation and sovereign debt and default.

Some Empirical Evidence on the Political Economy of Sovereign Debt and Default

The most well-known political economy theory of debt accumulation is the common pool problem of debt (Weingast et al., 1981; Velasco, 2000). This theory has been tested for advanced economies, mainly in parliamentary systems, and there is empirical evidence that supports its conclusions. However, when data on political parties for emerging economies has been used, there is no support for the predictions of the theory (Stein et al., 1998; Elgie and McMenamin, 2008; Eslava and Nupia, 2010). This should not be surprising, because emerging markets are characterized by presidential systems, where the number of parties in the current government coalition does not play a crucial role in terms of the budget (the most common measure of political fragmentation).

In this chapter presents alternative measures for political instability and fragmentation. The effective number of the political parties in power (or in the executive) is the proxy
of political instability. The proxy for political fragmentation is the percentage of votes in Congress of all the parties that never were in power, or those parties that never belong to the government’s coalition at any point in time. The idea of these two measures is to see if over time a country has had a stable group of political parties that alternate in power, and how big the votes’ share of those parties was in Congress. In a bipartisan system there would be only two parties over time that enjoy most of the votes in Congress. However, this is not the case of many emerging markets. Using a sample of 35 emerging countries between 1975 and 2012, this chapter documents that a higher degree of political instability and fragmentation is associated with lower levels of borrowing and a higher probability of default.

Another result of the empirical analysis is that the political color of political parties is not a determinant of debt accumulation or default. Differently, the political color affects the tax rates observed in the data. In particular, left wing governments set higher tax rates than right wing parties. Muller, Storesletten, and Zilibotti (2016) finds that the same holds for advanced economies. Also, using an event study analysis around default crises, the data reveals that emerging countries do exert a fiscal adjustment in terms of the tax rates before a default episode.

**Policy Gridlock and Sovereign Default**

Tax policy gridlock is defined as a situation in which political parties fail to reach an agreement that changes the current *status quo* tax rate and borrowing level. For that reason, the policies implemented the previous period are not changed. Policy inaction in terms of tax policy and its effects over debt accumulation has been studied in early political economy models (Alesina and Drazen, 1991). In terms of the more recent literature of sovereign default, Arellano and Bai (2014) and Andreasen, Sandleris, and Van Der Ghote (2011) have focused on the *inability to raise taxes*. As it was mentioned in the abstract of the previous chapter, on average emerging countries do raise taxes before a default episode. In this chapter policymakers will raise taxes before a default event, but importantly, they will not be able to reduce borrowing levels. This is exactly what occurs in the data. Hence, a crucial aspect of policy gridlock highlighted in this chapter is the *inability to reduce*
The model shares the most relevant characteristics of the benchmark model of sovereign default (Eaton and Gersovitz, 1981; Aguiar and Gopinath, 2006; Arellano, 2008). Some differences are that the model contemplates a production economy, and households value the provision of public goods. The model is also different due to its political economy dimension: (i) there are two parties that alternate stochastically in power and that represents two types of households (high and low productivity), and, (ii) the party in power offers a ‘take-it-or-leave-it’ policy proposal (tax rate, borrowing levels) to the other party, requiring unanimity to approve the proposal. There is no change to the status quo tax rate or the status quo borrowing policy if the proposal is rejected. In particular, the party that accepts or rejects will contrast the dynamic payoff of the proposal with the payoff of a scenario that contemplates maintaining the status quo policy. The setup in (i) and (ii) corresponds to a dynamic bargaining game with endogenous status quo, as in Bowen, Chen, and Eraslan (2014) and Ma (2014).

The main result of the paper is that the inability to reduce borrowing levels plays a more important role than the inability to raise taxes in terms of default episodes. In an economy without policy gridlock, a default episode can be ruled out implementing a fiscal adjustment that considers raising taxes and reducing borrowing levels in absolute terms. However, the paper documents that reductions in the absolute level of debt are not observed in the data (same sample of 35 emerging economies used in the second chapter). The introduction of gridlock generates more default episodes, because even though policymakers can raise taxes before a crisis (as it is observed in the data), are not able to convince the other party to reduce borrowing. This implies that when economic conditions deteriorate, there is an increase in the burden of debt. In a non-gridlock economy, the default probability is 3.18%, while in the economy with the possibility of gridlock, the chances of default raise up to 4.24%.

Even though this is a model with heterogeneous agents, policy gridlock induces similar borrowing levels and default probabilities by party, as reported in the second chapter. Also, the model can replicate the probabilities associated with political defaults, or defaults that
occur simultaneously with government changes, as well as political defaults in which there is also a change in the political color of the new incumbent.

**SOVEREIGN DEFAULT, POLITICAL INSTABILITY & POLITICAL FRAGMENTATION**

The workhorse model of sovereign default (Eaton and Gersovitz, 1981; Aguiar and Gopinath, 2006; Arellano, 2008) shows that debt levels that can be sustained in equilibrium are extremely low when the observed probabilities of default are targeted (Mendoza, 2015; Claessens and Kose, 2014; Aguiar and Amador, 2013; Tomz and Wright, 2013). While the benchmark model has been extended in different dimensions (long-term bonds, positive recovery rates, convex cost of default) that yield higher debt ratios, none of these new features has tried to address the reasons for higher borrowing. This chapter provides a motivation for this based on two political features: fragmentation and instability.

The model has the following characteristics: (i) the economy receives a stochastic endowment and can borrow from abroad; (ii) policymakers take a decision to repay previous obligations or default; (iii) the costs for default are the exclusion from capital markets and an output loss; (iv) government bonds are traded in international capital markets and their price incorporates the possibility of future default; (v) a number of political parties stochastically alternate in power (political instability) and bargain over the budget (endowment and net borrowing); and, (vi) the policymaker forms a coalition of parties to get the necessary votes to approve the budget, leaving out of the coalition a number of other parties (political fragmentation). Features (v)-(vi) follow the bargaining approach developed in Battaglini and Coate (2007, 2008) and in these authors’ subsequent papers.

The intuition of the mechanism is as follows. Every time the policymaker wants to borrow an extra dollar from abroad, he will need to get the votes of the members of his coalition. This implies that the extra dollar will be divided between the policymaker and the other coalition parties. Also, zero resources from the extra dollar will be allocated to those excluded from the coalition, simply because their votes are not necessary. In this setup, more debt provides not only more consumption to the policymaker, but also increases his share of the total resources. This political incentive to borrow more will confront market discipline. There exists a borrowing level at which issuing more bonds
becomes counterproductive, because debt has become too high and risky. International markets will recognize this and the price of bonds will start falling, providing less resources to the country and diminishing the policymaker’s share. Therefore, there is a non-monotonic relationship between borrowing decisions and the proposer’s share.

This mechanism accounts for two opposite forces: the political channel that provides a higher share, and the endogenous borrowing constraint that hampers the distributional benefits. The novel interaction between these two forces differs from previous political economy models of sovereign default (Cuadra and Sapriza, 2008, Hatchondo et al., 2009, D’Erasmo, 2011). These papers focused on the two-party case, discount factors, and only allow for a fixed policymaker’s share of resources. If this share does not vary with borrowing decisions, there are no distributional incentives to borrow more. Importantly, because these distributional benefits only exist under access to capital markets, policymakers will find repayment more attractive. This will allow the model to sustain higher levels of debt in equilibrium.

Political instability also plays a crucial role in the model. In the next period, the party in power might lose office and not enjoy the distributional benefits of being the policymaker. This possibility makes policymakers endogenously short-sighted. This endogenous mechanism does not resemble most of the models in the literature of sovereign default, that impose low discount factors and justify this emphasizing political turnover (Aguiar and Amador, 2013). Intuitively, a lower discount factor is not equivalent to political instability. In the first case, even though there is a higher need to frontload consumption, for each dollar borrowed the central planner is fully internalizing the costs of repayment or default. For this reason, a reduction in the discount factor reduces bond prices, and the default region widens. Differently, political instability implies that the current policymaker is not fully internalizing these future costs because he might not be in power tomorrow. More importantly, bond prices do not fall and the default region is not expanded. This is because, when there is political instability and fragmentation, the future policymaker will always find it more attractive to repay due to the distributional benefits.

Numerical simulations indicate that for the typical calibration target of the probability
of default of 3%, a model that uses short-term bonds yields debt ratios around 20% of quarterly output. Shutting down the political mechanism reduces the chances of default and borrowing levels up to 0.1% and 7% respectively. The inclusion of long-term bonds permits to register debt ratios above 100% without severely distorting the simulated business cycle statistics. Shutting down the political mechanism in this long-term debt model yields a similar loss in terms of default probabilities and debt ratios.
Acknowledgements

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Chapter 1

Introduction

Political factors have typically played an important role in sovereign default episodes, like the experiences of Greece and Argentina illustrate. Issues as to why governments accumulate debt up to unsustainable levels or the consequences of policy gridlock in turbulent times are at the core of policy discussions. This dissertation focuses on the political economy aspects of fiscal policy in emerging markets.

The first chapter of the dissertation studies the empirical relation between political factors (political instability, political fragmentation, policy gridlock and the political color of parties) and fiscal policy outcomes (tax rates, debt levels, default episodes). The second chapter focuses on policy gridlock, defined as a situation in which political parties do not reach an agreement to change a status quo policy. This chapter focuses on how the political color of parties affects mainly tax policy, and how the inability to reduce borrowing plays a more important role than the inability to raise taxes in terms of debt crises. The third chapter of the dissertation develops a sovereign default model in which political parties bargain over the budget and there is an unequal distribution of resources. The paper shows how distributional incentives facilitates the repayment of obligations, expanding the repayment region and letting the baseline model of default to be able to sustain higher levels of borrowing in equilibrium.
Chapter 2
Some Empirical Evidence on the Political Economy of Sovereign Debt and Default

2.1 Introduction

This chapter gathers information about the characteristics of the political system, fiscal policy variables and default episodes. A panel for 35 emerging countries between 1975 and 2012 was used in the analysis. First, an event study analysis shows the evolution of different variables around default episodes. The focus is on the evolution of tax rates, an analysis not previously discussed on the literature. Second, a panel regression analysis reveals the correlation between a set of economic and political variables with the evolution of debt, taxes and default episodes. Here, the approach differs from previous political economy empirical studies in the way the political variables are constructed. In particular, alternative measures of the degree of political fragmentation and instability are used in the analysis.

2.2 The Data and Definitions

Information about the number, names and voting shares of political parties in the executive as in Congress comes from the World Bank’s Database of Political Institutions, originally formulated in Beck et al. (2001). Data on crises comes from Reinhart and Rogoff (2009). Information on total public debt comes from Abbas, Belhocine, ElGanainy, and Horton (2010). Public debt was collected by the authors at the general government level.\(^1\) Data on taxes comes from Vegh and Vuletin (2015). The rest of the economic variables have as sources the International Monetary Fund’s World Economic Outlook database and the World Bank’s World Development Indicators database.

\(^1\)The authors define that the general government consists of all government units and all nonmarket nonprofit institutions that are controlled and mainly financed by government units, comprising the central, state, and local governments. The general government sector does not include public corporations or quasi-corporations.
A group of 35 countries were considered in the estimations. Initially a sample of 47 emerging market countries used in Manasse and Roubini (2009) was analyzed. Countries in the final sample were selected if they present some degree of variability in terms of their political characteristics. From the 47 countries, the ones that never showed a change or registered only one political party in the executive were not considered. The final sample include: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cyprus, Czech Rep., Dom. Rep., Ecuador, Estonia, Guatemala, Hungary, India, Israel, Jamaica, Korea, Lithuania, Latvia, Mexico, Panama, Peru, Philippines, Poland, Paraguay, Romania, Russia, El Salvador, Thailand, Trinidad-Tobago, Turkey, Ukraine, Uruguay, Venezuela, S. Africa.

2.2.1 Construction of Political Indicators

As in the empirical literature of the relation between fiscal policy and political characteristics, the effective number of political parties - ENPP (Laakso and Taagepera, 1979) was used in the calculations. This measure is calculated as follows:

\[
ENPP = \frac{1}{\left( \sum_{i} n s_i^2 \right)}
\]

Where \( s_i \) is the share of time in the executive of the \( i \)th party and \( n \) is the actual number of parties in power for the period 1975-2012. Alternatively, \( s_i \) can be interpreted as the share of votes in an election. For example, for the second case, if in an election there are only two political parties and they obtain the same number of votes, 50% for the first party and 50% for the second, the ENPP is 2. Meanwhile, if the results of the election are 75% for the first party and 25% for the second, the ENPP is 1.6. Hence, this measure penalizes the nominal number of parties by the distribution of votes in the election, or by the time parties were in power.

The following definitions are used to construct the political economy indicators:

**Definition 1** Political Instability is calculated as the ENPP that were in the executive.

---

2These are the cases of Algeria, China, Kazakhstan, Malaysia, Morocco, Pakistan, Oman and Jordan. Also, countries that were classified as military during the whole or a very long period were also excluded from the final sample. In this group there are three countries, Indonesia (31 years under military rule), Egypt (always military) and Tunisia (with a military government between 1988 and 2011). One last country was not considered, Slovak Republic, due to the lack of information on political variables.
during the period of analysis.

This definition implies that the names of the political parties (Beck et al., 2001) were used to calculate the total number of years that each party were in power (for the weights $s_i$). Also, not all the countries have full information about the whole sample, and periods of military governments were excluded from the calculation.

Most of the empirical work has focused on the predictions of the early theoretical models of political instability (Alesina and Tabellini, 1990; Persson and Svensson, 1989), finding little support for them and using alternatives measures of political instability. For example, Lambertini (2003) test if the provision of public goods follows a political pattern, or if a lower probability of reelection is associated with higher deficits. The data used was opinion polls for the case of the US, and an index of the political affiliation of the party in power, measuring the movements in the government towards right or left, for the case of OECD countries. Franzese (1998) followed a similar approach, combining the standard deviation across time of a measure of the average left-right position of each government with the actual duration of the incumbent in years. More recently, Brender and Drazen (2009) using a panel of 71 countries for three decades, did not find evidence of changes in the composition of spending after a change in government.

**Definition 2** Political Fragmentation is calculated using the share of votes in Congress of those parties that were not in the executive nor in the government’s coalition at any point in time.

This indicator considers the percentage of votes in Congress of all the parties that at some point were in the executive or belong to the government coalition (and the definition itself would be one minus this percentage). For example, suppose that in a 20 years’ window there were 3 political parties in power, party A held office twice, parties’ B and C were in power only one time. The indicator would calculate the share of votes for these three parties in each year, regardless of which party were in power in a particular year. The fragmentation indicator would be equal to one minus the calculated share.

This definition differs from previous measures of fragmentation, that focus only on the size of the current government coalition, or the number of parties in existing coalition
given for a particular year (Perotti and Kontopoulos, 2000). Most of the existing empirical literature on fragmentation has focused on advanced economies. The typical relation studied is between fiscal outcomes (like debt or government expenditures) and the presence of many political parties in the ruling coalition for a given year, a relevant measure for fragmentation in models of the common pool problem of debt (Weingast et al., 1981; Velasco, 2000). While this relation holds for advanced economies, when the same exercise has been done for emerging economies, the relative size of the party in power (Stein et al., 1998) or the one from the ruling coalition does not explain government expenditures (Elgie and McMenamin, 2008; Eslava and Nupia, 2010). This result should not be surprising, because most advanced economies have Parliamentary systems, while the majority of developing countries fall under the category of Presidential regimes.

The proposed measure of fragmentation takes a more comprehensive approach. For example, in a bipartisan system, the proposed measure of fragmentation would indicate that there is no fragmentation, because basically there are two parties that share most of the votes in Congress every year. If fragmentation only considers the current government coalition, as in Perotti and Kontopoulos, and the share of the votes are relatively equal, the previously implemented indicator of fragmentation would provide a size of the coalition of one half. For this reason, the proposed measure of fragmentation can capture the fact that many political systems in emerging markets are not characterized by the presence of a stable group of political parties, like in a bipartisan system. This is important, because as emphasized by Tirole (2012), the bi-partisan nature of the political systems in Sweden, Germany, or Chile allowed these countries to benefit from the necessary political consensus related to budget discipline.

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3For a recent review of the literature on the political economy of fiscal deficits, see Eslava (2011).
4Elgie and McMenamin (2008) indicate that the common pool problem is observed in OECD countries because these are older and more institutionalized countries, while the same is not true for non OECD cases. Eslava and Nupia (2010) explained that it is necessary to consider a measure of polarization (ideology) to find a positive effect of the size of the ruling coalition.
5This complements the political instability indicator, that focus on the number of parties, while the fragmentation indicator focuses on the percentage of votes in Congress.
Table 2.1: Political and Economic Variables, 1975-2012 for 35 countries

<table>
<thead>
<tr>
<th>Country</th>
<th>ENPP Executive</th>
<th>% of Votes for the Coalition Parties</th>
<th>Debt/GDP</th>
<th># Default Episodes</th>
</tr>
</thead>
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<td>73.51</td>
<td>0.51</td>
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<tr>
<td>Bolivia</td>
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<td>69.15</td>
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<tr>
<td>Brazil</td>
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<tr>
<td>Chile</td>
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<td>85.22</td>
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<td>Costa Rica</td>
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<td>Israel</td>
<td>2.14</td>
<td>70.17</td>
<td>1.24</td>
<td>N.A.</td>
</tr>
<tr>
<td>Jamaica</td>
<td>1.82</td>
<td>99.34</td>
<td>1.03</td>
<td>4</td>
</tr>
<tr>
<td>Latvia</td>
<td>6.58</td>
<td>58.75</td>
<td>0.18</td>
<td>N.A.</td>
</tr>
<tr>
<td>Lithuania</td>
<td>1.98</td>
<td>76.19</td>
<td>0.21</td>
<td>N.A.</td>
</tr>
<tr>
<td>Mexico</td>
<td>1.76</td>
<td>75.68</td>
<td>0.45</td>
<td>1</td>
</tr>
<tr>
<td>Panama</td>
<td>2.48</td>
<td>79.2</td>
<td>0.69</td>
<td>1</td>
</tr>
<tr>
<td>Paraguay</td>
<td>1.5</td>
<td>76.92</td>
<td>0.29</td>
<td>2</td>
</tr>
<tr>
<td>Peru</td>
<td>3.7</td>
<td>56.27</td>
<td>0.39</td>
<td>4</td>
</tr>
<tr>
<td>Philippines</td>
<td>5.26</td>
<td>76.68</td>
<td>0.5</td>
<td>1</td>
</tr>
<tr>
<td>Poland</td>
<td>4.97</td>
<td>73.52</td>
<td>0.52</td>
<td>1</td>
</tr>
<tr>
<td>ROK</td>
<td>5.56</td>
<td>58.12</td>
<td>0.19</td>
<td>0</td>
</tr>
<tr>
<td>Romania</td>
<td>3.36</td>
<td>70.44</td>
<td>0.2</td>
<td>2</td>
</tr>
<tr>
<td>Russia</td>
<td>1.45</td>
<td>40.45</td>
<td>0.42</td>
<td>0</td>
</tr>
<tr>
<td>S. Africa</td>
<td>1.99</td>
<td>64.22</td>
<td>0.37</td>
<td>3</td>
</tr>
<tr>
<td>Thailand</td>
<td>4.61</td>
<td>72.38</td>
<td>0.35</td>
<td>0</td>
</tr>
<tr>
<td>Trinidad-Tobago</td>
<td>2.02</td>
<td>84.02</td>
<td>0.37</td>
<td>1</td>
</tr>
<tr>
<td>Turkey</td>
<td>4.8</td>
<td>61.31</td>
<td>0.39</td>
<td>2</td>
</tr>
<tr>
<td>Ukraine</td>
<td>2.88</td>
<td>52.46</td>
<td>0.31</td>
<td>1</td>
</tr>
<tr>
<td>Uruguay</td>
<td>3.27</td>
<td>74.44</td>
<td>0.55</td>
<td>4</td>
</tr>
<tr>
<td>Venezuela</td>
<td>2.53</td>
<td>83.68</td>
<td>0.4</td>
<td>4</td>
</tr>
</tbody>
</table>

2.2.2 Data Characteristics

Table 2.1 presents a summary of political and economic variables for the 35 emerging countries in the sample. The average ENPP in the executive for each country is presented in the first column. In the same way, the second column reports the average percentage of votes in Congress of all the parties that at some point were in the executive or belong to the government’s coalition. Finally, in terms of the economic variables, the average ratio of debt over output, and the total number of default episodes reported by Reinhart and Rogoff (2009) are presented.
Figure 2.1: Unconditional mean of variables around a debt crisis event (45 episodes)

2.3 Event Study Analysis

An event study analysis is presented in Figure 1. In particular, the observations by country for each variable are averaged over each year for a time window around a sovereign default episode. The analysis spans three years before and after the crisis. This simple analysis can be subject to critics, because it focuses only on periods around a crisis and do not differentiate between ‘crisis’ and ‘normal times’, or changes in the fundamentals of default. For a more elaborate analysis see Panizza, Sturzenegger, and Zettelmeyer (2009), Gourinchas and Obstfeld (2012), or Catao and Milesi-Ferreti (2013).

Figure 1 corroborates the results presented in different studies about sovereign crises. The pace of GDP growth start declining 3 years before the event and reaches its two lowest points one year before and during the crisis event. The current account shows a negative
evolution before the crisis and the improvement of this variable starts occurring two years before the event (as in for example Catao and Milesi-Ferreti (2013)), indicating a sudden stop episode. There is a depreciation of the local currency two years before the default episode, which shows an increase in the bilateral real exchange rate of more than 20 per cent. This jump in the real exchange rate is not surprising, because as Reinhart (2002) first reported, debt crises were typically preceded by currency crises.\footnote{This was the case in 84 per cent of Reinhart’s debt crises, using a sample of 59 countries for 1970-1999.}

Importantly, there is a sharp increase in the ratio of public debt over GDP before the crisis episode, and the ratio stabilizes after the crisis. On average, there is a 15 points increase in the ratio of debt to GDP for the window starting 3 years before default. In line with the deterioration of the debt ratios, the fiscal deficit worsens before the default episode and it is corrected from the crisis onwards. Government expenditures over GDP show a spike around the default event.

The novel results of the event study analysis correspond to the data on tax rates, which comes from Vegh and Vuletin (2015). In the case of the VAT and the Corporate Income Tax, the figures reveal that there is on average a fiscal effort that involves a raise between 1.5 to 2.5 points in the tax rates around a default episode. In the case of the Personal Income Tax rates, the fiscal effort it is typically implemented two years before the event and involves an average increase of more than 4 percentage points in the rate.

It should be noted that the lack of complete information for the tax rates around default episodes implies that the number of events studied is significantly lower than the one used for the other figures. Nevertheless, the analysis reveals that governments typically implement a fiscal effort in terms of raising tax rates before a debt crisis.

2.4 Panel Regressions

This section studies the relation between debt levels, tax rates, default events with a set of political and economic variables. The exercises do not try to address potential endogeneity issues. Because of this, results are interpreted as correlations.
Table 2.2 studies the relation between public debt and political factors. The sample is restricted to non-military regimes. Public debt is measured as a percentage of GDP and as percentage of exports. This last ratio is used following Câtăo and Kapur (2006).\textsuperscript{7} The ENPP in the executive was used as a proxy of political instability. This variable is called ‘\(n\)’, as in the last chapter of the dissertation. In terms of the coalition size, all the parties that at some point belong to the government coalition were considered, instead of the parties that every year effectively belong to the coalition. The votes of all the parties that at least in one year belong to the coalition were considered. The percentage of votes in Congress for this group is denoted by ‘\(\gamma\)’. A lower value of \(\gamma\) indicates more political fragmentation.

Other political characteristics are included as controls, like the political color of the party in power (or in the executive), the regime type (Presidential regime is equal to one and zero otherwise), if there is a proportional rule (taking a value of one if it is the case), a dummy for the year of elections and the number of seats in Congress. Focusing on the fiscal policy outcomes of constitutional rules, Persson and Tabellini (2004) showed that Presidential regimes induce smaller governments than Parliamentary regimes, while majoritarian elections lead to smaller governments than proportional elections. In the case of proportional elections, legislators are elected in large districts, which gives incentives to form coalitions and spend more. On the other hand, in the case of majority rule, the size of the minimal winning coalition (and consequently government expenditures) is smaller than under proportional representation.\textsuperscript{8} Finally, a set of economic variables is included as controls. The three variables are GDP growth, the real exchange rate (RER) growth and the terms of trade (ToT) growth.

In terms of the political variables, the results of Table 2.2 indicate that a higher number of political parties in the executive, the proxy of political instability, implies lower levels of debt. This can be rationalized as countries that show a higher degree of political instability, which translates into more myopic governments, are able to sustain lower levels of public debt. This result hold for five of the six specifications in the table, \textit{i.e.} after controlling

\textsuperscript{7}They mentioned that \textit{once debt is scaled by exports (D/X), rather than GDP, the correlation between default events and debt burdens tightens considerably, although some important outliers remain.}

\textsuperscript{8}In the case of the majority rule, a party can win with 25 per cent of the votes: 50 per cent in 50 per cent of the districts. Under full proportional representation, a 50 per cent of the national vote is required.
for other political and economic variables, as well as time effects. An important caveat of the analysis is that the specifications do not control for time-invariant heterogeneity, since the indicator of political instability by country is constant over time. The interaction of \( n \) and \( \gamma \), or once we interact with the percentage of votes of those parties that belong to the government coalition, shows a positive and significant sign. This indicates that a lower level of fragmentation (higher \( \gamma \)) enables the country to sustain more debt. As it will be shown later, these are the predictions of the model develop in the last chapter of the dissertation.

Table 2.2: Panel Regression, 1975-2012 for 35 Emerging Countries: Debt Accumulation

<table>
<thead>
<tr>
<th>Dependent variable: Debt/GDP Growth</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>( \Delta b/y_t \equiv b/y_t - b/y_{t-1} )</td>
<td>( b/y_{t-1} ) [or ( b/X_{t-1} )]</td>
<td>( n )</td>
</tr>
<tr>
<td></td>
<td>-5.5340***</td>
<td>-0.8118**</td>
</tr>
<tr>
<td></td>
<td>-5.5978***</td>
<td>-0.4815*</td>
</tr>
<tr>
<td></td>
<td>-6.0649***</td>
<td>-0.2988</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.012</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.1640</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dependent variable: Debt/Exports Growth</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>( \Delta b/X_t \equiv b/X_t - b/X_{t-1} )</td>
<td>( b/X_{t-1} )</td>
<td>( n )</td>
</tr>
<tr>
<td></td>
<td>-0.0480***</td>
<td>-0.0743***</td>
</tr>
<tr>
<td></td>
<td>-0.0523***</td>
<td>-0.0578**</td>
</tr>
<tr>
<td></td>
<td>-0.0525**</td>
<td>0.0025</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.012</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.1640</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.000</td>
</tr>
</tbody>
</table>

Notes: The constant is not reported. RER denotes Real Exchange Rate, ToT denotes Terms of Trade, \( b/y_{t-1} \) denotes Debt over GDP, and \( b/X_{t-1} \) denotes Debt over Exports. Robust standard errors are reported in parentheses. *** Significant at 1%. ** Significant at 5%. * Significant at 10%.

Interestingly, the political color of political parties in emerging countries do not affect
debt outcomes. This result contrasts with the findings of Muller, Storesletten, and Zilibotti (2016), that found that in advanced economies left wing governments are normally associated with a fall in debt. Presidential regimes are associated with a lower debt accumulation, which is consistent with the findings of Table 2.4, that indicates that this type of regime also increases the chances of default. Other relevant variables in the estimation are GDP growth, with the expected negative sign, and the lagged debt over output (or exports) ratio, which indicates that debt is mean reverting (Bohn, 1998).

Table 2.3: Panel Regression, 1975-2012 for 35 Emerging Countries: Change in Tax Rates

<table>
<thead>
<tr>
<th>Dependent variable:</th>
<th>CHANGE IN THE TAX RATE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\Delta \tau^{VAT}$</td>
</tr>
<tr>
<td>$n$</td>
<td>0.1246</td>
</tr>
<tr>
<td></td>
<td>[0.465]</td>
</tr>
<tr>
<td>$n^\gamma$</td>
<td>0.0041</td>
</tr>
<tr>
<td></td>
<td>[0.005]</td>
</tr>
<tr>
<td>Center</td>
<td>-0.8338</td>
</tr>
<tr>
<td></td>
<td>[1.020]</td>
</tr>
<tr>
<td>Left</td>
<td>0.4744</td>
</tr>
<tr>
<td></td>
<td>[0.897]</td>
</tr>
<tr>
<td>Presidential</td>
<td>0.2619</td>
</tr>
<tr>
<td></td>
<td>[0.929]</td>
</tr>
<tr>
<td>Proportional</td>
<td>0.0938</td>
</tr>
<tr>
<td></td>
<td>[0.098]</td>
</tr>
<tr>
<td>Elections</td>
<td>-0.6386</td>
</tr>
<tr>
<td></td>
<td>[1.007]</td>
</tr>
<tr>
<td>Congress Size</td>
<td>-0.1607</td>
</tr>
<tr>
<td></td>
<td>[0.182]</td>
</tr>
<tr>
<td>GDP Growth</td>
<td>-0.4877***</td>
</tr>
<tr>
<td></td>
<td>[0.209]</td>
</tr>
<tr>
<td>RER Change</td>
<td>0.6547</td>
</tr>
<tr>
<td></td>
<td>[2.837]</td>
</tr>
<tr>
<td>ToT Growth</td>
<td>3.0179</td>
</tr>
<tr>
<td></td>
<td>[4.311]</td>
</tr>
</tbody>
</table>

Observations 481
Countries 24
$R$-squared 0.208
Time Effects Yes

Notes: The constant is not reported. RER denotes Real Exchange Rate, ToT denotes Terms of Trade, $\Delta \tau^{VAT} \equiv \tau^{VAT}_t - \tau^{VAT}_{t-1}$ denotes the change in the VAT rate, $\Delta \tau^{Corp} \equiv \tau^{Corp}_t - \tau^{Corp}_{t-1}$ denotes the change in the Corporate Income Tax rate, and $\Delta \tau^{Pers} \equiv \tau^{Pers}_t - \tau^{Pers}_{t-1}$ denotes the change in the Personal Income Tax rate. Robust standard errors are reported in parentheses. *** Significant at 1%. ** Significant at 5%. * Significant at 10%.
Table 2.3 replicates the exercise of Table 2.2, but now the focus of analysis is the change in tax rates. Now, the political color affects the changes in taxes for the case of the Personal Income Tax rate. The result is the same as the one for advanced economies, center and left wing governments seems to set higher tax rates (Muller et al., 2016). Another important aspect of the analysis is that tax rates are procyclical for the sample, as reported by Vegh and Vuletin (2015).

Table 2.4: Panel Regression, 1975-2012 for 35 Emerging Countries: Default Episodes

<table>
<thead>
<tr>
<th></th>
<th>[1]</th>
<th>[2]</th>
<th>[3]</th>
<th></th>
<th>[1]</th>
<th>[2]</th>
<th>[3]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Debt_{t-1}</td>
<td>2.5828***</td>
<td>3.3684***</td>
<td>4.0502***</td>
<td></td>
<td>0.1081</td>
<td>0.1957**</td>
<td>0.3189***</td>
</tr>
<tr>
<td></td>
<td>[0.495]</td>
<td>[0.777]</td>
<td>[0.850]</td>
<td></td>
<td>[0.068]</td>
<td>[0.081]</td>
<td>[0.102]</td>
</tr>
<tr>
<td>Debt_{t-1},n_{t-1}</td>
<td>0.1557</td>
<td>0.8675***</td>
<td>0.8618***</td>
<td></td>
<td>-0.0282</td>
<td>0.0681</td>
<td>0.0708</td>
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<tr>
<td></td>
<td>[0.189]</td>
<td>[0.257]</td>
<td>[0.308]</td>
<td></td>
<td>[0.039]</td>
<td>[0.041]</td>
<td>[0.049]</td>
</tr>
<tr>
<td>Debt_{t-1},n_{t-1},γ_{t-1}</td>
<td>0.0013</td>
<td>-0.0112***</td>
<td>-0.0139***</td>
<td></td>
<td>0.0014**</td>
<td>-0.0003</td>
<td>-0.0007</td>
</tr>
<tr>
<td></td>
<td>[0.003]</td>
<td>[0.004]</td>
<td>[0.005]</td>
<td></td>
<td>[0.001]</td>
<td>[0.001]</td>
<td>[0.001]</td>
</tr>
<tr>
<td>Left_{t-1}</td>
<td>-0.1092</td>
<td>-0.0818</td>
<td></td>
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<td>0.0584</td>
<td>0.0277</td>
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</tr>
<tr>
<td></td>
<td>[0.249]</td>
<td>[0.259]</td>
<td></td>
<td></td>
<td>[0.239]</td>
<td>[0.261]</td>
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<tr>
<td>Center_{t-1}</td>
<td>-0.2567</td>
<td>-0.9478*</td>
<td></td>
<td></td>
<td>-0.2907</td>
<td>-0.8863*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.473]</td>
<td>[0.543]</td>
<td></td>
<td></td>
<td>[0.427]</td>
<td>[0.513]</td>
<td></td>
</tr>
<tr>
<td>Presidential_{t-1}</td>
<td>2.3586***</td>
<td></td>
<td></td>
<td></td>
<td>2.1207***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.377]</td>
<td></td>
<td></td>
<td></td>
<td>[0.372]</td>
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<td></td>
</tr>
<tr>
<td>Proportional_{t-1}</td>
<td>0.5253</td>
<td>-0.5874</td>
<td></td>
<td></td>
<td>0.2317</td>
<td>-0.9024**</td>
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<tr>
<td></td>
<td>[0.362]</td>
<td>[0.399]</td>
<td></td>
<td></td>
<td>[0.287]</td>
<td>[0.376]</td>
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<tr>
<td>Elections_{t-1}</td>
<td>-0.3198</td>
<td>-0.3264</td>
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<td></td>
<td>-0.3141</td>
<td>-0.3302</td>
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<tr>
<td></td>
<td>[0.272]</td>
<td>[0.316]</td>
<td></td>
<td></td>
<td>[0.272]</td>
<td>[0.318]</td>
<td></td>
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<tr>
<td>Congress Size_{t-1}</td>
<td>-0.1779**</td>
<td>-0.0649</td>
<td></td>
<td></td>
<td>-0.3864***</td>
<td>-0.2836***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.081]</td>
<td>[0.094]</td>
<td></td>
<td></td>
<td>[0.083]</td>
<td>[0.099]</td>
<td></td>
</tr>
<tr>
<td>GDP Growth_{t-1}</td>
<td>-0.0890***</td>
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<td></td>
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<td>-0.1201***</td>
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<tr>
<td></td>
<td>[0.032]</td>
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<td></td>
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<tr>
<td>RER Change_{t-1}</td>
<td>0.178</td>
<td>-0.202</td>
<td></td>
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<td>0.3107</td>
<td>-0.355</td>
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<td>[0.202]</td>
<td>[0.265]</td>
<td></td>
<td></td>
<td>[0.261]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ToT Growth_{t-1}</td>
<td>-0.3091</td>
<td>-0.2952</td>
<td></td>
<td></td>
<td>-0.0992</td>
<td>-0.0992</td>
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<tr>
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<td></td>
<td>[0.261]</td>
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<td></td>
</tr>
</tbody>
</table>

Observations: 830 699 685 830 699 685
R-squared: 0.147 0.356 0.433 0.139 0.331 0.409
Time effects: No Yes Yes No Yes Yes

Table 2.4 reports the results of a logit specification. A dummy variable taking the

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Although Muller, Storesletten, and Zilibotti (2016) use tax revenues instead of tax rates.
value of one for the years in which the country was in default is explained by the same set of regressors. All the explanatory variables were included with a lag of one year. Also, including independently $n$ and $\gamma$ in the estimations yield non significant results. When the political variables where interacted with debt levels, it is found that the number of political parties in the executive is relevant. An increase in $n$ is associated with a higher chance of default (Table 2.4), and with less debt accumulation (as reported in Table 2.2). The results are significant when the ratio of debt over output is used. Once debt is interacted with $n$ and $\gamma$, the share of votes for the political parties in the government coalition turns out to reduce the chances of default. This is consistent with the results of Table 2.2, a lower level of fragmentation (higher $\gamma$) is associated with more debt and less default. These results are consistent with the model develop in the last chapter of the dissertation.

The political color does not seem to affect the chances of default. The results in the table are only significant at the 10% level for the models (3) and (3') and correspond exclusively to the center wing governments. Importantly, left governments do not default more frequently than right wing governments. This is relevant because in the default literature the heterogeneity of parties has been seem as an important determinant of default episodes. For example, Hatchondo, Martinez, and Sapriza (2009) develop a model in which impatient governments default more frequently than patient ones. D’Erasmo (2011) follows the same approach. The results of Tables 2.2 and 2.4 indicate that the political color of governments is not a variable that systematically affect the government’s default decision, nor debt accumulation. However, Table 3 indicates that political heterogeneity is relevant in explaining the different behavior of tax rates. This result is incorporated in the following chapter of the dissertation.

2.5 Conclusions

This chapter studies the empirical relation between fiscal political variables and political variables for emerging economies. A sample of 35 countries between 1975 and 2012 is used. The previous empirical literature indicates that theories of the common pool problem of debt (Weingast et al., 1981; Velasco, 2000) are backed by the data only for the case of
advanced economies, not for emerging countries. In this chapter new measures of political instability and fragmentation, consistent with the last chapter of the dissertation, are used. In particular, the effective number of the political parties in the executive is the proxy of political instability. The indicator for political fragmentation is the percentage of votes in Congress of all the parties that never were in power, or those parties that never belong to the government’s coalition. The results of the empirical analysis indicate that more fragmentation and instability are associated with less debt and a higher frequency of default. This is consistent with the remarks of Tirole (2012), that indicates that fiscal discipline is typically observed in political systems that are more stable and show a higher degree of cohesion.

While political fragmentation and instability affect debt levels and the country’s probability of default, the political color of governments (left or right wing) is not associated with these two fiscal outcomes. This result contradicts the spirit of previous political economy papers of default (Hatchondo et al., 2009; D’Erasmo, 2011), that highlight that the political nature of parties can generate different paths of default by party. Even though debt or default might not be affected by the party’s political orientation, there is evidence (for the case of the Individual Income Tax rate) that indicates that left wing governments set higher tax rates. This result not only holds for the sample of 35 emerging countries, but recent work by Muller, Storesletten, and Zilibotti (2016) points out that the same holds for advanced economies. The heterogeneity of taxes by political orientation is the basis for the development of the following chapter of the dissertation.
Chapter 3

Policy Gridlock and Sovereign Default

3.1 Introduction

It is not always possible to implement the desired policies. Policy gridlock arise when different views about an optimal plan block an agreement between political parties, such that the *status quo* policy remains.\(^1\) This paper studies sovereign borrowing, default and taxation in a two party economy, were a unanimous agreement is need to modify the tax and borrowing policies implemented in the previous period, or the *status quo* tax rate and the *status quo* level of borrowing.

Policy inaction in terms of tax policy and its effects over debt accumulation have been studied in early political economy models (Alesina and Drazen, 1991). These models abstracted from sovereign default. More recently, the policy relevance of analyzing the effects of policy gridlock has been indirectly recognized in the sovereign default literature, particularly in the article of Arellano and Bai (2014) about fiscal austerity and by the work of Andreasen, Sandleris, and Van Der Ghote (2011) on the political economy of default. The first paper *focus on how the rigidity of labor taxes can induce default because of the government’s inability to raise enough revenue*. To capture the rigidity, the authors considered the tax rate as a parameter of the calibration and not as a government’s choice variable. Based on the same motivation, the second article introduces a constraint that only looks at one side of the problem, the impossibility of raising taxes, and the analysis has no relation with the *status quo* tax rate.

This paper develops a sovereign default model of fiscal policy, following the work of

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\(^1\) Policy gridlock has been part of the discussion of financial crises. First, it is always possible to elaborate counterfactuals scenarios of how things would have been different if politics were not so messy and the optimal policies would have been approved. For the crisis of 2001 in Argentina, Powell (2002) and Haussman and Velasco (2002) present arguments in favor and against the role of political gridlock in generating the crisis, respectively. Second, scenarios can be constructed to guess if default episodes would have been avoided under a different policy. Arellano and Bai (2014) undertake this analysis for the recent Greek default episode, finding that more austerity would have not change the crisis event.
Cuadra, Sanchez, and Sapriza (2010), Arellano and Bai (2014) and Hatchondo, Martinez, and Roch (2015). The crucial departure from these articles is the policymaking process. In the model, there are two parties that alternate stochastically in power and that represents two types of households, which differ on their productivity levels. Because of this heterogeneity, the policy functions are going to be specific to the party, as in Hatchondo, Martinez, and Sapriza (2009) and D’Erasmo (2011).

The party in power offers a ‘take-it-or-leave-it’ policy proposal (taxes and borrowing) to the other party, requiring unanimity to approve the proposal. If the proposal is rejected, the status quo is not changed, or the tax rate and borrowing choices of the previous period are implemented. In particular, the party that accepts or rejects compares the dynamic payoff of the proposal with the payoff of a scenario that contemplates maintaining the status quo tax rate and borrowing policies. This framework corresponds to a dynamic bargaining game with endogenous status quo, as in Bowen, Chen, and Eraslan (2014) and Ma (2014). These papers studied fiscal policy in an environment without debt and default.

As expected, policy gridlock generates a reduction in the probability of a change in the tax rate. The logic of tax policy gridlock follows the case presented in Ma (2014). When the status quo tax rate is too high (too low), both parties can easily agree on reducing (increasing) the tax rate. However, when the status quo tax rate is between the two ideal tax rates (for the high productivity and low productivity parties), one party would prefer to increase the tax rate from the status quo, while the other would prefer to reduce the rate. When opposite views about tax policy arise, the status quo tax rate is implemented.

Even though the borrowing policies chosen by the two parties do not differ in most of the cases, the policy functions show that there is a region where gridlock also arises. In particular, debt policy gridlock is a crucial aspect of the paper and explains the different economies’ behaviour under no gridlock and gridlock. When economic conditions deteriorate, in the economy without the possibility of gridlock, a default episode can be avoided implementing a fiscal adjustment that considers an increase in taxes and a reduction in the absolute level of borrowing of the economy. Differently, there is a significant proportion of default episodes (73%) in the economy with policy gridlock where default occurs and cannot
be avoided (in the no gridlock economy for the same shock realization there is no default), because the fiscal adjustment allowed by the party which is not in power only considers an increase in the tax rate (and not a reduction of borrowing in absolute terms).

The previous discussion points out that it is the inability to reduce borrowing levels, more than the inability to raise taxes, what explains a large number of default episodes. Effectively, the paper documents that for a sample of 35 emerging economies during 1975-2012, fiscal adjustments in terms of raising the tax rates do occur before a default episode. This is an indication that the inability to raise taxes is not necessarily present on the average default episode. Also, the data indicates that fiscal adjustments in terms of reducing the absolute level of borrowing are not present in the data (the opposite occurs). This fact points out that the inability to reducing borrowing induced by policy gridlock has empirical support and can constitute a more important element than the one previously emphasized by the literature (Andreasen et al., 2011; Arellano and Bai, 2014).

Other results that are consistent with the empirical evidence is that the model, even though has heterogeneous parties, present similar borrowing levels and default probabilities by party. The data points out that differences in the political color of parties can generate differences in terms of the tax rates, a feature that characterizes this model. Also, the model can replicate the probabilities associated with political defaults, or defaults that occur simultaneously with government changes, as well as political defaults in which there is also a change in the political color of the new incumbent.

### 3.2 The Model

The model follows a similar structure of previous fiscal policy models that contemplates the possibility of default (Cuadra et al., 2010; Arellano and Bai, 2014; Hatchondo et al., 2015). Differently from these papers, the model allows for two different types of policymakers. The previous papers of sovereign default that builds on two different constituencies are Hatchondo, Martinez, and Sapriza (2009) and D’Erasmo (2011). Finally, the model incorporates the dynamic bargaining approach with endogenous status quo presented in Bowen, Chen, and Eraslan (2014) and Ma (2014).
3.2.1 Households

The economy is populated by two types of infinitely lived households. The types differ in their productivity levels $z_j$, and $j$ denotes the type. Two political parties will represent these different constituencies, as described later. Regarding the types, $j \in \{L, H\}$ and $z_j \in \{z_L, z_H\}$, where $z_H > z_L$. Each type of household $j$ has the same preferences, as follows

$$E_0 \sum_{t=0}^{\infty} \beta^t u(c_{jt}, l_{jt}, g_t)$$

Where $c_j$ and $l_j$ are consumption and leisure for type $j$ (the notation for time is omitted from here onwards). Let $g$ be the level of the public good provided by the government. The utility function is concave, strictly increasing and twice differentiable. Denote by $\beta \in (0, 1)$ the discount factor. The production of each type $y_j$ follows the standard production function $y_j = \phi^h(\varepsilon z_j) f(l_j)$. Denote by $\phi^h(\varepsilon z_j)$ the effective productivity, which depends on an aggregate productivity shock $\varepsilon$ and on the type specific productivity $z_j$. As in any model of sovereign default, in the event of a bad credit status, a lower level of the effective productivity is imposed. The function $\phi^h$ will depend on the credit status $h$. In particular, $h = B$ if the government default in this period or if it is in autarky. Differently, $h = G$ in the event that the government repaid and have access to capital markets.

The budget constraint for type $j$ is given by

$$c_j = (1 - \tau) \phi^h(\varepsilon z_j) f(l_j)$$

The government taxes production with the rate $\tau$ in order to finance public spending.$^2$

Taxes are not the only source of income for the government, because it can issue bonds in international capital markets. Each type $j$ will take as given taxes and government expenditures, and will behave optimally according to

$^2$Since it is going to be assumed that $f$ is linear, as in most papers of fiscal policy and sovereign default, the tax can also be interpreted as a labor tax.
\[
- \frac{u_l(c_j, l_j, g)}{u_c(c_j, l_j, g)} = (1 - \tau) \phi^h(\varepsilon z_j) f_l(l_j)
\]  

3.2.2 The Government Problem: No Gridlock Case

This section describes the problem for a party \( j \) that it is in power and can implement his desired policy. In particular, different from the following section, there is no need for the consensus of the opposition party to approve the tax rate. This formulation will be used as a benchmark to evaluate the effects of policy gridlock.

Once in power, party \( j \) will care about the well-being of both constituencies, but will put more weight on the utility of its own constituency. In particular, the periodic utility for party \( j \) is given by

\[
U_j(c_j, l_j, c_{-j}, l_{-j}, g) = \alpha_j u(c_j, l_j, g) + (1 - \alpha_j) u(c_{-j}, l_{-j}, g)
\]  

Denote by \( \alpha_j \) the weight that party \( j \) gives to its own constituency. To generate the bias in terms of weights the parameter is restricted to be in the following range \( 0.5 < \alpha_j < 1 \).

Regarding the timing of the problem, if the country has access to capital markets it is assumed that the party in power \( j \) will first take the repayment/default decision. If the government repays \( (h = G) \) and given the optimal behavior and constraints of the private sector ((3.1) and (3.2)), the party in power will choose the level of net assets \( a'_j \), the provision of the public good \( g_{jh} \) and the tax rate \( \tau_{jh} \). Note that if the country do not have access to capital markets \( (h = B) \), then the choice variables are restricted to the level of the public good and taxes. Also, denote by \( a \) the level of net assets chosen the previous period. The level of net assets corresponds to the number of one-period non-contingent bonds that promise to repay one unit of consumption the following period. At the end of the period, the policymaker leaves power with probability \( \pi \) and stays in office with probability \( 1 - \pi \).

The value function for party \( j \) corresponds to
$$V_j(a, \varepsilon) = \max \langle V_j^B(\varepsilon), V_j^G(a, \varepsilon) \rangle$$ \hspace{1cm} (3.4)$$

The same default/repayment decision can be described as follows

$$d_j(a, \varepsilon) = \begin{cases} 
1 & \text{if } V_j^B(\varepsilon) > V_j^G(a, \varepsilon) \\
0 & \text{if } V_j^B(\varepsilon) \leq V_j^G(a, \varepsilon) 
\end{cases}$$ \hspace{1cm} (3.5)$$

If party $j$ decides to default, the value of this scenario for this party is given by

$$V_j^B(\varepsilon) = \max_{\tau_jB} \langle U_j(c_j, l_j, c_{-j}, l_{-j}, g_j(\tau_jB)) \rangle$$
$$+ \beta \left[ \pi \left( \lambda EW_j(0, \varepsilon') + (1 - \lambda) EW_j^B(\varepsilon') \right) + (1 - \pi) \left( \lambda EV_j(0, \varepsilon') + (1 - \lambda) EV_j^B(\varepsilon') \right) \right]$$
$$\text{s.t.}$$
$$g(\tau_{jB}) = \tau_{jB} \left[ \phi^B(\varepsilon z_j) f(l_j) + \phi^B(\varepsilon z_{-j}) f(l_{-j}) \right]$$ \hspace{1cm} (3.7)$$

And constraints (3.1) and (3.2).

The problem above indicates that party $j$ accounts for the possibility of losing office next period. In particular, with probability $\pi$, party $j$ leaves power and $W_j$ denotes the value function of the same party at the beginning of the next period when it is not in office (see the continuation value of the objective (3.6)). $W_j$ is described later but it should be noted that it will consider the policy decisions that party $-j$ might implement in the future. Because the policy functions of party $-j$ do not need to coincide with the ones from party $j$, then the value functions $W_j$ and $V_j$ are not necessarily equal. Also, note that in autarky there is a probability $\lambda$ of regaining access to capital markets with zero assets.

Equation (3.7) is the budget constraint of the government under no access to capital markets, i.e. government expenditures are financed only with taxes.

If party $j$ decides to repay, the value of this scenario and for this party is given by

$$V_j^G(a, \varepsilon) = \max_{a_j, \tau_{jG}} \langle U_j(c_j, l_j, c_{-j}, l_{-j}, g_{jG}(a_j', \tau_{jG})) \rangle$$ \hspace{1cm} (3.8)$$
\[ + \beta [\pi EW_j (a'j, \epsilon') + (1 - \pi) EV_j (a'j, \epsilon')] \] 

s.t.

\[ g_{jG} (a'j, \tau_{jG}) = \tau_{jG} [\phi^G (\varepsilon z_j) f(l_j) + \phi^G (\varepsilon z_{-j}) f(l_{-j})] + a - q_{jG} (a'j, \varepsilon) a'j \]  

(3.9)

And constraints (3.1) and (3.2).

Now the government’s budget constraint (3.9) contemplates bonds as a source of financing.

To complete the description of the government’s problem, the value of party \( j \) when it is not in power and party \(-j\) default is given by (3.10). In this scenario, the tax decision of party \(-j\) is denoted by \( \tau_{-jB} \). The value of party \( j \) when it is not in power and party \(-j\) repay is given by (3.11). After repayment, the decisions of party \(-j\) under access to capital markets are denoted by \( a'_{-j} \) and \( \tau_{-jG} \).

\[ W_j (a, \epsilon) = U_j (c_j, l_j, c_{-j}, l_{-j}, g (\tau_{-jB})) \]  

\[ + \beta \left[ \pi \left( \lambda EV_j (0, \epsilon') + (1 - \lambda) EV^B_j (\epsilon') \right) + (1 - \pi) \left( \lambda EW_j (0, \epsilon') + (1 - \lambda) EW^B_j (\epsilon') \right) \right] \]  

(3.10)

\[ W_j (a, \epsilon) = U_j (c_j, l_j, c_{-j}, l_{-j}, g (a'_{-j}, \tau_{-jG})) \]  

\[ + \beta [\pi EW_j (a'_{-j}, \epsilon') + (1 - \pi) EW_j (a'_{-j}, \epsilon')] \]  

(3.11)

### 3.2.3 The Government Problem: Policy Gridlock

Under the political scenario presented below, the political party in power will make a tax policy proposal in order to change the status quo tax rate, which is the rate implemented in the previous period. It is assumed that a unanimous agreement is needed to change policy. Also, following Andreasen, Sandleris, and Van Der Ghote (2011), it is assumed that policy gridlock can arise only under access to capital markets.

As in previous quantitative models of sovereign default and in previous papers that consider dynamic bargaining with endogenous status quo (Bowen et al., 2014; Ma, 2014),
the focus of the analysis is on Markov Perfect Equilibria. As before, it is assumed that
the default decision is taken by the party in power $j$. Only if the country has access to
capital markets, the party in power makes a policy proposal to party $-j$. For that reason,
a proposal strategy for party $j$ considers borrowing levels and the tax rate, given the states.
Also, party $j$ has an acceptance strategy, which will depend on the states and the proposal
strategy of party $-j$. Parties will accept or reject comparing the dynamic payoff of the
proposal with the dynamic payoff of an scenario that contemplates maintaining the status
quo tax rate (the tax rate implemented the previous period) and the previous level of
borrowing.

In Bowen, Chen, and Eraslan (2014) there is a function that maps the policy choices of
period $t$ to the status quo in period $t + 1$. The problem in Bowen, Chen, and Eraslan (2014)
is how to allocate each period one dollar between mandatory and discretionary programs.
In this case, it is natural to assume that if today there is a certain level of government
expenditures in mandatory programs, the function indicates that next period’s mandatory
spending status quo is exactly what it is executed today. Also, the authors assume that no
matter what is the current level of discretionary spending, the function indicates that next
period’s status quo level of discretionary spending is equal to zero. In this way, a party that
has to accept or reject a proposal, is confronting the proposal with the utility level derived
uniquely from mandatory spending.

In this paper, it is assumed that today’s status quo tax rate is the rate implemented in
the previous period, and that today’s status quo level of borrowing is exactly the one imple-
mented in the previous period. It would not be natural to assume that the outside option
of party $-j$, under access to capital markets, contemplate the repayment of previous debt
but not the possibility of issuing new debt (or imposing an status quo of zero borrowing).
Including the previous level of bonds issued in the outside option ensures party $-j$ a level
of utility that is close to the one registered one period behind.\(^3\) Importantly, the focus of
the analysis, as in Bowen, Chen, and Eraslan (2014) and Ma (2014), is on equilibria were

\(^3\)Note that in the previous period, the level of borrowing was not necessarily the same as the level of
obligations, and even if they were the same, the price of the bonds for the current period can vary with
respect to the one registered one period behind.
the proposal is always accepted.

Considering this, the problem is reformulated in the following way. The value for a party $j$, which is in power, is given by

$$V_j(a, \varepsilon, \tau_{sq}) = \max \langle V^B_j(\varepsilon), V^G_j(a, \varepsilon, \tau_{sq}) \rangle$$  \hspace{1cm} (3.12)$$

The formulation is almost the same as in the no policy gridlock case (3.4), but the status quo tax rate $\tau_{sq}$ is now a state variable. In terms of the indicator function for default, $d_j(a, \varepsilon, \tau_{sq})$ is equal to 1 if $V^B_j(\varepsilon) > V^G_j(a, \varepsilon, \tau_{sq})$ and 0 otherwise.

In the event of default, the value for party $j$ is given by

$$V^B_j(\varepsilon) = \max \langle U_j(c_j, l_j, c_{-j}, l_{-j}, g(\tau_{jB})) \rangle$$  \hspace{1cm} (3.13)$$

$$+ \beta \left[ \pi \left( \lambda EW_j(0, \varepsilon', \tau_{jB}) + (1 - \lambda) EW^B_j(\varepsilon') \right) + (1 - \pi) \left( \lambda EV_j(0, \varepsilon', \tau_{jB}) + (1 - \lambda) EV^B_j(\varepsilon') \right) \right]$$

s.t.

$$g(\tau_{jB}) = \tau_{jB} \left[ \phi^B(\varepsilon z_j) f(l_j) + \phi^B(\varepsilon z_{-j}) f(l_{-j}) \right]$$  \hspace{1cm} (3.14)$$

And constraints (3.1) and (3.2).

Equation (3.14) is the government’s budget under default, as in the no gridlock problem. As before, the policy space is reduced to the tax rate in the event of default.

In the event of repayment, the value for party $j$ is given by

$$V^G_j(a, \varepsilon, \tau_{sq}) = \max \langle U_j(c_j, l_j, c_{-j}, l_{-j}, g_{jG}(a', \tau_{jG})) \rangle$$  \hspace{1cm} (3.15)$$

$$+ \beta \left[ \pi EW_j(a'_{j}, \varepsilon', \tau_{jG}) + (1 - \pi) EV_j(a'_{j}, \varepsilon', \tau_{jG}) \right]$$
\[ g_{jG} (a', \tau_{jG}) = \tau_{jG} \left[ \phi^G (\varepsilon z_j) f (l_j) + \phi^G (\varepsilon z_{-j}) f (l_{-j}) \right] + a - q_{jG} (a', \varepsilon, \tau^{sq}) a' \]  

(3.16)

\[ U_{-j} (c_{-j}, l_{-j}, c_j, l_j, g (a', \tau_{jG})) + \]

(3.17)

\[ \beta \left[ \pi \mathbb{E} V_{-j} (a', \varepsilon', \tau_{jG}) + (1 - \pi) \mathbb{E} W_{-j} (a', \varepsilon', \tau_{jG}) \right] \geq \mathbb{O}_{-j} (a, \varepsilon, \tau^{sq}) \]

And constraints (3.1) and (3.2).

Note that in problem (3.15) the current choice of the tax rate becomes the \textit{status quo} tax rate for the continuation value. Also, (3.17) is the acceptance strategy of party \(-j\). This last constraint indicates that the dynamic payoff for party \(-j\) associated with the proposal \{a', \tau_{jB}\} should be greater or equal to the dynamic payoff associated with \{a' = a, \tau = \tau^{sq}\}, which is represented by \(\mathbb{O}_{-j} (a, \varepsilon, \tau^{sq})\). The outside option also depends the productivity shock \(\varepsilon\). This last value function is given by

\[ \mathbb{O}_{-j} (a, \varepsilon, \tau^{sq}) = U_{-j} (c_{-j}, l_{-j}, c_j, l_j, g (a, \tau^{sq})) + \]

(3.18)

\[ \beta \left[ \pi \mathbb{E} V_{-j} (a', \varepsilon', \tau^{sq}) + (1 - \pi) \mathbb{E} W_{-j} (a', \varepsilon', \tau^{sq}) \right] \]

In this case, the outside option (3.18) for party \(-j\) is the utility that this party would get if the policies implemented in the previous period are also implemented in the current period.

To complete the description of the government’s problem, the value of party \(j\) when it is not in power and party \(-j\) default is given by (3.19) and when party \(-j\) repay is given by (3.20).

\[ W_{j} (a, \varepsilon, \tau^{sq}) = U_{j} (c_j, l_j, c_{-j}, l_{-j}, g (\tau_{-jB})) + \]

(3.19)

\[ + \beta \left[ \pi \left( \lambda \mathbb{E} V_{j} (0, \varepsilon', \tau_{-jB}) + (1 - \lambda) \mathbb{E} V_{j}^B (\varepsilon', \tau_{-jB}) \right) \right] \]

\[ + (1 - \pi) \left( \lambda \mathbb{E} W_{j} (0, \varepsilon', \tau_{-jB}) + (1 - \lambda) \mathbb{E} W_{j}^B (\varepsilon', \tau_{-jB}) \right) \]
\[ W_j(a, \epsilon, \tau^{sq}) = U_j(c_j, l_j, c_{-j}, l_{-j}, g(a'_{-j}, \tau_{-jG})) + \beta [\pi \mathbb{E} V_j(a'_{-j}, \epsilon', \tau_{-jG}) + (1 - \pi) \mathbb{E} W_j(a'_{-j}, \epsilon', \tau_{-jG})] \]

### 3.2.4 International Investors

It is assumed that international investors are risk neutral and that perfect competition determines that bond’s prices satisfy the zero profit condition. For this reason, bond prices are given by

\[
q_j(a'_j, \epsilon', \tau^{sq}) = \frac{1 - [\pi d_{-j}(a'_j, \epsilon', \tau_{jh}(a, \epsilon, \tau^{sq})) + (1 - \pi) d_j(a'_j, \epsilon', \tau_{jh}(a, \epsilon, \tau^{sq}))]}{1 + r} \tag{3.21}
\]

In this formulation the status quo tax rate \( \tau^{sq} \) is included, hence, the pricing condition corresponds to the model with the possibility of policy gridlock. In (3.21), the price of bonds depends not only on the current borrowing decision, but also on the current choice of the tax rate \( (\tau_{jh}) \), which is affected by the current status quo tax rate. The identity of the current policymaker informs of the chances of it staying in power, again affecting the next period’s value functions.

### 3.2.5 Definition of Equilibrium

The following definition correspond to the problem including policy gridlock.

The model’s Markov perfect equilibrium is given by a set of value functions and policy functions. The value functions are \( V_j(a, \epsilon, \tau^{sq}), V_j^B(\epsilon), V_j^G(a, \epsilon, \tau^{sq}), W_j(a, \epsilon, \tau^{sq}), W_j^B(\epsilon), \) and \( \Omega_j(a, \epsilon, \tau^{sq}) \) for \( j \in \{L, H\} \). The policy functions are given by \( d_j(a, \epsilon, \tau^{sq}), \tau_{jB}(\epsilon), \tau_{jG}(a, \epsilon, \tau^{sq}), a'_j(a, \epsilon, \tau^{sq}) \) and \( q_j(a'_j, \epsilon', \tau^{sq}) \) for \( j \in \{L, H\} \). In equilibrium

1. Given the policy functions, the value functions satisfy the system of functional equations (3.1)-(3.2), (3.12)-(3.21).
2. The default, tax and borrowing policy solve the problem specified in (3.1)-(3.2), (3.12)-(3.21).

3. Bond prices satisfy the lender’s zero profit condition, as indicated in (3.21).

4. Given the value and policy functions, all proposals all accepted in equilibrium, as it is implicitly specified in (3.17).

### 3.3 Quantitative Analysis

The following sections present the model specification, the calibration exercise, and the results of the paper.

#### 3.3.1 Model Specification

Preferences are given by:

\[
u(c, l, g) = \frac{1}{1 - \sigma} \left( c - \frac{l^{1+\omega}}{1 + \omega} \right)^{1-\sigma} + \chi g^{1-\sigma_g} \tag{3.22}
\]

Where \(\sigma\) is the coefficient of relative risk aversion for private consumption; \(\sigma_g\) is the coefficient of relative risk aversion for public goods; \(\omega\) is the inverse of the labor elasticity and \(\chi\) is the relative weight of the public good. For the production function in 3.1, it is assumed that \(f(l)\) is a linear function, as in for example Cuadra, Sanchez, and Sapriza (2010) or Hatchondo, Martinez, and Roch (2015).

Regarding the productivity process, let:

\[
\phi^h(\varepsilon_t z_j) = \begin{cases} 
    z_j \exp(\varepsilon_t) & \text{if } h = G \\
    z_j \left[ \exp(\varepsilon_t) - \max\left\{ 0, \phi_1 \exp(\varepsilon_t) + \phi_2 (\exp(\varepsilon_t))^2 \right\} \right] & \text{if } h = B
\end{cases} \tag{3.23}
\]

Where \(\varepsilon_t = \rho \varepsilon_{t-1} + \varepsilon_t\) and \(\varepsilon_t \sim N(0, \sigma^2_z)\). The truncation process for productivity follows the specification of Chatterjee and Eyigungor (2012). Given the parametrization used in this document, the above functional form gives an increasing and convex cost of default.
3.3.2 Calibration

The calibration exercise contemplates two parameters standard in the literature. These are the risk aversion of consumers, with a value of 2.0, the world interest rate, with a value of 1 per cent. Using information for Argentina for the period 1980:1-2001:4, the autocorrelation of shocks is set equal to 0.916 and the standard deviation of shocks is 3.1\(^4\). Data on historical yields from Neumeyer and Perri (2005) is used. The probability of reentry after default is equal to 0.0385, as in Chatterjee and Eyigungor (2012) or Uribe and Schmitt-Grohé (2015). For a country it takes, on average, six and a half years to reenter capital markets. This number of years is the average of the default episodes of Argentina for 1982 and 2001. The probability of losing office is taken from Hatchondo, Martinez, and Sapriza (2009), the inverse of the labor elasticity comes from Neumeyer and Perri (2005), the weight on public consumption is taken from Ma (2014). The utility weight of its own type \(\alpha_j\) was set equal to 0.55, in order to achieve convergence.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk aversion of (c)</td>
<td>(\sigma) = 2.0</td>
<td>Standard</td>
</tr>
<tr>
<td>Risk aversion of (g)</td>
<td>(\sigma_g) = 3.0</td>
<td>Target: mean (\tau = 0.187)</td>
</tr>
<tr>
<td>World interest rate</td>
<td>(r) = 0.01</td>
<td>Standard</td>
</tr>
<tr>
<td>Autocorrelation of shocks</td>
<td>(\tilde{\rho}) = 0.916</td>
<td>Argentina's data</td>
</tr>
<tr>
<td>Standard dev. of shocks</td>
<td>(\sigma_z) = 0.031</td>
<td>Argentina's data</td>
</tr>
<tr>
<td>Discount factor</td>
<td>(\beta) = 0.78</td>
<td>Target: probability of default 3.0</td>
</tr>
<tr>
<td>Output cost specification</td>
<td>(\phi_1) = -0.35</td>
<td>Target: (\sigma(c)/\sigma(y) = 1.09)</td>
</tr>
<tr>
<td>Output cost specification</td>
<td>(\phi_2) = 0.4403</td>
<td>Target: (\sigma(T\beta/y)/\sigma(y) = 0.34)</td>
</tr>
<tr>
<td>Probability of redemption</td>
<td>(\lambda) = 0.385</td>
<td>Argentina's data (Uribe and Schmitt-Grohé, 2015)</td>
</tr>
<tr>
<td>Productivity for the high type</td>
<td>(z_H) = 1</td>
<td>Argentina: difference in firm’s TFP, percentiles 75-25</td>
</tr>
<tr>
<td>Productivity for the low type</td>
<td>(z_L) = 0.75</td>
<td>Argentina: difference in firm’s TFP, percentiles 75-25</td>
</tr>
<tr>
<td>Probability of losing office</td>
<td>(\pi) = 0.1</td>
<td>Hatchondo, Martinez, and Sapriza (2009)</td>
</tr>
<tr>
<td>Inverse of the labor elasticity</td>
<td>(\omega) = 1/2.22</td>
<td>Neumeyer and Perri (2005)</td>
</tr>
<tr>
<td>Utility weight of its own type</td>
<td>(\alpha_j) = 0.55</td>
<td>Achieve convergence</td>
</tr>
<tr>
<td>Weight on public consumption</td>
<td>(\chi) = 0.42</td>
<td>Ma (2014)</td>
</tr>
</tbody>
</table>

Productivity differences comes from Busso, Madrigal, and Pages (2012), which study firm productivity heterogeneity for Latin America. In the case of Argentina, data is reported for the period 1997-2002 for firms with 10 or more employees. The results in terms of

\(^4\) The source of the data is the Ministerio de Economía and Finanzas Públicas of Argentina. The same is true for the estimations of the business cycle characteristics of other macro variables. As in Arellano (2008) and Chatterjee and Eyigungor (2012), a linear trend is used to obtain these estimates. The simulations use subsamples of 88 periods.
productivity indicates that firms in the 75th percentile are 131% more productive than firms in the 25th percentile. Normalizing the productivity level for the high type $z_H$ and setting this value equal to 1, then the productivity for the low type $z_L$ should be set equal to 0.75, such that the high type is one third more productive than the low type.

The calibration exercise involves choosing a set of parameters to achieve a set of moments in the data. The risk aversion for public goods $\sigma_g$ is set to achieve the average VAT rate for Argentina of 0.188, which corresponds to the period 1980-2001. The discount factor $\beta$ and the output cost specification ($\phi_1, \phi_2$) are calibrated to achieve a default probability of 3.0%, the observed ratio for the volatility of consumption over output (1.09), and the ratio of the volatility of the trade balance (as a percentage of output) over the volatility of output (0.34).

### 3.3.3 Results

The results of the simulation are reported in Table 3.2. In terms of the default probability and debt ratios, the inclusion of policy gridlock increases the frequency of default and reduces the debt ratios that can be sustained. The mechanism that generates these results is explain later.

The model generates a level of taxes as the one observed in the data, while the public goods level is above the observed data for Argentina. In terms of the volatility of the tax rate, the inclusion of gridlock reduces the volatility of the tax rate, in the same way as reported in Ma (2014). This last paper considers the tax rate as the only policy option, while in this paper fiscal policy also contemplates debt and default. In Ma (2014) policy gridlock also induces policy functions to reflect more extreme options in terms of the tax rate, due to the intention of making more difficult for the other party to make an acceptable offer.

The results reported indicate that tax rates are procyclical, as reported by Vegh and Vuletin (2015) for the case of developing countries, while fiscal revenues are follow the same behaviour. As expected, policy gridlock induces a reduction in the probability of a change

---

5 They also report that firms in the 90th percentile are 246% more productive than firms in the 10th percentile.
Table 3.2: Simulation Results: without Gridlock and with Gridlock

<table>
<thead>
<tr>
<th></th>
<th>Data</th>
<th>No Gridlock</th>
<th>With Gridlock</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\sigma(c)/\sigma(y)$</td>
<td>1.09</td>
<td>1.087</td>
<td>1.085</td>
</tr>
<tr>
<td>$\sigma(TB/y)/\sigma(y)$</td>
<td>0.34</td>
<td>0.090</td>
<td>0.085</td>
</tr>
<tr>
<td>$\sigma(\text{spread})$</td>
<td>5.61</td>
<td>11.75</td>
<td>23.07</td>
</tr>
<tr>
<td>$\rho(y,TB)$</td>
<td>-0.89</td>
<td>-0.31</td>
<td>-0.29</td>
</tr>
<tr>
<td>$\rho(y,\text{spread})$</td>
<td>-0.83</td>
<td>-0.55</td>
<td>-0.53</td>
</tr>
<tr>
<td>$\rho(y,c)$</td>
<td>0.97</td>
<td>0.99</td>
<td>0.99</td>
</tr>
<tr>
<td>$\rho(TB,\text{spread})$</td>
<td>0.78</td>
<td>0.427</td>
<td>0.739</td>
</tr>
<tr>
<td>Average Spread</td>
<td>11.64</td>
<td>4.60</td>
<td>7.37</td>
</tr>
<tr>
<td>Average $g/c$</td>
<td>0.188</td>
<td>0.222</td>
<td>0.219</td>
</tr>
<tr>
<td>Average $g/y$</td>
<td>0.130</td>
<td>0.181</td>
<td>0.179</td>
</tr>
<tr>
<td>Average $\tau$</td>
<td>0.187</td>
<td>0.188</td>
<td>0.184</td>
</tr>
<tr>
<td>$\sigma(\tau)$</td>
<td>2.25</td>
<td>2.24</td>
<td>2.12</td>
</tr>
<tr>
<td>$\sigma(\tau c)$</td>
<td>5.36</td>
<td>2.84</td>
<td>2.82</td>
</tr>
<tr>
<td>$\rho(y,\tau)$</td>
<td>-0.46</td>
<td>-0.821</td>
<td>-0.814</td>
</tr>
<tr>
<td>$\rho(y,\tau c)$</td>
<td>0.75</td>
<td>0.959</td>
<td>0.961</td>
</tr>
<tr>
<td>Probability of a change in the tax rate</td>
<td>0.08</td>
<td>0.452</td>
<td>0.218</td>
</tr>
<tr>
<td>Default Probability</td>
<td>3.00</td>
<td>3.18</td>
<td>4.24</td>
</tr>
<tr>
<td>Mean Debt/$y_{\text{quarterly}}$</td>
<td>[86.2 - 172.4]</td>
<td>25.49</td>
<td>21.51</td>
</tr>
</tbody>
</table>

Note: Private consumption and output correspond to the sum of the levels of consumption and output for both parties respectively. The average tax rate ($\tau$), the standard deviation and probability of a change, corresponds to the VAT for Argentina during 1980-2001 (there were 7 changes in 22 years, the probability reported is in quarterly frequency). The correlation between the tax rate and output ($\rho(y,\tau)$) comes from Vegh and Vuletin (2015), which used a panel with 41 developing countries for the period 1960-2009 to estimate the relation between changes in the VAT tax rate and GDP. The volatility of the tax revenues ($\sigma(\tau c)$) correspond to all the tax revenues for Argentina. Public goods correspond to public consumption for Argentina for the period 1993-2001. The statistics correspond to deviations from a linear trend, except for the case of the tax rate.

in the tax rate, from 0.45 in the no gridlock case to 0.21 in the gridlock case, although the probability is still relatively high with respect to the frequencies observed in the data (0.08).

3.3.4 Policy Functions: Taxes, Borrowing and Default under Gridlock and No Gridlock

Figure 3.1 shows the effects of policy gridlock over tax policy as a function of the status quo tax rate, for the scenario of access to capital markets, when the constraint (3.17) requires a unanimous agreement. The results in Figure 1 are the same as the ones reported in Ma (2014). Panel (a) on the left shows how parties choose their tax policy under no gridlock. In this case, the high productivity $z_H$ party would choose a tax rate above 0.2, that is completely independent from $\tau^{sq}$. In a similar fashion, the party with $z_L$ would choose a
Figure 3.1: Tax policy ($\tau_{zH}$) as a function of the status quo tax rate ($\tau^{sq}$), under access to capital markets

Note: The figure was constructed for a negative shock 5% below the trend, and debt obligations of $a = -0.22$. As a reference, party $z_H$ choose a tax rate around the gridlock zone, $\tau_{zH} \in [0.18, 0.22]$, more than 70% of the times during the simulations. Also, for these range of tax rates chosen, the most common level for debt obligations was $a' = 0.22$.

tax rate below 0.2.

Panel (b) in Figure 3.1 shows how these policies change under the presence of gridlock. In this case, it is important to notice that the 45 degree line represents the scenarios where policy gridlock arises, since the current tax policy and $\tau^{sq}$ are the same. The analysis is focus on the party with the low productivity or $z_L$ (the same logic applies to the high productivity party). The party $z_L$ would choose the same tax rate as in the no gridlock case when $\tau^{sq}$ is between 0.1 and a little more than 0.18. In this left region of panel (b), the status quo tax rate is below the ideal of both parties, hence, both can agree to raise the tax rate. The party with low productivity would propose to raise the tax rate until its ideal and the party with high $z_H$ would accept the offer.

The center region of panel (b) shows the gridlock scenario. This would occur when $\tau^{sq}$ is between the ideal tax rates of both parties (between a little more than 0.18 and below 0.22). In this region party $z_L$ would prefer to reduce the tax rate until its ideal, and party $z_H$ would prefer to have a higher tax rate, not reaching an agreement and implementing the status quo. Finally, the last region on the right, for $\tau^{sq}$ above 0.21, party $z_L$ would prefer to
Figure 3.2: Borrowing policy \((a'_{zH})\) as a function of the status quo borrowing \((a)\), under access to capital markets

(a) No Gridlock case

High productivity \(z_H\) party

(b) Gridlock case

High productivity \(z_H\) party

Note: The figure was constructed for a negative shock 5% below the trend, and for a status quo tax rate of \(\tau_{sq}=0.18\). As a reference, party \(z_H\) choose a tax rate around the gridlock zone, \(\tau_{zH} \in [0.18, 0.22]\), more than 70% of the times during the simulations. Also, for these range of tax rates chosen, the most common level for debt obligations was \(a' = 0.22\).

reduce the tax rate, but since the status quo is close to the ideal of \(z_H\), the party with high productivity will enjoy more bargaining power and reductions in the tax rate will be small. Only when \(\tau_{sq}\) is relatively high, say above 0.23, party \(z_H\) will lose all its bargaining power as the status quo is far from its ideal, and both parties will benefit from a strong reduction in the tax rate, until party \(z_L\) ideal.

Figure 3.2 highlights the same point but for the borrowing policy. Policy gridlock in this case generates a large zone in which the policies implemented the previous period are repeated. In panel (b), the gridlock zone corresponds to borrowing levels between -0.18 and -0.26 approximately. The zone to the left is the default zone, were high levels of borrowing the previous period (say above -0.26) are translated into a zero borrowing policy, or a default scenario. On the contrary, to the right of the gridlock zone, borrowing levels in the previous period were relatively low, and party \(z_H\) choose a higher level of borrowing in the current period.

An important difference between the tax policy functions and borrowing functions is that the tax rate reflects the differences in the productivity levels of parties, while borrowing
levels are the same for both parties. This would not be necessarily the same if a finer grid is used or if productivity differences are bigger; but the important point to highlight is that borrowing policies implemented by the two parties are very similar. As shown in the second chapter of the dissertation, the political color of parties does not affect borrowing levels nor default probabilities in a sample of 35 emerging economies during 1975-2012, but the political color do affect tax rates chosen by parties.

Figure 3.1 analyzes tax policy as a function of the status quo tax rate. Figure 3.3 reports the tax policy function for the high productivity party, for a given status quo tax rate ($\tau^{eq} = 0.18$), as a function of the potential shock realizations and current debt obligations.
Figure 3.4: Borrowing policy as a function of shocks and debt obligations, under access to capital markets, high productivity party $z_H$

(a) No Gridlock case
High productivity $z_H$ party
\[ \tau^{eq} = 0.18 \]

(b) Gridlock case
High productivity $z_H$ party
\[ \tau^{eq} = 0.18 \]

(c) Differences in Borrowing Policy: Gridlock case - No Gridlock case
(negative values indicate less debt due to Gridlock)

The results are very similar if one chooses a different status quo tax rate or the policies for the low productivity party. Panel (a) shows the no gridlock case, panel (b) the gridlock case, and panel (c) shows the differences in tax rates between the gridlock and no gridlock case.

Comparing both scenarios (panels (a) and (b)), policy gridlock induce party $z_H$ to choose lower tax rates for a set of states (negative values in panel (c)). In particular, this occurs in states with small or intermediate obligations and with low or intermediate realizations of shocks. In these states, the inability to raise taxes due to gridlock moves from states with very bad realizations of productivity and low obligations, towards bad-intermediate shocks coupled with a higher level of obligations.
Figure 3.5: Default policy as a function of shocks and debt obligations, under access to capital markets, high productivity party $z_H$

*Purple area: Repayment / Yellow area: Default*

(a) Default/Repayment region - No Gridlock case  
High productivity $z_H$ party  
$\tau^{sq} = 0.18$

(b) Default/Repayment region - Gridlock case  
High productivity $z_H$ party  
$\tau^{sq} = 0.18$

(c) Dif. in Tax Policy:  
G case - NG case

(d) Dif. in Borrowing Policy:  
G case - NG case

(e) Dif. in Default Policy:  
G case - NG case

In the same way as in Figure 3.3, the borrowing policy functions are shown in Figure 3.4. In this case, the big differences observed in panel (c) correspond to states in which under gridlock the party $z_H$ would default and would have zero borrowing, such that there are big negative differences for those states. This occurs mainly in states with neutral productivity shocks and high levels of obligations.

In Figure 3.5 the default and repayment regions are shown. The default region is bigger for the case of policy gridlock and this feature will be explained in the following section. The three bottom panels ((c), (d) and (e)) compares the different policy by states. Panel (e) shows the difference in the default policy, where the yellow areas represent the states in which default only occur under gridlock. Panel (d) shows the difference in the borrowing policy, with the blue states indicating a lower level of borrowing, which mainly happens in
those states were default occurs only under gridlock. Finally, in panel (c) the differences in tax policy are shown. Although it is not easy to see, there is a group of states in which gridlock induces a higher tax rate (yellow areas), in this case for the new states in which default only happens with gridlock, and to states close to it. This result might indicate that in states where default is highly probable, the tax rate under gridlock presents higher levels.

### 3.3.5 Policies Observed Around Default Events

Before describing the mechanism, Figure 3.6 reports the average evolution around a default episode of the Corporate Income Tax Rate, General Government Debt over GDP and General Government Debt in 1975 US Dollars. As reported in the second chapter of the dissertation, there is an increase of the tax rate before a default episode and the same is true for the ratio of debt over output. Interestingly, the value of debt in absolute terms also increases in a period of three years before a crisis, and stays flat one year before a default episode. Importantly, in the data it is not observed a contraction in terms of the level of debt before default. This is a key observation to understand the mechanism of the model.

Figure 3.7 shows the evolution of the model’s simulated variables around a default episode. In this case, the output deviation from trend, the tax rate, the ratio of debt over output and the evolution of debt are shown for the model without and with gridlock.
Figure 3.7: Variables around a Default Episode, Model Simulations

(Quarterly Frequency)

Note: The figures were constructed around the default episodes for the no gridlock and the gridlock economy. These episodes do not necessarily coincide. The numbers were calculated using 500 simulations of length 1000 periods for each economy subject to the same shocks (the total length of each simulation is 10 thousand periods, with a burning sample of 9 thousand observations).

The simulations of the model show that output’s contraction is similar in both types of economies. However, default episodes differ in terms of the policy reactions. In an economy without the possibility of policy gridlock, there is a small increase in the ratio of debt over GDP before a crisis, that goes from -0.282% to -0.318%. Importantly, the increase in the ratio is small because under no gridlock, the policymaker on average reduce debt levels in absolute terms before a default episode, something that it is not observed in the data. For this reason, the increase in the tax rate is relatively small. Differently, in an economy where gridlock can arise, debt in absolute terms is not reduced, there is a negligible increase in the level of borrowing. This, coupled with the recession, implies a larger deterioration of debt ratios, that go from -0.270% to -0.368%. A high debt burden implies that the tax policy effort is bigger for the economy with policy gridlock. Hence, even though the probability of a change in the tax rate in the gridlock economy is lower on average, around crisis events the tax rate shows a higher volatility.

Even though the default probability is larger under to gridlock, typically default events for both economies do not occur for the same realizations of shocks in the simulations. In particular, the probability of a default episode that occurs under gridlock, but not occurs
under no gridlock, is 3.07% (calculated over all the periods of the simulations). In other words, of the total default episodes under gridlock (probability of 4.24% in Table 3.2), most of them would not have occurred under the no gridlock scenario. Following the same logic, from the total of default episodes occurred under no gridlock (3.18% in Table 3.2), there is a high proportion (probability of 1.93%) that would not occur under gridlock. Then, in both cases there is a large proportion of episodes were fiscal austerity was imposed to avoid a crisis.

Figure 3.8 shows the average fiscal effort (in terms of taxes, public goods and debt) required to avoid defaults in both cases. The most important observation about Figure 3.8 is that the fiscal effort required to avoid a default scenario is much higher under no gridlock. In particular, this is reflected in the increase in the average tax rate from 0.194 to 0.228, from five quarters before a potential default episode until the potential crisis (red line in the figure). In the case of gridlock, the same effort required goes from 0.200 to 0.207. In sum, to avoid a default episode under no gridlock fiscal austerity would imply an increase of 3.4 percentage points in the tax rate, while in the gridlock scenario this effort would be only
Figure 3.9: Default Episodes that Only Occur under Gridlock, Model Simulations

Red line: Gridlock economy / Black dash line: No gridlock economy

Note: The figure is constructed in the following way. The dash vertical line indicates the default crisis, which only considers the default episodes that occurred in the gridlock economy but not occurred in the no gridlock case. The numbers were calculated using 500 simulations of length 1000 periods for each economy subject to the same shocks (the total length of each simulation is 10 thousand periods, with a burning sample of 9 thousand observations).

0.7 points. As the last panel of Figure 3.8 indicates, this is the case because the gridlock economy shows a lower level of output over GDP for those episodes where default happened only under no gridlock.

To see the behavior of the economy under the debt crises episodes that only occurred under gridlock, Figure 3.9 present the evolution of output deviation from trend, borrowing levels (in relative and absolute terms) and the tax rate. On average, the main difference between the gridlock economy and the no gridlock economy is the borrowing policy. In panel (a) it is observed that economic conditions start to deteriorate in both economies. The way both economies respond on average is increasing the tax rate in a similar fashion from periods $t - 5$ to $t - 2$, but the difference relies on the fact that the gridlock economy cannot reduce its borrowing level and the no gridlock economy is flexible enough to implement this fiscal adjustment in terms of borrowing.

3.3.6 Political Defaults

Political defaults are defined as crisis events that occur in the same period of a change in government. The change in the government might imply also a change in the political color of the new incumbent with respect to the party that leaves power, or simply both can present the same political orientation. In particular, this is the focus of the work of Hatchondo, Martinez, and Sapriza (2009). They show that a default can be triggered by a change in office, when more myopic parties come into power and there is enough political
stability. Under a scenario of high political stability, 95% of the times that there is a change from a patient to an impatient policymaker a debt crisis is generated. This number is very high in comparison to what it is observed in the data (a frequency of only 1.5%). The data corresponds to a sample of 35 emerging economies with information available regarding the political orientation of the party in power, for the period 1975-2012 (Beck et al., 2001). In fact, the data is consisted with the results of their unstable economy.

Table 3.3 reports political defaults observed in the data, the results of Hatchondo, Martinez, and Sapriza (2009) and the results of this paper. In terms of the policy gridlock case, the model does a decent job in terms of the frequency of default episodes associated with changes in government and with changes in the political color of parties. In particular, changes in office from the party with $z_H$ to the party with $z_L$ were considered in the calculations. The introduction of gridlock improves the predictions of the baseline model, although these changes are no large with respect to the no gridlock case.

<table>
<thead>
<tr>
<th></th>
<th>Data Stable</th>
<th>HMS Stable</th>
<th>Data Unstable</th>
<th>HMS Unstable</th>
<th>No Gridlock</th>
<th>Gridlock</th>
</tr>
</thead>
<tbody>
<tr>
<td># PD / # total D</td>
<td>0.182</td>
<td>0.097</td>
<td></td>
<td>0.102</td>
<td></td>
<td></td>
</tr>
<tr>
<td># PD with ∆ PC / # total D</td>
<td>0.061</td>
<td>0.050</td>
<td></td>
<td>0.049</td>
<td></td>
<td></td>
</tr>
<tr>
<td># PD with ∆ PC / # ∆ PC</td>
<td>0.015</td>
<td>0.95</td>
<td>0.04</td>
<td>0.008</td>
<td>0.011</td>
<td></td>
</tr>
</tbody>
</table>

Note: HMS stands for Hatchondo, Martinez, and Sapriza (2009), PD stands for Political Default (a default associated with a change in government, no matter the political orientation of the new versus the old party in the executive), D stands for Default, and ∆ PC stands for Changes in the Political Color of the new Incumbent. For the case of the model simulations, a change in the political color is interpreted as a change from party $z_H$ to party $z_L$. The political data comes from Beck, Clarke, Groff, Keefer, and Walsh (2001), while the default episodes comes from Reinhart and Rogoff (2009). The sample includes 35 emerging countries for the period 1975-2012.

### 3.3.7 Policy Gridlock by Different Available Policy Options and Types

Table 3.4 reports the average tax rate for a model with only taxes, in the spirit of Ma (2014), and the same result for a model with borrowing and default. In both cases, and also in Ma (2014), policy gridlock induces a reduction in the average level of taxes and in
the volatility of taxes along the equilibrium path.\footnote{In Ma (2014) this is also the case, but the policy functions show an increase in the wedge between taxes for the high and low types.}

Table 3.4: Taxes and Borrowing by Policy Options and Type

<table>
<thead>
<tr>
<th>Policy Options: Only Taxes</th>
<th>No Gridlock</th>
<th>Gridlock</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean tax</td>
<td>0.1843</td>
<td>0.1839</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0.0129</td>
<td>0.0124</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Policy Options: Taxes, Borrowing and Default</th>
<th>No Gridlock</th>
<th>Gridlock</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean tax</td>
<td>0.1882</td>
<td>0.1847</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0.0224</td>
<td>0.0212</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Policy by Parties (Access to Capital Markets)</th>
<th>No Gridlock</th>
<th>Gridlock</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\tau_H$</td>
<td>0.1898</td>
<td>0.1851</td>
</tr>
<tr>
<td>$\tau_L$</td>
<td>0.1843</td>
<td>0.1833</td>
</tr>
<tr>
<td>$a'_H/y$</td>
<td>-0.2763</td>
<td>-0.2483</td>
</tr>
<tr>
<td>$a'_L/y$</td>
<td>-0.2713</td>
<td>-0.2465</td>
</tr>
<tr>
<td>$a'_H$</td>
<td>-0.2565</td>
<td>-0.2308</td>
</tr>
<tr>
<td>$a'_L$</td>
<td>-0.2552</td>
<td>-0.2304</td>
</tr>
</tbody>
</table>

The reduction is more important for the model with borrowing and default, and this is due to the interaction between gridlock and default. As explained before, the introduction of gridlock makes not feasible the reduction in the absolute level of borrowing, and the continuation of the deterioration in economic conditions determines a default episode. On the contrary, under the no gridlock scenario, the policy maker is able to reduce debt levels in absolute terms, but this a feature that is not observed in the data.

The table also reports the average tax rate and borrowing levels, under access to capital markets, for both types of parties. In this case, it is the high productivity party $z_H$ which is mostly affected with the introduction of gridlock. The high type registers a reduction of almost 0.5 percentage points in the tax rate implemented, while this contraction is only
0.1 percentage points for the low type. The reduction in borrowing for party $z_H$ is 2.8 percentage points, while the reduction for the low type is 2.5 points. Hence, policy gridlock mainly affects the level of taxes.

Another important aspect is that, as shown in the second chapter of the dissertation, the political color of parties is not a variable that can explain differences in borrowing levels. This is observed in the last two rows of Table 3.4, were borrowing levels in absolute terms are almost the same for both parties (with a difference of 0.0004) in the gridlock scenario.

Table 3.5: Default by Political Type

<table>
<thead>
<tr>
<th>Data: Distribution of Default Episodes</th>
<th>Percentage [Number]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left</td>
<td>0.303 [10]</td>
</tr>
<tr>
<td>Center</td>
<td>0.121 [4]</td>
</tr>
<tr>
<td>Right</td>
<td>0.576 [19]</td>
</tr>
<tr>
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<td>- [12]</td>
</tr>
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<table>
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<th>Model Simulation - Default Probability</th>
<th>No Gridlock</th>
<th>Gridlock</th>
</tr>
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<tbody>
<tr>
<td>$z_H$</td>
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<td>0.04318</td>
</tr>
<tr>
<td>$z_L$</td>
<td>0.03220</td>
<td>0.04324</td>
</tr>
</tbody>
</table>

Note: The political data comes from Beck, Clarke, Groff, Keefer, and Walsh (2001), while the default episodes come from Reinhart and Rogoff (2009). The sample includes 35 emerging countries for the period 1975-2012.

Table 3.5 shows the default frequency by type. Without gridlock, the low productivity party $z_L$ register a higher frequency of default than the high type, as expected. Also, this is the same result emphasized by Hatchondo, Martinez, and Sapriza (2009). In their paper, political defaults are generated when the impatient policymaker takes power. However, the data indicates that left wing parties, which could be interpreted as the impatient ones, are not the ones that have registered most of the default episodes. In fact, 0.58 per cent of the default episodes in the sample occurred under right wing governments. The other half, under center or left wing governments. This is what occurs once gridlock is included, the
default probabilities for the two parties are almost the same; \textit{i.e.} the wedge in favor of the party $z_L$ vanishes. This result was reported in the second chapter of the dissertation, the political color of parties does not affect the default probabilities observed in the data, while it mainly affects the tax rates.

3.4 Conclusions

This paper studies tax policy, sovereign borrowing and default in a two party economy where a unanimous agreement is necessary to modify the policies implemented in the previous period. In particular, in order to change policy, the party in power makes a proposal in terms of the tax rate and borrowing levels. The other party can accept or reject the proposal comparing the dynamic payoff of the offer with the payoff of a scenario in which the policies implemented the previous period (tax and borrowing) are the same.

The introduction of policy gridlock is related to two important outcomes of the simulations. First, the probability of a change in the tax rate is reduced more than 20 percentage points after the introduction of gridlock, although the model stills reports a probability that is more than 2.5 times higher than the one observed in the data. Second, looking at the evolution of variables around a default episode, in the no gridlock economy, the deterioration of economic conditions before a crisis is translated into a fiscal adjustment that implies a reduction in borrowing in absolute terms. Typically, papers on sovereign default report only the ratio of debt over GDP, not showing that the policymaker has the ability of reducing borrowing in absolute terms. This predicted reduction in debt levels before a crisis is not observed in the data. Using a sample of 35 emerging economies, the paper documents that the opposite occurs on average. Importantly, when policy gridlock is introduced, the policymaker cannot reduce debt levels before a crisis, and has to rely only on increasing taxes to sustain borrowing levels and a level of utility that satisfy the other party (otherwise his proposal would be rejected). Hence, a fiscal effort in terms of an increase in tax rates is observed.

For this reason, this paper departs from previous sovereign default papers (Andreasen
et al., 2011; Arellano and Bai, 2014) that highlights the inability to raise taxes as a crucial determinant of default episodes. In this paper, and in the second chapter of the dissertation, it is shown that on average countries do raise taxes before a default episode, but more importantly, are not able to reduce borrowing levels. This paper highlights and rationalizes in a political economy model that the inability of reducing borrowing levels before a default episode is an important determinant of crises.

In equilibrium, an economy without the possibility of gridlock shows a default probability of 3.18% and a debt over output ratio of 25.49%, while the introduction of policy gridlock results in a higher chance of default, with a probability of 4.24%, and lower levels of debt, 21.51%. It should be noted that from the 4.24% of default episodes under gridlock, 3.07 percentage points correspond to cases where default only occurs under gridlock (and not under no gridlock). This set of cases is used to confirm the relevance of the inability of reducing borrowing. When economic conditions deteriorate, the no gridlock and gridlock economies can implement a fiscal adjustment in terms of the tax policy (increase rates), but the key difference is that the gridlock economy cannot avoid a crisis because it is not able to reduce its borrowing in absolute terms (or cannot stabilize its ratio of debt over output), as in the data.

The paper also documents that political defaults, understood as crisis that happens during a change in government, represent only a small proportion of the total number of default episodes (18%). Also, political defaults coupled with a change in the political color of the government are much less important in terms of the total number of default episodes (6.1%) or the total number of changes in government (1.5%). This last fact differs from the results highlighted by Hatchondo, Martinez, and Sapriza (2009), that indicates than in a stable economy 95% of the changes in governments of different types results in a default episode. The model with policy gridlock does a good job in matching these probabilities.

Finally, the introduction of policy gridlock mainly generates changes in tax rates with respect to the no gridlock case, and to a less extend, in borrowing levels and default probabilities. Importantly, under gridlock the differences in terms of tax rates chosen by the two parties remains, while there is a convergence for both parties in terms of the absolute
level of borrowing and default probabilities. This result is consistent with the data. In the second chapter of the dissertation it was shown that the political color of parties does not affect borrowing levels or default probabilities, but generates differences in terms of the tax rates chosen by different parties.
Chapter 4
Sovereign Default, Political Instability and Political Fragmentation

4.1 Introduction
What are the political motivations behind the repayment of sovereign obligations and the issuance of more debt? How do the characteristics of the political system affect debt levels and the frequency of default? This paper aims to give an answer to both questions, exploring how distributional incentives are linked to policymaker’s short-sightedness, and how distributional incentives facilitate borrowing and repayment in a quantitative model of sovereign default. For this, the bargaining approach of Battaglini and Coate (2007, 2008) is embedded into a standard model of default (Eaton and Gersovitz, 1981; Aguiar and Gopinath, 2006; Arellano, 2008). The model incorporates two essential features of any political system: the degree of instability and fragmentation.

As emphasized by Tirole (2012), the bi-partisan nature of the political systems in Sweden, Germany, or Chile allowed these countries to benefit from the necessary political consensus related to budget discipline. However, political systems in most emerging economies are far from this scenario and are characterized by different degrees of instability and fragmentation. Political instability is understood as the frequent turnover of different parties in power (with more than two, the bi-partisan scenario is abandoned). Fragmentation is interpreted as a situation in which a high number of parties are excluded from the policymaking process (a higher number indicating less cohesion).

To explore these issues, the workhorse model of sovereign default is extended to allow for several political parties that stochastically alternate in power and bargain over the budget. The bargaining process implies that in each period a randomly selected party’s representative (political instability) forms a coalition to approve policy decisions, leaving out of this coalition a given number of other parties (political fragmentation). First, an
endogenous distribution of resources for the party in power, the members of the coalition, and those groups excluded is determined in a natural way. The distribution depends on the structure of the political system and on economic conditions. The second outcome of the model indicates that policymakers, unsure about tenure, become short-sighted; and the degree of short-sightedness is a function of the political structure. Given that assets markets are not complete and that policymakers cannot commit to repay, the party in power will choose debt and default, internalizing the distributive effects of its decision and discounting the future more heavily.

The model nests the benchmark model of default, which in this article is labeled as the central planner’s case. In this setup, the benevolent central planner’s scenario corresponds to a situation in which all the political parties belong to the government coalition. When this occurs, all political parties receive the same level of consumption, and policymakers’ short-sightedness is eliminated.

In terms of the numerical results, the first simulation exercise contemplates Arellano (2008)’s calibration parameters. Under this scenario, the inclusion of political instability and political fragmentation increases default from 3.0% to 4.8% and debt from 5% to 19.6%. When the model is calibrated to target a default probability of 3.0%, a debt ratio of 23.2% is obtained if short-term bonds are used, as in Arellano. While it is possible to achieve debt ratios that are more consistent with the empirical evidence using short-term debt, doing so comes at the cost of less realistic business cycle statistics. For that reason, the introduction of long-term debt (Chatterjee and Eyigungor, 2012) in the model generates a debt ratio of 112.0%. This ratio is consistent with the range of public debt over quarterly GDP ratios observed in Argentina since the 1980s, which is between 86% and 172%. More importantly, the paper complements previous efforts of the literature aimed at generating high and realistic debt ratios, which has proven to be hard in this class of models.\footnote{The actual quarterly debt ratio is 172% (equivalent to an annual ratio of 43%). However, assuming that some proportion of debt is secured, given that in reality there are positive recovery rates after a default episode and this rate is not 0% as in the model, the lower bound for the relevant estimated ratio may be closer to 86%.
\footnote{Quantitative models of sovereign default have presented difficulties in obtaining the default frequencies observed in the data and, at the same time, high or realistic levels of debt (Mendoza, 2015; Claessens and Kose, 2014; Aguiar and Amador, 2013; Tomz and Wright, 2013). There have been important improvements with respect to the initial debt predictions. In particular, the use of long-term bonds (Hatchondo}}
Changes in the political factors are as indicated in Tirole (2012). More instability and fragmentation increase the probability of default and reduce debt levels in equilibrium, which reflect a lower degree of fiscal responsibility. The same is true when correlations are analyzed using a sample of 35 emerging countries between 1975 and 2012. These results can also be related to the debt intolerance phenomenon, described in Reinhart, Rogoff, and Savastano (2003). These authors conjectured that low debt-to-GNP thresholds for default in emerging markets can be explained by a combination of the procyclical nature of capital markets and short-sighted governments.

The intuition behind the model’s distributional mechanism is as follows. When a party is selected to be the policy proposer, it can exploit (as in most bargaining games) the bargaining power derived from the possibility of making the first policy proposal. This will generate a distribution of resources that favors the proposer. This distribution can vary according to the state of nature and borrowing decisions, or the ‘size of the pie’. When the party in power decides the country’s level of borrowing, the political mechanism will provide the policymaker a better share of resources when it chooses more debt, hence the policymaker will also care about the ‘share of the pie’. The reason is that self-interested policymakers will not have an incentive to provide anything to parties excluded from the coalition. Therefore, the resources associated with an additional bond issued in capital markets will be split between the proposer and the members of the coalition. This mechanism will work only up to a certain debt threshold. At this point, an increasing debt becomes counterproductive because the typical endogenous borrowing constraint of models of sovereign default becomes binding. In other words, market discipline will deter the issuance of more bonds via a decline in bond prices. Since debt has become too big and too risky, choosing debt above the threshold provides less resources for the country and a worse share of the pie for the proposer.

This mechanism explains the main features of the model. First, in the event of default, the country loses access to capital markets and, consequently, the possibility of borrowing costs of default (Mendoza and Yue, 2012; Chatterjee and Eyigungor, 2012) and positive recovery rates (Bi, 2009; Benjamin and Wright, 2009; Yue, 2010; D’Erasmo, 2011) allow these models to sustain more debt. Differently from these mechanisms, this paper looks at the motivations for borrowing.
and improving the policymaker’s share of resources. Then, distributional incentives are relevant under access to capital markets, which facilitate repayment in equilibrium and explain why the model can sustain more debt in the numerical exercises. This mechanism is novel in the literature of default. Second, distributional incentives are stronger in economic booms, when repayment obligations are low and when the coalition size is small. Third, distributional incentives explain the degree of policymakers’ short-sightedness. Since today’s proposer might not be in power in the next period, it will try to take the maximum advantage of its bargaining power today. A different situation would arise in the case of the central planner. In this scenario, even though there is political turnover, since all the policymakers receive the same share of resources, there are no distributional incentives that drive myopic policies.

Most calibrations of sovereign default models impose low discount factors, and justify this decision claiming the existence of political turnover or political instability (Aguiar and Amador, 2013). In this context, it is interesting to evaluate if a reduction in the discount factor, using the central planner’s case, provides the same results and operates through the same channels as the introduction of political instability and fragmentation. The full-commitment-to-repay and no-commitment cases are considered in this analysis.

Under full commitment to repay, a lower discount factor and the introduction of political instability and fragmentation operate through the same mechanism; there is a reduction in the marginal cost of repaying debt obligations. When the possibility of default is introduced, a reduction in the discount factor does not affect the marginal cost anymore. Changes in impatience are completely absorbed by the equilibrium pricing condition, expanding the default region. When political instability and fragmentation are introduced, the marginal cost of repayment/default is reduced, as in the full-commitment case. Crucially, the default region is not expanded. The same holds if only political instability is introduced in a model without political factors (as in the central planner’s case).

Why do political factors and impatience operate differently under the no-commitment

\footnote{Previously, Cuadra and Sapriza (2008) proposed a two-party model of sovereign default with an invariant distribution of resources. If the share of resources does not change with the borrowing decision, then there are no distributional benefits from borrowing more. Other similar models abstracted from redistribution.}
case? For the scenario of an introduction of instability and fragmentation, international investors understand the motivations for repayment and borrowing. Importantly, they know that, in the next period, any political party chosen to be the policymaker will value more repayment because borrowing is a mechanism to improve his well-being and share of resources. Under these conditions, repayment is more probable and bond prices do not fall. By contrast, when there is more impatience, international investors know that the central planner will not have any particular motivation for repayment in the next period. For that reason, bond prices will fall as a consequence of the planner’s desire to frontload consumption. In terms of the equilibrium results, more impatience yields more default and less debt, while political instability or both political factors yield more default and more debt.

The rest of the paper is organized as follows. Section 4.2 discusses the related literature. In Section 4.3 the model is introduced. A description of the calibration exercise and the quantitative results are presented in Section 4.4. The last section presents the conclusions.

4.2 Related Literature

This paper is at the intersection of the literature on the quantitative models of sovereign default (Eaton and Gersovitz, 1981; Aguiar and Gopinath, 2006; Arellano, 2008) and the literature on the political economy of debt. To be more specific, the paper is related to three strands of the literature.

**Quantitative–Political Economy Models of Sovereign Default:** The previous models have considered the case of bi-partisan systems; in this paper the existence of more than two parties is allowed. Cuadra and Sapriza (2008) presents a model with two parties that alternate stochastically in power. In Cuadra and Sapriza’s paper the distribution of resources is fixed and depends on the parties’ preferences, while in this paper an endogenous outcome is generated. Other political economy papers abstract from the distribution of resources, with the exception of D’Erasmo and Mendoza (2014). This paper

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4 An early review of this literature is found in Hatchondo and Martinez (2010).

5 The focus of that paper is not on political economy issues.
incorporates domestic debt, and redistribution of resources occurring among agents when
the government defaults, affecting local bondholders. Hatchondo, Martinez, and Sapriza
(2009) present two parties with different degrees of impatience or discount factors. Under
this setup, default may not only be triggered by very low realizations of the endowment
shock, but also by a change in the type of policymaker. The authors call this a ‘political
default’. 6

Using a similar framework as in Hatchondo, Martinez, and Sapriza (2009), D’Erasmo
(2011) adds private information and the possibility of endogenous renegotiation. In D’Erasmo’s
model, since international investors cannot observe if the government is a patient one or not,
short-sighted governments tend to mimic patient ones to build reputation and be able to
access more debt at lower interest rates. Andreasen, Sandleris, and Van Der Ghote (2011)
analyzes the political economy of taxation and default. In that model the government might
not garner enough political support to raise taxes for repayment (the ‘inability to pay’ sce-
nario). As in this paper, a political constraint will affect debt and default in equilibrium.
The political constraint in that paper makes repayment more difficult, while in this paper
repayment is more attractive.

MODELS OF FISCAL POLICY WITH DYNAMIC LEGISLATIVE BARGAINING. In Battaglini
and Coate (2007) the authors develop a model in which a legislature decides the level of
taxation and the allocation of resources between a productive public good, and district-
specific transfers (pork barrel spending). They characterize the conditions for a situation in
which taxation is too high, the level of the public good is too low, and pork is over provided.
Battaglini and Coate (2008) uses a similar framework to examine a richer set of fiscal
policy variables, including government debt. Borrowing, as well as distortionary taxation,
is used to provide pork and a public good with a stochastic value. Finally, Battaglini and
Barseghyan (2013) investigates fiscal policy in the context of a model of endogenous growth,
where public investment affects productivity.

Differently from this article, the papers cited above have studied fiscal policy models

6 In particular, it occurs when a patient policymaker is replaced by an impatient one and the economy
enjoys a relatively politically stable environment. On the contrary, if political stability is low (or there is high
instability), then debt levels that could be sustained would be relatively low and changes in the government’s
type would not generate a crisis.
for closed economies under full commitment to repay. While the political motivations for borrowing are similar, in this paper, debt is limited by the endogenous borrowing constraint derived from the possibility of default; in Battaglini and Coate’s models, other reasons play this role. Other dynamic legislative bargaining papers incorporate the possibility of an endogenous status quo, like in Bowen, Chen, and Eraslan (2014) and Ma (2014). The first paper studies the welfare properties of an economy in which the level of spending on mandatory programs is not easy to change, while the second studies the consequences of policy gridlock in terms of the tax rate. These articles abstract from borrowing and default.

PROCYCLICALITY OF FISCAL POLICY IN EMERGING MARKETS. Gavin and Perotti (1997) provides two initial hypotheses for this characteristic of emerging markets. The first is borrowing constraints, that can be relevant during downturns; and the second is political incentives, to spend more during times of plenty. Talvi and Vegh (2005) supports the view that political distortions explain fiscal procyclicality. The authors explain that if a government knows that it will be excluded from international markets, it must accumulate reserves during good times. Using a sample of 32 emerging economies during 1970-2006, Panizza, Sturzenegger, and Zettelmeyer (2009), featuring a survey of sovereign debt and default, shows that this is not the case. The authors conclude that the lack of access to capital markets cannot be the only reason for procyclical borrowing and that political factors matter. Cuadra, Sanchez, and Sapriza (2010) challenges this view and emphasizes that the discussion about borrowing constraints mainly has been focused on the scenario of a full exclusion from capital markets. In quantitative models of sovereign default, the option of no repayment is exercised only under extreme conditions. This article does not take a stand on this debate, and considers both potential explanations in the modeling approach.

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7For example, they include taxes, debt, public goods, and transfers.
8For example, in Battaglini and Coate (2008) distortionary taxation provides a self-insurance motive that pushes debt down.
4.3 The Model

The benchmark quantitative model of sovereign default (Eaton and Gersovitz, 1981; Aguiar and Gopinath, 2006; Arellano, 2008) is extended to incorporate long term bonds (Chatterjee and Eyigungor, 2012) and the political process developed in Battaglini and Coate (2007, 2008) and those author’s subsequent papers, in particular Battaglini and Barseghyan (2013).

4.3.1 The Economic Environment

A small open economy receives each period a stochastic endowment. Also, it trades a single good and a single asset with the rest of the world. Different from the benchmark model, there are $n$ types of domestic agents, each represented by a political party, indexed by $i = 1, \ldots, n$. There is a continuum of infinitely lived citizens in each of the $n$ parties. The size of the population in each party is normalized to one.\footnote{This setup is similar to those presented in Battaglini and Coate (2007, 2008) or Barseghyan and Guerdjikova (2011). Battaglini and Coate do not identify each type as a party, but as a geographical district that can receive transfers from the government and whose representatives bargain over the budget. Barseghyan and Guerdjikova modified the Battaglini and Coate setup to have two types of citizens. They are the elite and the workers, and the elite are divided into subgroups that bargain over policy. In this paper the types or groups are identified as parties, as, for example, Cuadra and Sapriza (2008) did in a previous article about the political economy of sovereign default.}

All the individuals in the economy have the same preferences, given by $u(c_t)$. Consumption for party $i$ at period $t$ is $c_t^i$ and $u(\cdot)$ is increasing and strictly concave. The stochastic endowment $y_t$ follows the typical autoregressive process, described later in section (4.4.1).

At the beginning of each period and for a country that has access to capital markets, the policymaker will make a decision regarding paying back the bond or defaulting. A detailed description of who is the policymaker will be discussed in the following section. Depending on this decision, the budget constraint faced by the policymaker will differ. In the event of repayment, the budget constraint is the following

$$\sum_{i=1}^{n} c_t^i = y_t + [\eta + (1 - \eta) \zeta] a_t - q_t [a_t+1 - (1 - \eta) a_t]$$ (4.1)

The above specification corresponds to the random-maturity bond specification of Chatterjee and Eyigungor (2012). Let $a_t$ be the net foreign assets held by the small open econ
omy. Each unit of outstanding net foreign assets matures next period with probability \( \eta \), paying out one unit of consumption. When the bond does not mature, in this case with probability \( 1 - \eta \), then it pays a coupon equal to \( \zeta \) units of consumption. Because bonds are assumed to be infinitesimally small, current obligations for the country are given by 
\[
[\eta + (1 - \eta) \zeta] a_t.
\]
Also, the bonds issued this period are indistinguishable from the bonds that did not mature and all are traded at the price \( q_t \) per unit. For this reason, the new resources available for consumption are given by the market value of the difference between the new level of net assets and the number of bonds previously issued that did not mature, or 
\[
q_t [a_{t+1} - (1 - \eta) a_t].
\]
If \( \eta = 1 \), the bond structure becomes the one-period specification used in Aguiar and Gopinath, or Arellano. The introduction of long maturity bonds is a crucial ingredient for calibrations that generate high ratios of debt over output.

In the event of default or if the country did not repay in the past and is still in financial autarky, the budget constraint is given by

\[
\sum_{i=1}^{n} c_i^t = \varphi(y_t)
\]  

(4.2)

This budget constraint reflects that the economy has no access to capital markets, which constitutes the first cost of default. The second cost is a loss in terms of output represented by the function \( \varphi(y_t) \), which is discussed later. The description of the two budget constraints is similar to the one in Cuadra and Sapriza (2008), but these authors restrict their attention to the case of two political parties and one-period debt. This highly stylized setup is useful to illustrate the distributional incentives related to a bargaining mechanism in the context of a sovereign debt problem, but it completely abstracts of many important fiscal policy issues, among other relevant aspects of reality. This point is highlighted because it would be very difficult to argue that the resulting distribution of resources is a good proxy of income inequality.

Define the net resources available in the economy as the right hand side of the equation (4.1) in the event of repayment, and \( \varphi(y_t) \) in the event of default (4.2). Finally, define \( \lambda \) as the probability that after default, or in a situation without access to capital markets, the country regains access to credit for the beginning of the next period. If this is the case, the
economy starts with zero net assets.

4.3.2 The Political Process

The main features of the political process are as follows. For the \( n \) parties, one citizen from each party is selected to be a representative. Since all citizens have the same preferences, the selection process can be ignored.

At the beginning of the period and under access to capital markets, one policy proposer is randomly selected and there is an initial proposer’s decision to default or not, as in the standard model of sovereign default. The decision will be taken after the proposer observes the realization of the endowment. The value function for the policy proposer or the party in power of an economy with access to capital markets is \( v^p(a_t, y_t) \). The superscript \( p \) denotes the policy proposer. If the country defaults, the value function of the proposer is \( v^{p,B}(y_t) \), and if it repays, the value function is \( v^{p,G}(a_t, y_t) \). The credit status decision is given by \( h \in \{G, B\} \). \( B \) denotes a bad credit history (default) and \( G \) denotes a good credit history (repayment). Considering the previous description, an economy with good credit standing will default if \( v^{p,B}(y_t) > v^{p,G}(a_t, y_t) \).

This specification assumes that the default decision does not need to be approved by the legislature. However, the value of default or repayment will depend on the distribution of resources. The approval and implementation of this distribution needs to receive the support of a given number of parties. In particular, the budgetary process is modeled as a non-cooperative bargaining process between self-interested parties.

Previously, it was mentioned that at the beginning of the period and under access to capital markets, one policy proposer is randomly selected. This also occurs if the country is in autarky, because resources should be distributed among parties in any case. The random process at the beginning of the period will also contemplate the selection of \( \gamma - 1 \) representatives. In the scenario of access to capital markets \((h = G)\) or without \((h = B)\), the proposer will choose a policy platform that could be approved or not. It is assumed that \( \gamma \leq n \) votes are necessary to approve policy. The proposer and the \( \gamma - 1 \) representatives are considered the minimal winning coalition (MWC). The size of the MWC (\( \gamma \)) is not restricted
to be half of the representatives.\textsuperscript{10} Denote by $j \in \{p, c, e\}$ the representative's role, where $p$ stands for the proposer, $c$ refers to the other MWC members and $e$ the representatives excluded from the MWC.

The bargaining process takes place each period. As usual, there can be different rounds for each process and representatives meet at the beginning of each round. Each meeting takes an infinitesimal amount of time, or there is no discounting between rounds. There will be one bargaining process if the proposer defaults, considering the budget constraint (4.2); and a different one if the proposer repays, using the constraint (4.1). In the first case, representatives will bargain over the distribution of the endowment; in the second case, they will approve the distribution of resources and the new level of net assets ($a_{t+1}$). Let the first proposed distribution of resources be $(c^{p,h}_t, c^{c,h}_t, c^{e,h}_t)$. For $h \in \{G, B\}$ and period $t$, under this platform the policy proposer receives $c^{p,h}_t$, the other MWC members get $c^{c,h}_t$, and the representatives excluded from the MWC receive $c^{e,h}_t$.\textsuperscript{11}

If the first proposal or policy platform is accepted by $\gamma$ members, then it is implemented and the bargaining process ends. If it is not, nature chooses again a randomly selected proposer and the rest of the representatives of the coalition for the bargaining-process second round. This new proposer can choose an alternative policy platform. The process continues until a proposal is approved for this period. If after $T \geq 2$ rounds no proposal has been accepted, then a default policy is implemented. The default policy should be feasible ((4.1) and (4.2)) and it involves a uniform distribution of resources.

Finally, it is assumed that $c^{e,h}_t = c^e$, the consumption of the excluded is exogenous and constant for $t$ and $h$, as in Battaglini and Barseghyan (2013). The level of consumption $c^e$.

\textsuperscript{10}This assumption reflects the fact that the process for the budget’s approval is quite different in the U.S. and in emerging markets. In the U.S. the Congress has great influence over the budget. The literature has captured this fact modeling pork barrel spending (Weingast et al., 1981). As was mentioned before, Battaglini and Coate (2007) studied why pork might be overprovided. Drazen and Ilzetzki (2011) presents the case in which pork is useful because it greases the legislative wheels. Hence, in the numerical simulations of Battaglini and Coate’s models, $\gamma$ is set to 0.5. Different from this situation, in Latin America (the region that experienced more default episodes), Congress does not play a crucial role in terms of budgetary decisions (Hallerberg et al., 2009). For example, in most cases there are formal restrictions to change the executive’s budget proposal. Legislators are not allowed to increase expenditures (just to reallocate them) or they are required to ‘identify’ additional sources of funding. In the case of Chile, legislators are allowed only to reduce expenditures. Congressional influence also can be limited by allowing only a short time to analyze the executive’s proposal.

\textsuperscript{11}For this policy platform and in the following sections, the notation that corresponds to the bargaining round is not included. As discussed in the following section, in equilibrium the first proposal will be accepted.
is the minimum level of consumption that any party should get, and it is associated with a minimum level of utility. For this to be true, it is assumed that $y_t > nc^e$. Importantly, it captures the idea that those who are not in power typically do not benefit from the government’s decisions. In other words, if political parties are self-interested, then policymakers do not have any incentive to give more resources to parties that are out of the coalition, simply because their votes are not needed.

### 4.3.3 The Political Equilibrium

The analysis presents four stages. First, as an outcome of the bargaining process the distribution of resources is characterized as a function of the degree of political instability and fragmentation. Second, the optimal plan for a policy proposer that today is in power but might lose office next period is studied. Third, the country’s default policy and the behavior of international investors are discussed. Finally, the definition of the equilibrium is given.

#### Bargaining Over the Budget

One important implication of the bargaining process is that the selected proposer will always try to provide enough consumption to the $\gamma - 1$ representatives to guarantee their vote. If this is not the case and the bargaining process moves to the next stage, the proposer will lose the bargaining power associated with the possibility of making the proposal.

To characterize the political equilibrium, it is assumed that representatives vote for a policy platform if they prefer it (weakly) to continuing into the next proposal round (weakly stage undominated strategies). This is a standard assumption in the theory of legislative voting.

In each of the two potential scenarios, default or repayment, the proposer will choose a policy platform to maximize his utility subject to the resource constraint and to an incentive compatibility constraint (IC). The IC constraint guarantees that the proposal is approved
by $\gamma$ votes (by the other MWC members). For $h \in \{G, B\}$, the constraint is given by

$$u(c_{t}^{c,h}) + \beta v_{cont}^h \geq v_{out}^h$$

(4.3)

In this case, $v_{cont}^h$ denotes the continuation value for the MWC members, while $\beta$ is the discount factor. Importantly, $v_{out}^h$ is the expected utility of an MWC member of voting "no" and therefore moving to the next round of the bargaining game, in which a new proposer is randomly selected. The constraint will bind in equilibrium, because the proposer will minimize the cost of obtaining a MWC. Hence, in equilibrium, there will be only one round or the first proposal will be accepted. The next result is derived in Appendix 1.

**Lemma 1.** In equilibrium the incentive compatibility constraint (4.3) is satisfied if and only if $c_{t}^{c,h} = u^{-1}\left(\Gamma \left[u\left(c_{t}^{p,h}\right) + (n - \gamma) u(c^e)\right]\right)$; where $h \in \{G, B\}$ and $\Gamma = 1/(n - \gamma + 1) \in (0, 1]$. Also, $c_{t}^{c,h} \in (c^e, c_{t}^{p,h})$.

The first lemma reflects that the proposer should provide enough consumption to the MWC members to be indifferent between voting "yes" and "no". For this reason, $u\left(c_{t}^{c,h}\right)$ is equal to the expected utility of moving to the next round, where the uncertainty is related to the future role of the current MWC members. In other words, $u\left(c_{t}^{c,h}\right) = \mathbb{E}_{j}u\left(c_{j}^{c,h}\right)$. As a result, the condition in Lemma 1 indicates that the MWC members will get a weighted average of the consumption for the proposer and the consumption of those excluded.

The conditions derived in Lemma 1, the budget constraints (4.1)-(4.2) and $c^e$, implicitly define the functions $c_{t}^{p,h}(R_{t}^{h})$ and $c_{t}^{c,h}(R_{t}^{h}) \in (c^e, c_{t}^{p,h}(R_{t}^{h}))$; where $R$ denotes net resources available in the economy, $R_{t}^{G} = y_{t} + [\eta + (1 - \eta) \zeta] a_{t} - q_{t} \left[a_{t+1} - (1 - \eta) a_{t}\right]$ if $h = G$, and $R_{t}^{B} = \varphi(y_{t})$ if $h = B$. These consumption levels, and the number of parties and the coalition size, determine the distribution of resources in the economy. The previous formulation allows to define two scenarios, one in which the distribution of resources is equal among parties and another in which it is not.

**Definition 1.** The central planner’s case is a situation where $\gamma = n$, or there are no parties excluded from the MWC.

\footnote{Note that $c_{t}^{p,h}(R_{t}^{h})$ is given by $c_{t}^{c,h} + (\gamma - 1) u^{-1}\left(\Gamma \left[u\left(c_{t}^{p,h}\right) + (n - \gamma) u(c^e)\right]\right) + (n - \gamma) c^e = R_{t}^{h}$. Given the consumption for the proposer, $c_{t}^{c,h}(R_{t}^{h})$ is derived using the condition from Lemma 1.}
Note that in the central planner’s case $\Gamma = 1$ and $c^{c,h}_t (R^h_t) = c^{p,h}_t (R^h_t)$. In this scenario all the parties are equally important and receive the same level of consumption. A different situation occurs when a positive number of parties has been excluded from the MWC. When the number of parties excluded is very high, then $c^{c,h}_t (R^h_t) \approx c^e$.

**Definition 2.** Political fragmentation is a situation in which $\gamma < n$ or $\Gamma < 1$. The degree of political fragmentation is given by the number of parties excluded from the MWC, or $n - \gamma$. Political instability is a situation in which $n > 1$. The degree of political instability is given by the inverse of the probability of being elected as a proposer, or $n$.

An important aspect to understand is how the levels of consumption are affected by different degrees of political instability or fragmentation. The following lemma provides an incomplete and static analysis on how the consumption of the MWC members is affected by changes in $n$ and $\gamma$. The result is derived in Appendix 1.

**Lemma 2.** For a given level of net resources, the consumption of the members of the MWC is decreasing in $(n - \gamma)$.

This result can be explained as follows. The higher $(n - \gamma)$ or the possibility of being left out of the coalition in the scenario of voting "no", the lower is the level of consumption that the MWC members can request to the proposer today. This rationalizes why the consumption of the MWC members is decreasing in $(n - \gamma)$. The interpretation is that the proposer will be able to exploit the bargaining power derived from the possibility of making the policy proposal, as in most bargaining games, if there is fragmentation.

The analysis of Lemma 2 assumes that the level of net resources available in the economy is given. However, different levels of political instability and fragmentation will affect the level of debt that can be sustained through changes in bond prices, and consequently the levels of consumption that the parties can achieve. Section 4.4.8 discusses the general equilibrium effects of changes in political factors over debt and default probabilities.

**The Policymaker’s Optimal Plan**

Every period a proposer is randomly selected to choose policy. Even though the proposer can change over time, since all party representatives are identical, the problem for the
policymaker elected at period \( t \), from the point of view of period \( t \), will be the same as the problem that corresponds to the proposer at \( t + 1 \), from the point of view of \( t + 1 \).

The same is not true for a particular representative elected at \( t \), which needs to choose an optimal plan (for periods \( t, t + 1, t + 2 \ldots \)). If today a representative is selected to be the incumbent, there is a non-negligible chance that this representative will have a different role next period. This will affect the optimal plan. What follows presents a discussion about the problem of a particular representative that has been selected today as policymaker.

For a country with access to capital markets, once a proposer is selected he faces the following problem, denoted by (\( \mathcal{P}.0 \))

\[
v^p(a_t, y_t) = \max_{d_t \in \{0,1\}} \left\{ v^p_G(a_t, y_t), v^p_B(y_t) \right\}
\]

(\( \mathcal{P}.0 \))

The value of default is given by

\[
v^{p,B}(y_t) = u \left( c^{p,B}_t \left( R^B_t \right) \right) + \beta E_{y_{t+1}|y_t} \left[ \lambda v^p(0, y_{t+1}) + (1 - \lambda) v^{p,B}(y_{t+1}) \right]
\]

(4.4)

s.t. \( R^B_t = \varphi(y_t) \)

Note that \( c^{p,B}_t \left( R^B_t \right) \) is implicitly defined by the budget constraint (4.2) and the IC constraint (4.3), as indicated before.

The value of repayment is given by

\[
v^{p,G}(a_t, y_t) = \max_{a_{t+1}} \left\{ u \left( c^{p,G}_t \left( R^G_t \right) \right) + \beta E_{y_{t+1}|y_t} v^p(a_{t+1}, y_{t+1}) \right\}
\]

(4.5)

s.t. \( R^G_t = y_t + [\eta + (1 - \eta) \zeta] a_t - q_t [a_{t+1} - (1 - \eta) a_t] \)

As in the case of default, \( c^{p,G}_t \left( R^G_t \right) \) is implicitly defined by the budget constraint (4.1) and the IC constraint (4.3).
The problem above follows closely the standard model of sovereign default. After default, there is an exogenous probability ($\lambda$) of regain access to the capital markets (with zero net assets for the next period) and resources are limited to the endowment in default ($\varphi(y_t)$). A first difference with the benchmark model is that the proposer will choose how to distribute the resources, following the IC constraint (4.3) to approve the budget. Under the scenario of repayment, a distribution of resources and the level of net assets are chosen by the proposer and accepted by the MWC. The second difference is that today’s value function for the current proposer is not equal to the continuation value of the problem ($v^p(a_t, y_t) \neq V^p(a_t, y_t)$), as equations (4.4) and (4.5) indicate.

In particular, the continuation value for today’s proposer (for period $t + 1$ and the subsequent ones, but expressed in terms of $t$) is a problem ($P.1$) defined as follows

$$V^p(a_t, y_t) = (1 - d_t(a_t, y_t)) V^{p,G}(a_t, y_t) + d_t(a_t, y_t) V^{p,B}(y_t)$$  \hspace{1cm} (P.1)

The value function under default, $V^{p,B}(y_t)$, is given by

$$V^{p,B}(y_t) = \Gamma u \left( c^{p,B}_t \left( R^{B}_t \right) \right) + K + \beta \mathbb{E}_{y_{t+1}|y_t} \left[ \lambda V^p(0, y_{t+1}) + (1 - \lambda) V^{p,B}(y_{t+1}) \right]$$  \hspace{1cm} (4.6)

Subject to the same constraint as in ($P.0$). The same is true for the value function under repayment, $V^{p,G}(a_t, y_t)$, which is given by

$$V^{p,G}(a_t, y_t) = \Gamma u \left( c^{p,G}_t \left( R^{G}_t \right) \right) + K + \beta \mathbb{E}_{y_{t+1}|y_t} V^p(a_{t+1}(a_t, y_t), y_{t+1})$$  \hspace{1cm} (4.7)

Note that ($P.1$) is expressed in terms of the policy functions.\textsuperscript{13} This is the case because the policy functions that solve ($P.0$) given ($P.1$), should also satisfy ($P.1$). In other words,

\textsuperscript{13}The default decision corresponds to $d_t(a_t, y_t)$, the borrowing decision is given by $a_{t+1}(a_t, y_t)$. The equilibrium condition for international capital markets, described in the next section, is given by $q_t(a_{t+1}(a_t, y_t), y_t)$. 
the equilibrium is given by a fixed point that satisfies \((P.0)\) and \((P.1)\). For the last two
value functions given in (4.6) and (4.7), \(\mathcal{K}\) is a constant given by \(\mathcal{K} = \Gamma (n - \gamma) u (c^e)\). This
completes the description of the problem. The derivation is given in Appendix 1.

From the previous description, at period \(t\) the selected policy proposer will face a prob-
lem \((P.0)\) that is not equal to the problem represented by the continuation value \((P.1)\).
The difference is explained by the possibility of losing office. From the point of view of the
representative that has been selected to be the proposer today, next period this representa-
tive could be the proposer again \((p)\), be part of the MWC \((c)\), or excluded from the MWC
\((e)\). From Lemma 1, this future uncertainty can be eliminated because the IC constraint
will equate the expected utility of the group’s role \((p, c, or e)\) with the utility of the MWC
members \((c)\), as discussed before. This will change the continuation value under default
and repayment, introducing the wedge \(\Gamma\) before the utility of the proposer and adding the
constant \(\mathcal{K}\) in the objective function.

The implications of the differences introduced in the continuation value are straight-
forward. When there is political fragmentation \((\Gamma < 1)\), today’s proposer will discount
more his future utility when deciding its optimal plan.\(^{14}\) This implies that the proposer
will not fully internalize the future repayment/default costs, or policymakers will become
short-sighted. The presence of short-sighted policymakers and an unequal distribution of
resources will affect the endogenous borrowing limit generated by this type of models, as
well as the incentives to default, as will be discussed later.

On the contrary, in the central planner’s case all the parties receive the same level of
consumption. Because \(\Gamma = 1\) and \(\mathcal{K} = 0\) in this case, the value functions of \((P.0)\) and \((P.1)\)
are the same. This implies that the policymakers’ short-sightedness is driven by the political
structure of the system, in particular the existence of political fragmentation, which implies
the possibility of obtaining a more favorable distribution of resources. Also, the model with
instability and fragmentation nests the benchmark model of default as a special case when
\(n = \gamma = 1\) (or when \(\Gamma = 1\) and \(\mathcal{K} = 0\)).

\(^{14}\)In other words, the proposer will choose an optimal plan assuming that in the following periods
he will be an MWC member. As indicated in Lemma 1, \(c^{c,h}_t (R^h_t) \in \{c^e, c^{c,h}_t (R^h_t)\}\) and if \(\Gamma < 1\) then
\(c^{c,h}_t (R^h_t) < c^{c,h}_t (R^h_t)\).
Default Policy and International Investors

The policymaker’s default policy can be characterized by default sets \((D)\) and repayment sets \((A)\). Define

\[
A(a_t) = \{ y_t \in Y : v^{p,G}(a_t, y_t) \geq v^{p,B}(y_t) \}
\]

\[
D(a_t) = \{ y_t \in Y : v^{p,G}(a_t, y_t) < v^{p,B}(y_t) \}
\]

Given the default policy and a competitive international capital market with risk neutral investors, the market equilibrium implies that bonds are priced according to the zero profit condition

\[
q(a_{t+1}, y_t) = \mathbb{E}_{y_{t+1}|y_t} \left( \frac{1 - d_{t+1}(a_{t+1}, y_{t+1}) [\eta + (1 - \eta) (\zeta + q(a_{t+2}(a_{t+1}, y_{t+1}), y_{t+1}))]}{1 + r} \right)
\]

(4.8)

Where \(d_{t+1}\) is an indicator function. It takes the value of one if the proposer defaults, or \(d_t = 1\) if \(y_t \in D(a_t)\). In the event of repayment, there is a chance \(\eta\) that the bond will mature, and in the event the bond does not mature, with probability \(1 - \eta\), it will pay a coupon payment \(\zeta\) and will be priced at \(q\). The future cash flows are discounted at the international interest rate, which is given by \(r\). As usual, today’s price of the bond is linked to tomorrow’s default decision \((d_{t+1})\). While there is a chance that today’s proposer will not be in power tomorrow, whoever is the newly elected proposer will behave exactly as today’s given the corresponding state of nature, since all the individuals and representatives are ex-ante identical.

Definition of Equilibrium

In a symmetric Markov perfect equilibrium, any representative selected to be the proposer will make the same decisions depending on the state of the economy. Focusing on the bargaining game, at any round of the bargaining process any representative makes the same proposal and this proposal depends only on the level of net assets, the endowment
shock, and the economy’s credit standing. The focus is on equilibria in which at each round, proposals are immediately accepted by the MWC. Then, the first proposal in the first bargaining round is accepted and implemented.

For the following definition, any variable $x_t$ or $x_{t+1}$ is denoted by $x$ and $x'$ respectively, as it is the standard practice.

The model’s symmetric Markov perfect equilibrium is given by a set of value functions and policy functions. The value functions are $\tilde{v}^p \equiv \{v^p(a, y), v^{p,G}(a, y), v^{p,B}(y)\}$ for $(P.0)$ and $\tilde{V}^p \equiv \{V^p(a, y), V^{p,G}(a, y), V^{p,B}(y)\}$ for $(P.1)$. The policy functions correspond to: (i) consumption of the proposer $(c^{p,B}(y), c^{p,G}(a, y))$, (ii) a level of net assets $(a'(a, y))$, (iii) default sets $(D(a))$ and default probabilities, and (iv) the price function for sovereign bonds $(q(a', y))$. In equilibrium:

1. Taken as given the bond price function $(q(a', y))$ and $\tilde{V}^p$, the proposer’s policy functions $a'(a, y)$ and $D(a)$ solves $(P.0)$.

2. Taken as given $a'(a, y)$ and $D(a)$, then $c^{p,B}(y)$ and $c^{p,G}(a, y)$ satisfy the budget constraints and the incentive compatibility constraints for $(P.0)$.

3. The bond price function $(q(a', y))$ reflects the default probabilities for $(P.0)$ given $\tilde{V}^p$, and are consistent with the zero profit condition in international markets.

4. Taken as given the bond price function $(q(a', y))$ and the policy functions $a'(a, y)$ and $D(a)$, then $\tilde{V}^p$ satisfies $(P.1)$.

As mentioned before, the equilibrium is characterized by a set of policy functions that correspond to a fixed-point implied by $(P.0)$ and $(P.1)$.

### 4.4 Quantitative Analysis

The model is calibrated and solved numerically. The three following subsections complete the model specification, comment on the computational algorithm, and describe the calibration exercise, respectively. The simulations results, the nature of the mechanism, and the effects of the political parameters changes are presented in the last subsections.
4.4.1 Model Specification

As is typical in models of default, the utility function is assumed to be CRRA.

\[ u(c_t^i) = \frac{(c_t^i)^{1-\sigma}}{1-\sigma} \quad (4.9) \]

Where \( \sigma \) is the coefficient of relative risk aversion. The endowment follows an autoregressive process. Let \( y_t = \exp(z_t) \), where \( z_t = \tilde{\rho}z_{t-1} + \epsilon_t \) and \( \epsilon_t \sim N(0, \sigma_z^2) \).

The endowment process is truncated if the policymaker defaults. In particular, the functional form presented in Chatterjee and Eyigungor (2012) is used. The value of the endowment under default (\( \varphi(y_t) \)) is defined as follows

\[ \varphi(y_t) = y_t - \max\{0, \phi_0 + \phi_1y_t + \phi_2y_t^2\} \quad (4.10) \]

This functional form is flexible enough to capture two different specifications of the cost of default. As in Chatterjee and Eyigungor (2012), setting \( \phi_0 = 0, \phi_1 < 0, \phi_2 > 0 \) gives rise to an increasing and convex cost of default, in the spirit of Mendoza and Yue (2012). Setting \( \phi_0 = \tilde{\phi}\mathbb{E}(y_t), \phi_1 = 1, \phi_2 = 0 \) provides the Arellano (2008) specification cost, which is linearly increasing in the endowment realization. The simulations of the model will consider both cases, because the Arellano’s case was typically used in the earlier papers of default that focused on the one period bond scenario, while the Chatterjee and Eyigungor specification is commonly used in more recent papers of default, that also incorporate long maturity bonds.

4.4.2 Computational Algorithm

The details of the computational algorithm are presented in Appendix 2. There are two main departures from the standard value function iteration solution of models of sovereign default. First, the combination of the budget constraint ((4.1) or (4.2)) and the IC constraint (4.3) yields a nonlinear equation that has to be solved numerically. To reduce the computational burden, the optimal consumption for the proposer is solved outside of the iterative cycle, as in, for example, Maliar and Maliar (2005). Based on this solution, interpolation methods
are used in each iteration.

Second, the computational algorithm should look for a fixed-point that solves \((P.0)\) and \((P.1)\). The straightforward application of value function iteration fails to converge, because an initial candidate solution for \((P.0)\) is not a solution for \((P.1)\). This is a feature that characterizes the models with quasi-geometric discounting. Following Chatterjee and Eyigungor (2014), the value function under access to capital markets should be updated in each iteration using

\[
V^{p,G}(a_t, y_t)_{k+1} = (1 - \varsigma) V^{p,G}(a_t, y_t)_k + \varsigma V^{p,G}(a_t, y_t)_{k+1}
\]

Where \(\varsigma \in (0, 1)\) and is a very small number, \(k + 1\) is the current iteration, and \(k\) corresponds to the previous iteration. The value under default receives exactly the same treatment.

### 4.4.3 Calibration

Three calibration exercises have been carried out. The first one replicates the Arellano (2008) exercise, in order to see what are the effects of the introduction of political instability and fragmentation in the benchmark case. Given that the introduction of political factors using Arellano’s parameters does not yield the typical calibration targets, the second exercise changes these parameters maintaining the Arellano’s cost of default specification and considers the case of short-term bonds. The third exercise uses a convex cost of default and long term bonds, as in Chatterjee and Eyigungor (2012), but in a way different from these authors, the calibration targets the probability of default and not debt levels.

Following the standard practice for the quantitative models of sovereign default, the model is set to a quarterly frequency. All the parameters are standard in the literature and are presented in Table 4.1. For example, the coefficient of risk aversion was set to 2.0 and the world interest rate is 1.0\%, as in almost all the models of default. The autocorrelation of shocks is 0.916 and the standard deviation of shocks is 3.1, and the information corresponds to the GDP of Argentina from 1980:1-2001:4.\(^{15}\) The probability of reentry after default is

\(^{15}\text{The source of the data is the Ministerio de Economía and Finanzas Públicas of Argentina. The same}
Table 4.1: Calibration: Short-Term Bonds and Long-Term Bonds cases

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STANDARD PARAMETERS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risk aversion</td>
<td>$\sigma$</td>
<td>2.0 Standard</td>
</tr>
<tr>
<td>World interest rate</td>
<td>$r$</td>
<td>0.01 Standard</td>
</tr>
<tr>
<td>Probability of redemption</td>
<td>$\lambda$</td>
<td>0.0385 Argentina’s data</td>
</tr>
<tr>
<td>Autocorrelation of shocks</td>
<td>$\rho$</td>
<td>0.916 Argentina’s data</td>
</tr>
<tr>
<td>Standard dev. of shocks</td>
<td>$\sigma_z$</td>
<td>0.031 Argentina’s data</td>
</tr>
<tr>
<td>Probability that the bond matures</td>
<td>$\eta$</td>
<td>1 / 0.05 Argentina’s data</td>
</tr>
<tr>
<td>Coupon payments</td>
<td>$\zeta$</td>
<td>0 / 0.03 Argentina’s data</td>
</tr>
<tr>
<td>Discount factor</td>
<td>$\beta$</td>
<td>0.98 Calibrated / Calibrated</td>
</tr>
<tr>
<td>Output cost specification</td>
<td>$\phi_0$</td>
<td>1.04E (yt) / 0 Calibrated / -</td>
</tr>
<tr>
<td>Output cost specification</td>
<td>$\phi_1$</td>
<td>1 / -0.35 - / Calibrated</td>
</tr>
<tr>
<td>Output cost specification</td>
<td>$\phi_2$</td>
<td>0 / 0.44 - / Calibrated</td>
</tr>
<tr>
<td><strong>POLITICAL PARAMETERS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumption for the excluded</td>
<td>$c^e$</td>
<td>0.079 Calibrated / Calibrated</td>
</tr>
<tr>
<td>Total ENPP</td>
<td>$n$</td>
<td>1.75 Argentina’s data</td>
</tr>
<tr>
<td>ENPP in gov. coalition</td>
<td>$\gamma$</td>
<td>1.27 Argentina’s data</td>
</tr>
<tr>
<td><strong>TARGETS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual probability of default</td>
<td>3.0 / 3.0</td>
<td>Argentina’s data</td>
</tr>
<tr>
<td>$\sigma(c)/\sigma(y)$</td>
<td>1.09 / 1.09</td>
<td>Argentina’s data</td>
</tr>
<tr>
<td>$\sigma(TB/y)/\sigma(y)$</td>
<td>- / 0.34</td>
<td>Argentina’s data</td>
</tr>
<tr>
<td>Income share for the highest 6 deciles</td>
<td>0.89 / 0.89</td>
<td>Argentina’s data</td>
</tr>
</tbody>
</table>

Note: ST denotes short-term and LT denotes long-term. ENNP is effective number of political parties.

the same as in Chatterjee and Eyigungor (2012) and is equal to 0.0385. Considering this value, for a country it takes, on average, six and a half years to reenter capital markets. This length of exclusion corresponds to the default episodes of Argentina for 1982 and 2001, and the details of this estimation are discussed in Uribe and Schmitt-Grohé (2015). The characteristics of the long-term debt also come from Chatterjee and Eyigungor.

The first two political parameters correspond to Argentina’s information on the number of political parties; the source is the World Bank’s Database of Political Institutions (Beck et al., 2001). First, the total number of political parties, $n$ in the model, plays a dual role in reality. It can be interpreted as the parties in power (executive), as well as the total number of parties in Congress. Since in the model $n$ reflects the potential number of policymakers, and Latin America is characterized by presidential regimes (the role of Congress is not crucial in the budget approval, as indicated in Hallerberg, Scartascini, and Stein (2009)), is true for the estimations of the business cycle characteristics of other macro variables. Data on historical yields from Neumeyer and Perri (2005) is used. As in Arellano (2008) and Chatterjee and Eyigungor (2012), a linear trend is used to obtain these estimates. The simulations use subsamples of 88 periods.
then the total number of parties in the executive was used.\textsuperscript{16}

Importantly, for the calibration exercise, \( n \) and \( \gamma \) are interpreted as a \textit{measure} of the number of parties, rather than the actual number of parties, where the proposer has size one. This is done following the empirical literature about the relation between fiscal policy outcomes and the number of parties. This literature uses the effective number of political parties (ENPP) for the estimations, and not the actual number of parties.\textsuperscript{17} The same is done in the first chapter of the dissertation, where an empirical analysis using a sample of emerging countries is carried out to test the predictions of the model. During the period 1984-2012, three major political parties have held executive branch positions in Argentina.\textsuperscript{18} Based on the years in power, the ENPP is set to 1.75. In order to calculate the number of parties that belong to the government coalition, the percentage of votes of all the parties that at some point belong to the coalition was calculated. Besides the three parties in the executive, a fourth party was considered.\textsuperscript{19} On average, these four parties represent 0.73\% of the votes in Congress between 1984 and 2012. Based on this number, \( \gamma \) was set to 1.27.

For the second calibration exercise, that considers Arellano’s cost of default and short-term bonds, the three remaining parameters \( \beta, \phi_0 \) and \( c_e \) are selected to match (i) an annual probability of default of 3\%; (ii) the relative volatility of consumption and output \( (\sigma(c)/\sigma(y)) = 1.09 \); and (iii) a measure of the distribution of resources, in this case the income share for the highest 6 deciles\textsuperscript{20} in Argentina, which is equal to 0.89 for the period 1998-2003 in the main 28 cities in the country.\textsuperscript{21} The discount factor is set to 0.98. This value is above the 0.954 of Chatterjee and Eyigungor (2012), 0.953 used in Arellano (2008), 0.88 of Mendoza and Yue (2012), and 0.80 used by Aguiar and Gopinath (2006). In the case of the cost of default, \( \phi_0 = 1.04E(y_t) \).\textsuperscript{22} Finally, \( c_e \) is set equal to 0.079. Under this

\textsuperscript{16}See footnote 10 for a discussion about the role of Congress in presidential regimes and in Latin America.
\textsuperscript{17}See the first chapter for a formal definition of the ENPP.
\textsuperscript{19}The party was UdCD, that formed part of the government coalition between 1991 and 1995.
\textsuperscript{20}The share for the proposer in terms of the number of political parties is 1/1.75=0.57. In terms of the target income share is 0.89.
\textsuperscript{21}The source is SEDLAC (CEDLAS and The World Bank).
\textsuperscript{22}This value is higher than the one used by Arellano (0.969E(y_t)). A higher value reduces the cost of default, facilitating default. However, this is done because the other cost of default (time of the country in autarky) was increased with respect to Arellano’s calibration. This is because Arellano considered an extremely short period of time (less than a year) in autarky.
value, each group excluded receives 10% of the lowest realization of the endowment \( y_{\text{min}} \) and gives a distribution of income similar to the target. It should be noted that it is evident that the model is too stylized to explain the differences in income within a country, but a measure was necessary to impose discipline to the calibration. In practice, a high share of resources in favor of the policymaker aims to represent the political benefits of being in power. More importantly, as is discussed in the following sections, the focus will be on how this share can change under different states of nature.

The third calibration exercise incorporates long-term bonds and a convex cost of default. In this case, \( \beta, \phi_1, \phi_2 \) and \( c^e \) are selected to match (i) an annual probability of default; (ii) the relative volatility of consumption and output \( \sigma(c)/\sigma(y) \); (iii) a measure of the distribution of resources; and (iv) the relative volatility of the trade and output \( \sigma(TB/y)/\sigma(y) \) of 0.34. For this case, \( \phi_1 = -0.35 \) and \( \phi_2 = 0.4403 \), which corresponds to the values selected by Uribe and Schmitt-Grohé (2015) to achieve similar targets. In this case, the values chosen by Chatterjee and Eyigungor were not used, because they target debt levels and as a consequence they obtained a default frequency of 6.8%.

### 4.4.4 Results

Simulation results are reported in Table 4.2. The most important result is that the model with political instability and fragmentation \( I\&F \) is able to generate higher ratios of debt/output and, at the same time, increases the probability of default. The valid comparison for the model with political factors is the central planner’s scenario \( CP \). In this model, this would be the case of a representative that gives equal consumption to each of the parties, since none of these is excluded from the coalition, as noted after Lemma 1. The mechanism behind this main result is discussed later.

The logic of the three calibration exercises is as follows. In the first case, all the parameters of Arellano (2008) are used, in order to make the most transparent comparison with this model. While Arellano achieved a default probability of 3% and a debt/output ratio above 5%, the introduction of political factors increases the chances of default up to 4.82% and the debt ratio rises almost four times (19.63%). While there are small changes
Table 4.2: Results: with Instability and Fragmentation (I&F) and the Central Planner (CP)

<table>
<thead>
<tr>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Argentina</td>
<td>CP</td>
<td>I&amp;F</td>
<td>CP</td>
</tr>
<tr>
<td>$\sigma(y)$</td>
<td>7.87</td>
<td>5.69</td>
<td>5.90</td>
<td>6.89</td>
</tr>
<tr>
<td>$\sigma(c)$</td>
<td>8.60</td>
<td>6.21</td>
<td>6.82</td>
<td>6.88</td>
</tr>
<tr>
<td>$\sigma(TB/y)$</td>
<td>2.66</td>
<td>1.39</td>
<td>2.66</td>
<td>0.66</td>
</tr>
<tr>
<td>$\sigma(\text{spread})$</td>
<td>5.61</td>
<td>5.98</td>
<td>10.81</td>
<td>0.24</td>
</tr>
<tr>
<td>$\rho(y, TB)$</td>
<td>-0.89</td>
<td>-0.24</td>
<td>-0.12</td>
<td>0.04</td>
</tr>
<tr>
<td>$\rho(y, spread)$</td>
<td>-0.83</td>
<td>-0.22</td>
<td>0.15</td>
<td>-0.50</td>
</tr>
<tr>
<td>$\rho(y, c)$</td>
<td>0.97</td>
<td>0.97</td>
<td>0.91</td>
<td>1.00</td>
</tr>
<tr>
<td>$\rho(TB, spread)$</td>
<td>0.78</td>
<td>0.28</td>
<td>0.10</td>
<td>0.16</td>
</tr>
<tr>
<td>Average Spread</td>
<td>11.64</td>
<td>6.24</td>
<td>6.86</td>
<td>0.12</td>
</tr>
<tr>
<td>$\sigma(c)/\sigma(y)$</td>
<td>1.09</td>
<td>1.16</td>
<td>1.09</td>
<td>1.00</td>
</tr>
<tr>
<td>$\sigma(TB/y)/\sigma(y)$</td>
<td>0.34</td>
<td>0.24</td>
<td>0.45</td>
<td>0.09</td>
</tr>
<tr>
<td>Proposer’s Share</td>
<td>0.89</td>
<td>1.00</td>
<td>0.91</td>
<td>0.57</td>
</tr>
<tr>
<td>Default Probability</td>
<td>3.00</td>
<td>3.07</td>
<td>4.82</td>
<td>0.12</td>
</tr>
<tr>
<td>Mean Debt/$y_{quarterly}$</td>
<td>[86.2 - 172.4]</td>
<td>5.19</td>
<td>19.63</td>
<td>6.78</td>
</tr>
</tbody>
</table>

in the business cycle statistics, the most notorious one is the correlation between output and the spread ($\rho(y, spread)$), which varies from a negative value (like in the data), to a positive one. This result can be interpreted through the lens of the findings of Tomz and Wright (2007), which found that there is a weak correlation between default decisions and economic conditions. Tomz and Wright conjectured that the inclusion of political turnover in the benchmark model of default might weaken this correlation.

The second calibration exercise [2] maintains the Arellano’s specification of the cost of default and the one-period bonds setup, while achieving a probability of default of 2.8% and a debt ratio of 23%. The third calibration exercise [3], with a convex cost of default and long-term debt, yields the desired probability of default and provides a realistic debt over output ratio of 112%. At the same time, this exercise presents the correct sign for the correlation between the spread and output, although the ratio of the volatility of consumption over output is slightly above the target.\textsuperscript{23} The actual range for debt of [86.2-172.4] was calculated following Uribe and Schmitt-Grohé (2015). The average ratio of public debt over annual GDP in Argentina for the period 1980-2001 was 43.1% (with an average for

\textsuperscript{23}In fact, it is possible to achieve high ratios of debt to output using the framework of the second calibration. However, the ratio of the volatility of consumption over output explodes, as indicated in Chatterjee and Eyigungor (2012).
Figure 4.1: Borrowing contracts - Bond price schedule & debt Laffer curve

(a) Bond price schedule
(y-axis: price of the bond; x-axis: net assets, $a_{t+1}$)

(b) Debt Laffer curve
(y-axis: $q_t (a_{t+1}, y_t) a_{t+1}$; x-axis: net assets, $a_{t+1}$)

Note: The figures in panel (a) and (b) correspond to the case of an initial level of net assets $a_t = -0.0604$. The model corresponds to the one-period bond case.

the exclusion period of 2002-2005 of 129.64%). Also, considering an average haircut of 50% for the default episodes of 1982 and 2001 and the fact that the model assumes that the country defaults on 100% of its debt, then it can be assumed that at least half of the annual debt/output ratio (21.55%) is unsecured debt. This value translated into a quarterly frequency represents the lower bound for the debt to output ratio (86.2%). The upper bound assumes that the haircut was zero.

4.4.5 Borrowing Contracts and the Policymaker’s Share

This section analyzes the distributional incentives for the proposer in terms of borrowing decisions. In order to make the exposition simpler, transparent, and closer to the benchmark model, the second calibration exercise [2] is used for the discussion. The same is true for the following sections.

The bond price schedule and the usual debt Laffer curve associated with models of sovereign default, explained in Arellano (2008), are shown in Figure 4.1. For the one-period debt model [2], the price schedule reveals the set of contracts $\{q_t (a_{t+1}, y_t), a_{t+1}\}$ between

\footnote{Uribe and Schmitt-Grohé (2015) considers the net external debt in Argentina for the period 1994-2001, which was around 30% of GDP.}
the country and international investors that the proposer can choose every period, given an initial level of net assets.\textsuperscript{25} The two typical characteristics of these contracts are that the bond price is an increasing function of net assets (or a decreasing function of debt), and that more favorable contracts are associated with higher endowment shocks. Because the model is able to sustain higher levels of debt, bond prices start declining only for levels above 15% of GDP, for the standard analysis of shocks 5% above and below the trend. Another important characteristic of these contracts is the countercyclical borrowing constraints, which are reflected in panel (b) of Figure 4.1. The debt Laffer curve associated with these contracts shows that resources available from borrowing, \( q_t (a_{t+1}, y_t) a_{t+1} \), are first increasing and then decreasing in net assets. The second effect is driven by falling bond prices associated with increasing levels of borrowing. As the figure indicates, this effect is more important in the bad states of nature.

In the benchmark model, the endogenous debt Laffer curve reveals the relevant set of potential choices for borrowing.\textsuperscript{26} In this model, it is the interplay of the debt Laffer curve and the distribution of resources associated with the set of contracts \( \{q_t (a_{t+1}, y_t), a_{t+1}\} \) that matters in terms of borrowing decisions. In other words, in the benchmark case only the ‘size of the pie’ is relevant, while in this model it is the ‘size and the proposer’s share of the pie’. Hence, in the benchmark model, debt is used only for smoothing consumption purposes, while in the model with political instability and fragmentation, distributional considerations also play a role. Figure 4.2 shows the proposer’s share of net resources for different levels of net assets, where the share for the one-period bond model is defined by:

\[
\frac{c_t^{p,G}}{y_t + a_t - q_t (a_{t+1}, y_t) a_{t+1}}.
\]

Since the discussion corresponds to the same set of contracts presented before, Figure 3 also presents the proposer’s share for shocks 5% above and below the trend.

The proposer’s share of net resources is a non-monotonic function of net assets, first increasing and then decreasing.\textsuperscript{27} The share is increasing due to the bargaining mechanism

\textsuperscript{25} The initial level of net assets was set to \( a_t = -0.0604 \), similar to the final debt level sustained in Arellano (2008), of \( a_t = -0.0596 \).

\textsuperscript{26} In particular, the policymaker will never choose borrowing above the level associated with the maximum value of the debt Laffer curve. This level represent an endogenous borrowing constraint. For that reason, the relevant borrowing region goes from zero borrowing up to this endogenous constraint.

\textsuperscript{27} The proposer’s share in Figure 4.2 fluctuates between 0.89% and 0.92%. These numbers should be...
Figure 4.2: Borrowing contracts - Distribution of net resources by net assets

\[(y-axis: \text{proposer’s share of net resources}; \ x-axis: \text{net assets, } a_{t+1})\]

Net assets (potential borrowing decisions \(a_{t+1}\))
-0.6 -0.5 -0.4 -0.3 -0.2 -0.1 0
Proposer’s share \((\frac{cp,G_t}{yt + at - qt (at+1, yt) at+1})\)
0.895
0.9
0.905
0.91
0.915
0.92
0.925
45th percentile shock
55th percentile shock

Note: The figure correspond to the case of an initial level of net assets \(a_t = -0.0604\). The model corresponds to the one-period bond case.

and the fact that the parties excluded from the coalition do not receive any additional benefit when net assets are higher, leaving more resources available for the proposer and the MWC members. When the endogenous borrowing constraint comes into play, benefits in terms of distribution of resources are diluted. Clearly, the proposer’s share inherits the debt Laffer curve shape for the decreasing part, because it is the reduction in net resources that worsens the proposer’s situation. Hence, the model presents an additional incentive to front load consumption—higher levels of borrowing improves the distribution of resources for the proposer, particularly in the good states of nature.

This result resembles the modeling of political rents in Alesina, Campante, and Tabellini (2008). In a model that explains the procyclicality of fiscal policy in emerging economies, corrupt politicians can appropriate part of the tax revenues for their own benefit. Their argument is simple as in this model. The higher the endowment, the bigger the opportunities to grab rents. Differently, when there is a high level of debt, the room for stealing is limited. A similar interpretation of these ideas applies in the context of this paper, where the focus understood as an illustration of the mechanism presented in the paper. As it was mentioned before, such a highly stylized model is not well suited to account for real measures of income inequality.
is not on rents but on the distribution of resources. Closer to the modeling approach of this paper is the view of Aguiar and Amador (2011) that indicates that political economy frictions might emerge as a consequence of a disproportionate share of consumption in the hands of the incumbent. More generally, the opposite forces behind this nonlinear relation have been discussed a long time ago in the literature of fiscal procyclicality in emerging markets. Even though the model abstracts from taxes, public goods, and transfers, this framework captures two of the initial hypothesis of this literature (Gavin and Perotti, 1997): borrowing constraints that can be relevant during downturns; and political incentives, to spend more during times of plenty.

4.4.6 Policymaker’s Share in Equilibrium

Figure 4.3 shows the relation between shocks and the proposer’s share of net resources derived from the policy functions, which ultimately determine the default decision and the value for the proposer in \( P_0 \). The figure depicts three scenarios: the case of autarky; a situation in which debt carried from the previous period \( a_t \) is relatively low \( a_t = -0.1 \); and the case in which obligations are relatively high \( a_t = -0.3 \). Recall from Table 4.3 that the average level of net assets sustained in the second simulation \( [2] \) is 0.23. For all the cases, the higher the shock the better the distribution of resources for the proposer, as was discussed previously.

Under autarky, the distribution reaches a maximum because the shock is truncated for medium and high values, due to the nature of Arellano’s cost specification (4.10). This is an important part of the mechanism, because the distributional incentives vanish in the event of default because of this truncation and also because the country is not able to borrow. In the case of access to capital markets and low debt acquired the previous period \( a_t \), the distribution of resources is slightly better in relative terms. On the contrary, when the economy issues high levels of debt in the previous period, the repayment of this obligation will represent a bigger proportion of net resources in the bad states of nature. Also, net resources will be diminished by the effect of a low price of bonds. The outcome is that a bigger proportion of the scarce net resources is devoted to the fixed payments
Figure 4.3: Distribution of net resources in equilibrium, by endowment shocks

(y-axis: proposer’s share of net resources; x-axis: shocks, $z_t$)

Note: Estimated using the policy functions. The model corresponds to the one-period bond case.

for the consumption of the excluded, leaving the proposer with a share that is around 3-4 percentage points smaller than the case of low debt, for most of the negative realizations of the endowment. Hence, the proposer’s share will be unfavorable for low realizations of the endowment and high levels of debt acquired the previous period. Differently, the proposer’s share will be favorable, and in particular much higher than the share for the default scenario, for positive realizations of the endowment.

4.4.7 Disentangling the Political Effects

What is the value-added of the bargaining mechanism? How to disentangle the numerical effects of political fragmentation and instability? The model cannot give a direct answer to these questions, but analyzing different counterfactual scenarios can provide insight.\footnote{Recall that fragmentation was defined as $n - \gamma$. Even though instability depends on the probability of being selected as a proposer $(1/n)$, the degree of short-sightedness depends on $\Gamma$. This last term depends negatively on $n - \gamma$.}

Five models are considered in Table 4.3, taking as a reference the calibration exercise\footnote{\cite{ref}}, that considers short-term bonds as well as the Arellano’s cost specification for default.
Model \((M_0)\) is the baseline scenario and assumes \(n = \gamma = 1.75\), or corresponds to the central planner’s case. As mentioned, the inclusion of fragmentation and instability increases the probability of default and debt levels that can be sustained. This complete model \((M_4)\) is reported in the last column of Table ???. The central planner’s case \((M_0)\), as do most of the scenarios, uses a discount factor of 0.98, while model \((M_1)\) looks again at the central planner’s case, but with a lower discount factor of 0.905. Models \((M_2)\) and \((M_3)\) correspond to the case in which there is only political fragmentation and only political instability, respectively. Model \((M_2)\) simply imposes \(\Gamma = 1\) and \(K = 0\), maintaining an unequal distribution of total resources (fragmentation). In other words, model \((M_2)\) eliminates short-sightedness. On the contrary, model \((M_3)\) imposes an equal distribution, but allows for short-sightedness, or \(\Gamma < 1\). It should be noted that models \((M_2)\) and \((M_3)\) are presented for illustrative purposes and are not strictly correct, because in this paper both political characteristics are linked.

Table 4.3: Individual effects of a lower discount factor, Instability (I) and Fragmentation (F)

<table>
<thead>
<tr>
<th></th>
<th>Data</th>
<th>((M_0)) CP</th>
<th>((M_1)) CP Lower (\beta)</th>
<th>((M_2)) Only (I)</th>
<th>((M_3)) Only (F)</th>
<th>((M_4)) With (I&amp;F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default Probability</td>
<td>Argentina</td>
<td>3.00</td>
<td>0.12</td>
<td>2.60</td>
<td>0.11</td>
<td>3.93</td>
</tr>
<tr>
<td>Mean Debt/(Y_{\text{quarterly}})</td>
<td>86.2 - 172.4</td>
<td>6.78</td>
<td>5.00</td>
<td>6.70</td>
<td>15.88</td>
<td>23.24</td>
</tr>
<tr>
<td>(\sigma(c)/\sigma(y))</td>
<td>1.09</td>
<td>1.00</td>
<td>1.06</td>
<td>1.00</td>
<td>1.12</td>
<td>1.11</td>
</tr>
<tr>
<td>(\sigma(TB/y)/\sigma(y))</td>
<td>0.34</td>
<td>0.09</td>
<td>0.20</td>
<td>0.09</td>
<td>0.37</td>
<td>0.35</td>
</tr>
<tr>
<td>Proposer’s Share</td>
<td>0.89</td>
<td>0.57</td>
<td>0.57</td>
<td>0.91</td>
<td>0.57</td>
<td>0.91</td>
</tr>
</tbody>
</table>

For \((M_0)\): \(\beta = 0.98, n = \gamma = 1.75, \Gamma = 1, K = 0\)
For \((M_1)\): \(\beta = 0.905, n = \gamma = 1.75, \Gamma = 1, K = 0\)
For \((M_2)\): \(\beta = 0.98, n = 1.75, \gamma = 1.27, \Gamma = 1, K = 0\)
For \((M_3)\): \(\beta = 0.98, n = \gamma = 1.75, \Gamma < 1, K \neq 0\)
For \((M_4)\): \(\beta = 0.98, n = 1.75, \gamma = 1.27, \Gamma < 1, K \neq 0\)

When models \((M_0)\) and \((M_1)\) are compared, a lower discount factor yields a higher probability of default and a lower level of debt. This was reported in Aguiar and Gopinath (2006) and it is discussed in Uribe and Schmitt-Grohé (2015). The following paragraphs go back to this point. When only political fragmentation \((M_2)\) is introduced in the model, changes in the default frequency and debt levels are minor. The introduction of only political instability \((M_3)\) increases both outcomes. Interestingly, this result differs from the reduction of the discount factor, which has opposite effects over debt levels. While the
introduction of only fragmentation did not yield significant changes, its introduction in a model with political instability reduces the probability of default in one percentage point and increases debt levels in more than seven percentage points. Hence, fragmentation also plays a significant role in terms of the results. Also, political fragmentation is at the core of the mechanism and gives the reason to the policymaker for being short-sighted.

While the effects of a reduction in the discount factor have been reported before, there is a generalized use of very low discount factors in the literature of sovereign default. In fact, as explained in Aguiar and Amador (2013), a motivation for this assumption is that the governmental decision maker is relatively impatient due to political turnover. Does using low discount factors have the same effects as political instability (turnover)? Do they operate through the same channels? The following paragraphs address these questions.

Before exploring the differences between a reduction in the discount factor and the introduction of political instability and fragmentation, it is helpful to look at the scenario in which the policymaker has full commitment to repay his obligations. This is relevant because a reduction in the discount factor operates through different mechanisms under full and no commitment to repay. Under full commitment, the problem for the proposer today is given by

$$ v^{p,\text{COM}}(a_t, y_t) = \max_{a_{t+1}} \left\{ u(c_t^p(\mathcal{R}_t)) + \beta \mathbb{E}_{y_{t+1}|y_t} v^{p,\text{COM}}(a_{t+1}, y_{t+1}) \right\} $$

(4.11)

s.t.

$$ \mathcal{R}_t = y_t + [\eta + (1 - \eta) \zeta] a_t - q_t [a_{t+1} - (1 - \eta) a_t] $$

$$ \mathbb{V}^{p,\text{COM}}(a_t, y_t) = \Gamma u(c_t^p(\mathcal{R}_t)) + K + \beta \mathbb{E}_{y_{t+1}|y_t} \mathbb{V}^{p,\text{COM}}(a_{t+1}, y_{t+1}) $$

In order to make the model comparable to the exercises in Table 4.3, attention is restricted to the case of one-period bonds ($\eta = 1$). Also, the same table indicates that a reduction in the discount factor and also the introduction of political instability increases
the probability of default. However, the effects over debt levels are the opposite. What lies behind these different results?

Figures 4.4 and 4.5 analyze the borrowing decision for the full commitment case and for the case with sovereign default respectively. The analysis of both figures focus on the change in utility \( \Delta v^p (a_t, y_t) \) for different potential choices of net assets against the utility associated with the no-borrowing decision. In particular, the variation in utility derived from a particular borrowing decision \( a_{t+1} = a \) can be analyzed using

\[
\Delta v^p (a_t, y_t) \equiv v^p_{a_{t+1} = a} (a_t, y_t) - v^p_{a_{t+1} = 0} (a_t, y_t)
\] (4.12)

\[
\Delta u (c^p_t) \equiv u_{a_{t+1} = a} (c^p_t) - u_{a_{t+1} = 0} (c^p_t)
\] (4.13)

\[
\Delta \mathbb{E}_{y_{t+1} | y_t} v^p (a_{t+1}, y_{t+1}) \equiv \mathbb{E}_{y_{t+1} | y_t} v^p_{a_{t+1} = a} (a_{t+1}, y_{t+1}) - \mathbb{E}_{y_{t+1} | y_t} v^p_{a_{t+1} = 0} (a_{t+1}, y_{t+1})
\] (4.14)

Because \( v^p (a_t, y_t) = u (c^p_t) + \beta \mathbb{E}_{y_{t+1} | y_t} v^p (a_{t+1}, y_{t+1}) \), the total change in utility is broken up into its two components. First, the current utility gain is \( \Delta u (c^p_t) \equiv u_{a_{t+1} = a} (c^p_t) - u_{a_{t+1} = 0} (c^p_t) \). Second, the future cost associated with more borrowing today is given by the following expression: \( \Delta \mathbb{E}_{y_{t+1} | y_t} v^p (a_{t+1}, y_{t+1}) \equiv \mathbb{E}_{y_{t+1} | y_t} v^p_{a_{t+1} = a} (a_{t+1}, y_{t+1}) - \mathbb{E}_{y_{t+1} | y_t} v^p_{a_{t+1} = 0} (a_{t+1}, y_{t+1}) \).

Column [A] of Figures 4 and 5 present the marginal gain from borrowing, the second column [B] presents the future marginal cost of repayment/default, and the third column [C] reports net marginal gain. Only for Figure 5, in which the policymaker can choose to default, does a last column [D] indicate the bond price.

Four different scenarios are considered in Figures 4.4 and 4.5. The first row [A'] looks at a reduction in the discount factor for the central planner’s case. Row [B'] compares the central planner with a model with only political instability, as in (M3). Case [C'] focuses on the case of the central planner and the model with instability and fragmentation. To complete the description, all the graphs in Figures 4.4 and 4.5 correspond to a negative
Figure 4.4: Full Commitment to Repay: Variation in the level of utility for different borrowing levels in comparison to the utility of the no-borrowing case

(y-axis: change in utility; x-axis: net assets or borrowing decision, $a_{t+1}$)

[A] Current period

[B] Exp. continuation value

[C] Lifetime

$[\Delta u (c^p_t)]$ $[\Delta E_{y_{t+1}|y_t} V^p (a_{t+1}, y_{t+1})]$ $[\Delta v^p (a_t, y_t)]$

[A'] Central Planner (CP) with high β vs CP with low β

[B'] Central Planner (CP) vs Only Instability (I)

[C'] Central Planner (CP) vs with Instability & Fragmentation (I&F)

Note: Estimated for a 45th percentile shock. The model corresponds to the one-period bond case.

shock that is on the 45% percentile, in the same way as in previous figures.

Under full commitment to repay, a reduction in the discount factor and the introduction of political instability operate through the same mechanism. In both cases there is a reduction in the marginal cost of repayment and no changes in the current marginal gain from borrowing. Also, the total change in utility shows that in both cases more borrowing is chosen (column [C]). To complete the description, the last row [C'] contemplates the case with instability and fragmentation. In this scenario, there is a reduction in the current marginal benefit of borrowing. This is because fragmentation allows for a bigger share for the proposer, such that the marginal change in utility for a higher level of consumption is smaller. Despite this reduction in the current marginal benefit, the policymaker choose
Figure 4.5: Model with Default: Variation in the level of utility for different borrowing levels in comparison to the utility of the no-borrowing case

\( y\)-axis: change in utility; \( x\)-axis: net assets or borrowing decision, \( a_{t+1} \)

[A] Current period

\[ \Delta u (c^*_t) \]

[B] Exp. continuation value

\[ \Delta E_{y_{t+1}|y_t} v^p (a_{t+1}, y_{t+1}) \]

[C] Lifetime

\[ \Delta v^p (a_t, y_t) \]

[D] Bond price

\[ p_t (a_{t+1}, y_t) \]

[A'] Central Planner (CP) with high \( \beta \) vs CP with low \( \beta \)

[B'] Central Planner (CP) vs Only Instability (I)

[C'] Central Planner (CP) vs with Instability & Fragmentation (I&F)

Note: Estimated for a 45th percentile shock. The model corresponds to the one-period bond case.

more borrowing than in the central planner’s case.

Figure 4.5 considers the case with default. Now the current benefits from borrowing \((\Delta u (c^*_t))\) replicate the debt Laffer curve presented in Figure 4.1, simply because consumption depends on the resources obtained from issuing risky bonds \((q_t (a_{t+1}, y_t) a_{t+1}\) for short term bonds). Differently from the full commitment case, for the relevant part of the debt Laffer curve, a reduction in the discount factor does not change the marginal benefit of borrowing today, nor the marginal cost of repayment/default in the future. A reduction of the discount factor in a model with sovereign default is reflected in a contraction in the bond price schedule and, consequently, on a smaller relevant borrowing region.\(^{29}\) This can

\(^{29}\) The relevant borrowing region goes from the zero borrowing decision up to the borrowing level associated
Figure 4.6: Default thresholds as a function of the shock \((z_t)\) and repayment obligations \((a_t)\)

(a) Central Planner (CP)
\((y\text{-axis}: \text{shock, } z_t; \text{x-axis: net assets, } a_t)\)

(b) CP and Model with Political Factors
\((y\text{-axis}: \text{shock, } z_t; \text{x-axis: net assets, } a_t)\)

Note: Estimated for a 45th percentile shock. The model corresponds to the one-period bond case.

also be observed in panel (a) of Figure 4.6, where a reduction in \(\beta\) implies a smaller default threshold (smaller repayment region or bigger default region). Note that more impatience implies that the planner cares less about the consequences of default that mainly arise in the future. Because of the higher risk of default and interest rates, the planner finds it optimal to choose a lower level of net assets.

The key difference between a reduction in the discount factor and the introduction in political instability is observed in case [B'] of Figure 4.5. While the reduction in the discount factor does not affect the marginal cost of borrowing, political instability reduces this marginal cost as in the full commitment case. Because the proposer today does not expect to be in power tomorrow, he is not fully internalizing the costs of the borrowing decision. With a lower discount factor, even though there is a higher need to consume more today, the planner is fully internalizing the costs of repayment or default. The bond price schedule will not change in the same way as in the reduction of the discount factor; in fact changes are small. Why do bond prices are not affected in the same way as in the more impatient scenario? Because international investors understand that in every period with the highest level of resources that the country can get issuing bonds, or the maximum point of the debt Laffer curve. See the discussion associated with Figure 4.1.
a potential new policymaker will care much more about his term in office (current period), and the only way to improve his current utility is by repaying previous obligations and borrowing more. Consequently, the default region shrinks with political instability for low levels of repayment obligations. Panel (b) of Figure 4.6 demonstrates this.

The introduction of political fragmentation in a model that already considers instability is left for the last case [C'] in Figure 4.5. There will be an important expansion of the relevant repayment region (Figure 4.6 panel (b)); an increase in the current marginal benefit from borrowing; and a bigger reduction in the marginal costs of repayment/default in the future. Recall that having a model with only instability (M3) is not strictly correct, because there must be a reason for the existence of short-sightedness. Now the model with both political factors gives the complete picture of why the default region shrinks. Since international investors fully understand the problem, they know that tomorrow’s policymaker will be more willing to repay because he will need the access to capital markets to benefit from a much better distribution of resources. For that reason, repayment will be more probable and higher levels of debt can be sustained in equilibrium.

It should be noted that the shifts in the default region from the central planner towards a more impatient one (Figure 4.5 panel (a)) and towards a model with instability and fragmentation (Figure 4.5 panel (b)) are also different. In the first case, there is a parallel expansion of the default region. In the second case, the reduction in the default region is relatively small for high repayment obligations (for example $a_t = -0.3$) and relatively large for medium levels of repayment obligations ($a_t = -0.2$). As shown in the previous section, the proposer’s share is highly unfavorable for negative shocks and high levels of repayment obligations (Figure 4.4). This will not favor the value of repayment under these conditions, determining a small shrink of the default region under high repayment obligations.

4.4.8 Changes in Political Factors

This section looks at the effects of changes in political factors over debt and default. Table 4.4 show the effects of changes in $n$, $\gamma$ and $c^e$. The degree of instability was defined as the inverse of the probability of being elected as a proposer, or $n$. Fragmentation was defined
as $n - \gamma$. Then, any change in $n$ will affect both political factors. Similarly, a problem of identification arises when $\gamma$ is modified. The degree of short-sightedness is a function of $\Gamma$, and this parameter depends negatively on $n - \gamma$. Then, an increase in $\gamma$ will reduce fragmentation and the degree of short-sightedness. Finally, variations in the consumption for the excluded ($c^e$) are analyzed. Differently from $n$ and $\gamma$, changes in $c^e$ are not directly related to the degree of short-sightedness.

Table 4.4: Changes in $n$, $\gamma$ and $c^e$ and its effects over Debt & Default

<table>
<thead>
<tr>
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<th>DATA</th>
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<th>$n = 2.0$</th>
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<tbody>
<tr>
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<td>$\gamma = 1.27$</td>
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<tr>
<td>$c^e = 0.079$</td>
<td>$c^e = 0.079$</td>
<td>$c^e = 0.079$</td>
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<td></td>
</tr>
<tr>
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<td>2.79</td>
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<tr>
<td>Mean Debt/yquarterly</td>
<td>[86.2 - 172.4]</td>
<td>34.66</td>
<td>23.24</td>
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</tr>
<tr>
<td>$\sigma(c)/\sigma(y)$</td>
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<td>1.09</td>
<td>1.11</td>
<td>1.10</td>
</tr>
<tr>
<td>$\sigma(TB/y)/\sigma(y)$</td>
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<td>0.27</td>
<td>0.35</td>
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</tr>
<tr>
<td>Proposer’s Share</td>
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<td>0.90</td>
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<tr>
<td>$c^e = 0.079$</td>
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<td>1.03</td>
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<td>$\sigma(TB/y)/\sigma(y)$</td>
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<td>0.35</td>
<td>0.26</td>
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<table>
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<td>$\gamma = 1.27$</td>
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<td></td>
</tr>
<tr>
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<td>$c^e = 0.079$</td>
<td>$c^e = 0.150$</td>
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</tr>
<tr>
<td>Default Probability</td>
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<td>2.79</td>
<td>3.22</td>
</tr>
<tr>
<td>Mean Debt/yquarterly</td>
<td>[86.2 - 172.4]</td>
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<td>$\sigma(c)/\sigma(y)$</td>
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</tr>
<tr>
<td>$\sigma(TB/y)/\sigma(y)$</td>
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<td>0.36</td>
<td>0.35</td>
<td>0.35</td>
</tr>
<tr>
<td>Proposer’s Share</td>
<td>0.89</td>
<td>0.99</td>
<td>0.91</td>
<td>0.84</td>
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Table 4.4 indicates that a higher number of parties ($n$) for a given size of the government coalition, or more political instability and fragmentation, is linked to a higher probability of default and lower debt ratios. The same results arise with a lower $\gamma$. Changes in $c^e$ are more

\[30\] Recall that $\Gamma = 1/(n - \gamma + 1)$.

\[31\] The degree of short-sightedness depends on $\Gamma$ and the term $K = \Gamma (n - \gamma) u(c^e)$, which is a constant that depends on $c^e$. Simulations of the model with and without $K$ yield the same numerical results. Changes in $c^e$ will affect the continuation value of the problem, or $(P.1)$, because they will affect the consumption for the members of the coalition. Recall that the proposer expects to be part of the MWC in the future.
interesting because they represent the core of the mechanism. An increase in \( c^e \) reduces the bargaining power of the proposer, leaving him with a lower share of resources. For the policymaker it is less attractive to access the capital markets, because the distributional benefits of repayment are weaker. This will shrink the repayment region and expand the default region, facilitating more default in equilibrium.

Despite the fact that the model is too stylized to explain patterns in inequality, Table 4 indicates that the relation between debt, default, and the proposer’s share of resources is not unique. For a very high value of \( \gamma \), or a very low number of parties excluded, the model registers a low probability of default, high debt ratios, and a lower share for the proposer. Differently, for a high value of \( c^e \), a low share for the proposer also is obtained, but in this case coupled with high default and low debt. These inconclusive predictions are in line with different empirical relations recently reported in the literature. Recognizing that it is not possible to make a strict comparison, Azzimonti, de Francisco, and Quadrini (2014) reported a positive correlation between debt and inequality, D’Erasmo and Mendoza (2014) found a nonlinear relation between the two, and Ferriere (2014) found a negative correlation.

In terms of the empirical literature of debt and default, political instability can be linked to debt intolerance phenomenon. Reinhart, Rogoff, and Savastano (2003) conjectured that historical low default thresholds and higher probabilities of default can be explained by a combination of the procyclical nature of capital markets and short-sighted governments. Also, as indicated by Tirole (2012), more fiscal discipline is associated to high stability and cohesion of the political system. In this case, more instability and fragmentation (less cohesion), are linked to higher chances of default. In terms of Table 4, default will be more frequent if the country has a higher number of parties or the size of the government coalition is smaller.

Finally, the second chapter of the dissertation gathers data on the number of political parties, public debt, and default episodes for a sample of 35 emerging economies between 1975 and 2012. The effective number of political parties in power, or in the executive

\[ ^{32} \text{Is not possible due to the different time frameworks, countries used, and controls among these studies.} \]
leadership, was considered to proxy instability \( (n) \). The percentage of votes of the political parties that at some point in time belong to the government coalition was considered to proxy the size of the coalition \( (\gamma) \). The purpose of this exercise is not to establish causality or to provide an extensive econometric analysis, but to shed light on simple correlations. The panel estimations are in line with the results of Table 4.4, a higher \( n \) is associated with a higher probability of default and less debt, while an increase in \( \gamma \) is associated with a lower chance of default and higher levels of borrowing.

### 4.5 Conclusions

This paper studies how distributional incentives and policymaker short-sightedness affect default and borrowing decisions in a quantitative model of sovereign default. The country can borrow from international capital markets and bond prices are an endogenous outcome that depends on the probability of repayment/default. A bargaining mechanism is introduced in the workhorse model of default in order to generate an endogenous distribution of resources among political parties. The policymaker forms a coalition with a given number of parties to approve policy. Not all parties belong to this coalition. As in most bargaining games, the distribution favors the policymaker or proposer. Policymakers become endogenously short-sighted, because in the future they can lose office and this favorable distribution of resources.

A non-monotonic relationship between borrowing decisions and the policymaker’s share of resources arises. First, the more the country borrows, the higher the share for the policymaker. This is because any resources the policymaker brings from abroad are shared among him and the members of the coalition. In this setup the policymaker does not need the vote of those excluded from the coalition, and for that reason the policymaker’s share increases. This positive relation is true as long as more borrowing brings more resources to the country. However, in models of sovereign default, high levels of borrowing imply a higher probability of default in the future, lowering bond prices and the resources that the country can get in international capital markets. For this reason, there is a borrowing threshold that determines that the proposer’s share starts declining if the policymaker wants to issue
This mechanism is novel in the literature of sovereign default, since previous political economy models assumed a fixed distribution of resources for any borrowing decision or state of nature. Importantly, because the distribution of resources depends on borrowing decisions, policymakers will value more repayment. If the policymaker defaults, he loses access to capital markets and to the possibility of improving his share of total resources through more borrowing. This explains why the introduction of these political factors in a model of sovereign default facilitates repayment and borrowing. In equilibrium, it allows to sustain higher debt ratios and a higher frequency of default.

This paper also sheds light on the differences between having a low discount factor and political instability and fragmentation. In a model without political factors, more impatience implies that the country wants to frontload consumption. However, international investors know that more impatience also implies that the planner cares less about the consequences of default, which arise mainly in the future. For this reason, the chances of default are higher and will be translated in lower bond prices. In equilibrium, more default and less debt are sustained in equilibrium. In a model with political factors, there will not be a decrease in bond prices and more debt and default will be observed. Political instability also will generate incentives to frontload consumption. Differently, international investors will not punish bond prices because they know that in the next period the new policymaker will value more repayment. This is because the new policymaker, as well as the current one, wants to repay obligations in order to borrow more and enjoy a higher share of resources.
Appendix 1

[A] Lemma 1

The IC constraint implies that $u(c_c,h_t) + \beta v_{cont}^h = v_{out}^h = E_j u(c_{j,t}) + \beta v_{cont}^h$, where $j \in \{p, c, e\}$ and $h \in \{G, B\}$.

In other words, the members of the MWC should receive a level of consumption and an associated utility equal to the expected utility of the scenario in which they vote "no" and the game moves to the next round. In this case, each of the members of the MWC can (i) become proposers, (ii) still belong to the MWC or (iii) do not belong to the next round’s MWC. Then, it is true that

$$u(c_c,h_t) = E_j u(c_{j,t})$$

Solving for the consumption of the MWC yields the expression in Lemma 1.

Also, from equation (4.15), if $n - \gamma = 0$, then $c_{c,t}^h = c_{p,t}^h$. If $n - \gamma \to \infty$, then $c_{c,t}^h \to c_e$.

[C] Lemma 2

The budget constraint is given by:

$$Q(c_{p,t}^h, c_{c,t}^h, c_e, n, \gamma) = c_{p,t}^h + (\gamma - 1) c_{c,t}^h + (n - \gamma) c_e - R_{t}^h$$

As in the previous Lemma, $R_{t}^h$ is defined as net resources.

From the expression obtained in Lemma 1, it can be shown that

$$\frac{\partial c_{c,t}^h}{\partial (n - \gamma)} = -u^{-1'}(\cdot) \Gamma^2 \left[ u(c_{p,t}^h) - u(c_e) \right] < 0$$

Since $y_t > ne^e$, then $u(c_{p,t}^h) > u(c^e)$. Note the first term of the derivative is positive since $u(\cdot)$ is increasing and strictly concave.

---

$^33 v_{cont}^h$ is corresponds to the second expression of equation (C1p), defined later in section [C] of this Appendix.
[C] The Proposer’s Problem

At any point in time, the state of the economy is given by net assets $a_t$, a credit standing $h \in \{G, B\}$ and an endowment process that depends on the random variable $\epsilon$. To maintain the notation of Aguiar and Gopinath (2006), $\theta$ refers to the shock $\epsilon$. There are two more random variables in the system. The first one is the role of the representative, denoted by $j \in \{p, c, e\}$. The second is the random variable $\lambda$, which is the probability of regaining access to the capital markets if the proposer default in the current period or the credit condition is $B$.

In the same way as Aguiar and Gopinath, the credit standing variable $h$ is split into its random and nonrandom components. Define $\tilde{h}_t$ as the credit status at the end of period $t - 1$, which was decided by the default/repayment decision in $t - 1$ (the nonrandom part). Then, $h_t = G$ has a probability one if $\tilde{h}_t = G$ and with probability $\lambda$ if $\tilde{h}_t = B$. Finally, denote as $\rho_t \in \{0, 1\}$ the random variable with a value of one if redemption in the previous period. Denote the state of the economy by $s_t = (a_t, \tilde{h}_t, \rho_t, \theta_t)$

Define $\Phi(s_t)$ as the budget correspondence that maps the state $s$ into the range of possible consumption level for the proposer ($c^{p,B}_t$) (the consumption of the members of the MWC ($c^c_t$) is given by the IC constraint), credit standings $\tilde{h}_{t+1}$ and assets $a_{t+1}$.

- If $\tilde{h}_t = B$ and $\rho_t = 0$; and $j = p$

\[
\Phi(s_t) = \begin{pmatrix}
    c^{p,B}_t + (\gamma - 1) c^c_t + (n - \gamma) e^c = \varphi(y_t) \\
    c^c_t = u^{-1} \left[ \Gamma \left[ u \left( c^{p,B}_t + (n - \gamma) u(e^c) \right) \right] \right] \\
\end{pmatrix} ; \left( \tilde{h}_{t+1} = B \right) ; \left( a_{t+1} = 0 \right)
\]

- If $\tilde{h}_t = G$ or $\rho_t = 1$; and $j = p$

If the proposer default

\[
\Phi(s_t) = \begin{pmatrix}
    c^{p,B}_t + (\gamma - 1) c^c_t + (n - \gamma) e^c = \varphi(y_t) \\
    c^c_t = u^{-1} \left[ \Gamma \left[ u \left( c^{p,B}_t + (n - \gamma) u(e^c) \right) \right] \right] \\
\end{pmatrix} ; \left( \tilde{h}_{t+1} = B \right) ; \left( a_{t+1} = 0 \right)
\]
If the proposer repay

\[
\Phi (s_t) = \left( \begin{array}{c}
\left( c_t^{p,G} + (\gamma - 1)c_t^{e,G} + (n - \gamma)c_t^e = \\
y_t + [\eta + (1 - \eta)\zeta]a_t - q_t[a_{t+1} - (1 - \eta)a_t] \right) \; : \; \left( \hat{h}_{t+1} = G \right) \; : \; (a_{t+1})
\end{array} \right)
\]

Before presenting the problem, it is important to highlight the role of the representative, because only the proposer will choose policy. Denote the combination of the state and the role of the representative as \( s_t = (s_t, j_t) \). Using this last notation, the problem for a proposer initially for \( s_0 = (s_0, p) \) is

\[
v^p (s_0, p) = \sup_{\{c_t^p, a_{t+1}, \hat{h}_{t+1}\}} \left\{ u (c_0^p) + \mathbb{E}_0 \sum_{t=1}^{\infty} \beta^t u \left( c_t^i \right) \right\}
\]

subject to

\[
\left( c_t^p, a_{t+1}, \hat{h}_{t+1} \right) \in \Phi (s_0, p), \Phi (s_t, j_t) \quad t = 1, 2, ...
\]

The problem represented by (C1) and (C2) can be reformulated. In particular, the future uncertainty with respect to the role of the representative can be eliminated using the IC constraint, where \( \mathbb{E}_j u \left( c_t^{j,h} \right) = u \left( c_t^{c,h} \right) \) given the corresponding state \( h_t \), which can be decomposed in its random and non-random components, as before. Using this condition

\[
\mathbb{E}_j u \left( c_t^{j,h} \right) = \Gamma u \left( c_t^{p,h} \right) + \Gamma (n - \gamma) u (c^e)
\]

Then, the problem can be expressed as

\[
v^p (s_0, p) = \sup_{\{c_t^p, a_{t+1}, \hat{h}_{t+1}\}} \left\{ u (c_0^p) + \mathbb{E}_0 \sum_{t=1}^{\infty} \beta^t \left[ \Gamma u \left( c_t^p \right) + K \right] \right\}
\]

subject to

\[
\left( c_t^p, a_{t+1}, \hat{h}_{t+1} \right) \in \Phi (s_t, p) \quad t = 0, 1, 2, ...
\]
Where $\mathcal{K} = \Gamma (n - \gamma) u (c^e)$ and $c^e$ is assumed exogenous and fixed. From (C1p) and (C2p) the problem can be reformulated in its recursive form, as in equations (4.6) and (4.7).

**Appendix 2**

An asset grid of 150 points and a shock grid of 150 points are used. The model is simulated 300 times. Each simulation had a length of 10,000 quarters. Only the last 1000 were considered to rule out any effect of initial conditions.

The algorithm to solve the model is the following:

1. Discretized the state space.

2. Define $R_h$ as net resources. $R^G = y_t + [\eta + (1 - \eta) \zeta] a_t - q_t [a_{t+1} - (1 - \eta) a_t]$ if $h = G$, or $R^B = \varphi (y_t)$ if $h = B$. Construct a grid of values for $R_h$, \{${R_1, ..., R_m}$\}. The grid should include all the potential values for $R_h$ under repayment and under default. Define the grid function:

   \[ G(R_m) = \{c_m^p : c_m^p + (\gamma - 1) u^{-1} (\Gamma [u (c_m^p) + (n - \gamma) u (c^e)]) + (n - \gamma) c^e = R_m \} \]

   For $m = 1, ..., M$.

3. Start with a guess for the bond price schedule $q^0 (a_{t+1}, y_t)$.

4. Given the bond price schedule and for an initial guess of the value function:

   (a) Use interpolation methods to calculate $c^{p,h}(a_t, y_t)$ based on $G(R_m)$.

   (b) Given the previous iteration value functions for $(P.1)$, solve for the policy functions in $(P.0)$. Suppose that for the current iteration $k + 1$ the optimal level of assets is $a^{k+1}_{t+1}$ and the default decision is $d^{k+1}_{t+1}$.

   (c) Calculate the set:

   \[ S = \{V^p_{a_{t+1}} (a_t, y_t), V^{p,B} (y_t)\}_{a_{t+1} = a_{min}}^{a_{max}} \]

   There will be a value function for each potential choice of $a_{t+1} \in A = [a_{min}, a_{max}]$ in $(P.1)$.
(d) Use the policy functions of \((\mathcal{P}, 0)\) to find the optimal continuation values over the set \(\mathcal{S}\). Then, the optimal choice \(a_{t+1}^{k+1}\) and the default decision is \(d_{t+1}^{k+1}\) will be the same for \((\mathcal{P}, 0) \& (\mathcal{P}, 1)\).

(e) Considering (b) and (c), iterate the value functions in \(\mathcal{S}\) until convergence for a given \(q^0\). Suppose that \(\mathcal{S}_{k+1}\) are the functions delivered in the current iteration. The first element of \(\mathcal{S}\) is updated as a weighted average of the previous and current iteration values

\[
\mathcal{V}^p(a_t, y_t)_{k+1} = (1 - \varsigma) \mathcal{V}^p(a_t, y_t)_k + \varsigma \mathcal{V}^p(a_t, y_t)_{k+1}
\]

Where \(\varsigma \in (0, 1)\) and is a very small number. The same for \(\mathcal{V}^{p, B}(y_t)_{k+1}\). The algorithm loops until \(\max |\max |\mathcal{V}^{p, G}(a_t, y_t)_{k+1} - \mathcal{V}^{p, G}(a_t, y_t)_k|, \max |\mathcal{V}^{p, B}(y_t)_{k+1} - \mathcal{V}^{p, B}(y_t)_k||\) has dropped below \(10^{-5}\).

5. Given the new value function for \((\mathcal{P}, 0)\), update the bond price function \(q^1\).

6. Use the update price function \(q^1\) to repeat 2. to 4. until the convergence criterion is met.
Bibliography


E. Mendoza. Interview: Enrique Mendoza on sovereign debt. The Economic Dynamics Newsletter, Volume 16, Issue 1, April, 2015.


