

Why Do Some Countries Default More Often Than Others?

The Role of Institutions

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Abstract

This paper examines how a country's weak institutions and polarized government can affect the likelihood of its default on sovereign debt. Using a data set of 90 countries, it shows that strong institutions are associated with fewer sovereign default crises. In addition, when institutions are weak, a more polarized government tends to default more often. To explain these findings, the author develops a model showing the dynamics between the quality of institutions, the level of government polarization and sovereign default risk. Countries default

more often when they lack rules and strong institutions to curb the influence of powerful groups on government policies. That is because in a polarized government, each powerful group makes decisions without considering the impact on other groups. Simulations of the model show that more than half the cross-country variation in sovereign default frequencies can be explained by institutional quality and the degree of government polarization observed in the data.

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1 Introduction

One of most striking empirical differences between advanced economies and middle and low-income countries in terms of financial crisis is the vulnerability to sovereign debt crisis. The average external default probability of high-income countries is 0.07, less than half of middle and low-income countries, 0.17, and almost one-fifth of Latin American countries, 0.34.² Standard theoretical models like Eaton and Gersovitz (1981) do not offer explanations about why rich countries borrow less externally and why they have less incentive to default than middle and low-income countries. Among middle and low-income countries, the fact that Latin American countries defaulted more often than other countries, who presumably face similar external shocks and are in a similar stage of development, suggests that the causes are underlying political factors in addition to macroeconomic fundamentals.

The idea that political factors and institutions might be part of the reason some countries' default risk is higher is not new. Empirical papers such as Reinhart, Rogoff and Savastano (2003) and Kraay and Nehru (2004) show how countries' history of non-repayment, weak policies and institutions affect the likelihood of debt distress. My contribution is to find a particular mechanism through which institutions matter for countries' default risk.

The objective of this paper is twofold. First it shows empirically: 1) a negative correlation between institutional quality and frequency of sovereign defaults; and 2) conditional on having weak institutions, a polarized government is more likely to default. The second objective is to provide a theory of sovereign default that takes into account institutions. Countries with good institutions are characterized by well-developed legal and other institutional structures that make it hard for powerful groups to influence central government policies. The central planner maximizes collective welfare by setting economy-wide expenditure and debt. In contrast, countries with bad institutions are characterized by lack of institutional barriers to limit the influence of powerful groups in the government decision-making process. Powerful groups act in non-cooperative ways;³ they behave in ways that are optimal from their own point of view,

² Default probability is defined as number of episodes over number of years. For the majority of the countries, the period of analysis is 1960 to 2008. For some recent independent countries, the analysis starts at the year of its independence. It can be interpreted as incidence of default crisis as well. Source: Qian, Reinhart & Rogoff (2010).

³ Argentina during the seventies and eighties is a clear example of uncoordinated behavior among several public agencies, particularly, between the Provinces and the Federal government. Sanguinetti (1994)

without taking into account the effect of their actions on other groups. Under this situation, the more polarized the groups are, this is when groups' ideological distance is large and/or their relative power is uneven, the larger in size the inefficiency would be.

A two-period model is derived to demonstrate that regardless of the degree of polarization in the government, in countries with good institutions, default probabilities are lower than in countries with weak institutions. In addition, I show that when there are weak institutions in the country, the likelihood of default increases by degree of polarization. The model is then extended to an infinite horizon setup adopting a standard sovereign default framework. Numerical simulations are able to explain more than half the cross-country difference in sovereign default frequencies observed in the data.

1.1 Related Literature

This paper is related to both politico-institutional and sovereign default literature. In the politico-institutional literature, there is a set of papers that studies the role of institutions on shaping macroeconomic policies that ultimately explain the cross-country differences in growth, output volatilities and vulnerability to crisis. Acemoglu et al. (2003) argue that countries pursuing poor macroeconomic policies also have weak institutions. Kraay and Nehru (2006) find the quality of policies and institutions are an important determinant of debt distress. Their findings are confirmed in this paper, and I build a model to show the mechanism through which institutions affect macroeconomic outcomes.

Another set of papers studies how budgetary institutions affect fiscal and debt policy. Von Hagen (1992) and Stein, Talvi and Gruisanti (1998) argue that budget institutions matter because they can affect the rules of the game under which political agents interact. They find that countries with better budgetary institutions display relatively smaller fiscal deficit and public debt. I do not model the budgetary process; I simply assume that bad budgetary institutions allow powerful groups to influence government policies.

Aizenman (1993), Von Hagen and Harden (1995) and Velasco (1999) study the role of interest groups in shaping macroeconomic policies. In their models, government resources are a “common property” out of which interest groups can finance expenditure on their preferred items. Knowing that at least part of the cost would be borne by others, interest groups are

tempted to overspend and overborrow. Therefore, if fiscal policy is decided in a decentralized manner, a negative externality arises. In my model, the negative externality comes from the fact that each group underestimates the cost of borrowing more, and when a single group chooses to default, it forces the country (all groups) to default.

Tornell and Lane (1999) study the consequences of not having strong legal and political institutions and the presence of multiple powerful groups, two common characteristics of developing countries. They explain theoretically how these powerful groups interact and expropriate national resources in a society with weak legal-political infrastructure. This paper follows this line of analysis, and shows the importance of limiting powerful groups' influence on policy decisions regarding spending and borrowing. Furthermore, it demonstrates empirically and theoretically how the interplay of having weak institutions and a government with polarized interests results in suboptimal debt policies.

The paper is also related to studies that examine the role of polarization in macroeconomic policies. Alesina and Tabellini (1990) argue that polarization leads to over-accumulation of public debt because the current government has a different preference on spending than its opponent. Hence when it borrows, it does not internalize the future cost of serving the debt because there is a risk of losing power to the opponent group. Alesina and Drazen (1991) show that polarization leads to a higher deficit and high debt because it delays stabilization. Eslava and Nupia (2010) find that party fragmentation has no effect on government spending in the absence of ideological polarization, and a positive effect when polarization is high enough. These papers focus on deficit/spending, but not the financing cost of the deficit. In this paper, I model the financing side and allow for defaults, which might depend on government polarization. Conditional on having weak institutions, more polarization leads to more defaults because the more polarized are the groups, the higher will be the aggregate sovereign debt and the higher will be the default cost not internalized by the defaulting group; both result in more defaults in equilibrium.

Studies of sovereign defaults pioneered by Eaton and Gersovitz (1981) and followed by recent quantitative models such as Aguiar and Gopinath (2006), Arellano (2008), and Mendoza and Yue (2008), among others, have modeled default episodes as an equilibrium outcome in which creditors agree to offer debt contracts even in cases when defaults are possible outcomes.

These papers provide a framework to study sovereign defaults but do not provide reasons why do some countries default considerably more times than others given similar fundamentals.

Recent work by Hatchondo, Martinez and Saprizza (2008) and D'Erasmus (2008) take a political economy approach. In their models, international lenders face different types of borrowers. Policymakers of the borrowing country that have different degrees of impatience alternate in power. Lenders cannot directly observe a borrower's type and, hence, have to infer from the borrower's actions. My paper differs from these in two ways. First, in the model, default risk does not depend only on the policymaker in power. What is essential is the institutional environment in which these powerful groups take actions. Second, since I focus on explaining the cross-country difference in terms of sovereign default frequencies, I do not try to match with a particular country's data, as the other papers do.

This paper is organized as follows. Section 2 provides details of the data used in the cross-country empirical analysis and shows the findings. Section 3 presents a two-period model with default option in period two with a closed-form solution. It shows that with weak institutions, default is more likely. Furthermore, default probability is increasing in polarization. In Section 4, the analysis embeds the two-period model into an infinite horizon framework. Section 5 compares simulation results with the data. Section 6 concludes.

2 Data and Findings

This section documents the cross-country differences in terms of institutional quality and sovereign default frequencies, and establishes the facts the paper aims to explain using the models that developed in Sections 3 and 4. The data set covers more than 90 countries. It includes measures of quality of institutions, sovereign default history and economic indicators from 1960 to 2008.⁴

2.1. Data Description and Source

The first key measure of government characteristics is government polarization (polar), which captures how different are the preferences of the governing parties on certain issues, as well as

⁴ Our main data set spans from 1960 to 2008. However we use sovereign default crisis data from 1800 to 1959 to construct a measure of default history.

their relative bargaining powers. The idea is that having a polarized government in a country with weak institutions (i.e., powerful groups have strong influence on government policies), spending and borrowing policies are suboptimal compared with a country with good institutions. This is because in a polarized government, powerful groups have different preferences and they fail to coordinate to achieve an equilibrium that is welfare improving in the aggregate.

The term “polarization” has been used in the literature with different meanings, and has also been operationalized in different ways. In theoretical papers, polarized government means that governing parties have different preferences over an issue that voters care about, for example public goods. The difference could be between governing parties or between alternate governments (Alessina and Tabellini 1990). Polarization can also mean the degree of political cohesiveness. In Alessina and Drazen (1991), a government with a high degree of polarization is one with uneven distribution of the expected cost of stabilization. A high degree of polarization is intended to capture a low degree of political cohesiveness, hence an agreement that is optimal for the aggregate would be harder to achieve.

In the empirical literature, polarization has been measured as ideological distance, in a left-center-right scale, between the chief executive’s party and other parties in the governing coalition (Keefer and Stasavage 2003). Fragmentation has also been used to refer to ideological distance among agents that participate in policy-making. For example Volkerink and De Hann (2001) refer to distance as political fragmentation. However, the majority of the literature, started by Weingast et al. (1981), that studies the role of political fragmentation on government spending refers to the number of different interests or parties whose demands are reflected in the budget. Higher fragmentation is expected to increase government expenditure and debt through a “common pool” problem. The most commonly used measure of fragmentation is the number of legislative parties in the governing coalition, either raw or effective.⁵

Considering that both the preference differences and the number of governing parties, as well as their relative bargaining power, are important in the process of determining aggregate spending and debt, I measure government polarization as the weighted standard deviation of ideologies of the three largest parties in the government, where the weight given to each party is

⁵ The effective number of parties, proposed by Laakso and Taagepera (1979), adjusts the number of parties by taking into account the weight of each party in terms of number of seats in Congress; it is effectively equal to the inverse of a Herfindal-type concentration index.

its voting share in the legislature. A greater number implies greater polarization. This method of measuring polarization has been used by Franzese (2008) and Eslava and Nupia (2010). The data used to calculate government polarization are from the Database of Political Institutions (2010).⁶

The second important variable of interest is the quality of institutions. Ideally this would require a measure that captures how the interests of powerful groups are translated into central government policies. Such powerful groups can be political leaders, provincial governments, labor unions, parastatal enterprises, and financial backers of the ruling government. This measure at its lowest would describe the case of a central government that is weak and surrenders to all the demands of the interest groups. At its highest value, it captures the case when the central government is strong and makes optimal decisions for the aggregate economy. As far as I know, there is no cross-country indicator of institutions or governments that measures that. Instead I used two proxies. The first is the standard market assessment measure of institutional quality: the International Country Risk Guide (ICRG) institutional index. The index from the PRS Group is based on investors' evaluation regarding the rule of law, bureaucratic quality, corruption, expropriation risk, and government repudiation of contracts. It ranges from 0 and 1, with high values representing better institutions. This measure of institutional quality includes several aspects of government structure. There are two potential disadvantages: 1) ICRG, as any market assessment measure of institutions, tends to improve with income level rather than reflect durable institutional constraints in the government; and 2) ICRG might already contain information about past defaults,⁷ hence there would be an endogeneity problem.

The second proxy that I use is regulation of participation (parreg) from POLITY IV. It measures the degree of institutionalization or "regulation" applied regarding how political preferences are expressed by subordinates.⁸ It captures the extent to which the political system enables non-elites to influence political elites in regular ways. A five-category scale is used: 1- Unregulated, 2- Multiple identity, 3- Sectarian, 4- Restricted, and 5- Regulated. Details of each

⁶ A broader concept of polarization is social polarization. We can think of different interest groups of the society represented in the government by governing parties. If we use income inequality (Gini coefficient) as a proxy for social polarization as it has been suggested by Woo (2003) and Keefer and Stephen (2002), results are similar to those using polar.

⁷ Reinhart, Rogoff and Savastano (2003) show that history of non-repayment is an important driver of the market perceptions of default risk.

⁸ Marshall & Jaggers (2000), p. 23

category can be found in the Data Appendix. The overall take is that the higher *parreg* is, the better the influence of interest groups on government policies is regulated. The disadvantage of using this measure is that it is not as well-known and used as *ICRG*, therefore it is difficult to compare with other studies. Nonetheless it captures better the degree of influence that powerful groups have over government, which will be a key feature in the model presented in Section 3. Although I cannot rule out the potential endogeneity problem of using regulation of participation, that is, when default crisis cause government structure and rules to change, I argue that institutions are very persistent and thus evolve slowly.⁹

To calculate default probability, my main data source is Reinhart and Rogoff (2009).¹⁰ I supplement it with a dataset constructed by Laeven and Valencia (2008), De Paoli et al. (2006) and Levy-Yeyati and Panizza (2011). Default probability for each country is calculated as the number of sovereign default episodes that occurred between 1960 and 2008 divided by the number of years since 1960 (or year of independence). As a proxy for countries' default history, I follow Reinhart and Savastano (2003) and use the percent of years in a state of default or restructuring between 1800 (or year of independence) and 1959.¹¹ As control variables, I include the log of average real GDP per capita in constant 2000 dollars from the WDI database and debt as a percent of gross national income (GNI), the 1970 to 2008 average, from the Global Development Finance database.

Table 1 provides some basic descriptive statistics of the sample of countries and Table 2 reports the pairwise correlation among the determinants of default crisis.

2.2 Stylized Facts

The main objective of the paper is to explain why some countries default on their sovereign debt more often than other countries. The key findings using the dataset described above are:

Fact 1: Institutional quality and sovereign default probability are negatively correlated.

⁹ Acemoglu, Johnson and Robinson (2005).

¹⁰ The definition of sovereign default crisis can be found in the appendix.

¹¹ Results are similar if we use number of default episodes over years (1800-1959) as proxy for default history, or exclude countries that are independent after 1959 since they have no default history by construction.

Countries with good institutions rarely default. Figures 1 and 2 show the negative relationship between the two measures of institutional quality and sovereign default probability. The correlations of sovereign default probability with the ICRG institutional index and regulation of participation are -0.53 and -0.44, respectively. They are significant at 1%. Columns 1 and 2 of Table 3 report the summary statistics of institutional quality and government polarization of non-defaulters, one-time defaulters and serial defaulters. Non-defaulters, countries that have not defaulted during this period, have a substantially higher index in both measures of institutions than defaulters, and the difference is statistically significant at 1%. However there is no statistical difference between one-time defaulters and serial defaulters.

Column 3 of Table 3 shows the average government polarization. Non-defaulters on average have higher polarization than defaulters; and among defaulters, one-time defaulters are less polarized than serial defaulters. However, these differences are not statistically significant. This is also shown in Figure 3. It seems that default probability is not positively correlated with government polarization. In fact, the pairwise correlation between default probability and government polarization is 0.01 and it is not significant. I will argue that polarization does not matter under the presence of good institutions because powerful groups, regardless of how polarized they are, cannot influence government decisions. Therefore countries with more polarized government do not necessarily default more times. To show this, I perform an OLS analysis where the dependent variable is the default probability. I first show that quality of institutions is an important determinant. Second, conditional on having weak institutions, default probability is higher in countries with a higher degree of government polarization.

It could be argued that there might be omitted variables that could explain cross-country differences, in both institutional quality and default frequencies; for example, stage of development. This is a valid argument since most advanced economies enjoy better institutions and rarely default. The correlation between real GDP per capita and default probability is -0.46, significant at 1%. Another issue is that if a country does not have external debt, either because it does not need to borrow abroad or it has no access to foreign funding, its sovereign default probability will be zero by definition. In fact, countries with higher debt as a percent of GNI are also those that default more often. The average debt as a percent of GNI of non-defaulters is 0.11 while the average of defaulters is 0.60. Finally, countries that have defaulted in the past are more

likely to default again in the future. As discussed in Reinhart and Rogoff (2005), history matters and one possible explanation is the inertia of institutions. Adopting this interpretation, past defaults should be seen as symptoms of deeper institutional failures and not just contemporaneous policies or external shocks. The market penalizes countries with default records by charging them a higher risk premium, which will in turn exacerbate the vulnerabilities of these countries.

Taking into account these issues, I include as explanatory variables log of real GDP per capita, debt as percent of GNI and default history in addition to ICRG, regulation of participation and government polarization. Table 4 reports the OLS cross-country regression analysis. Column 1 includes as explanatory variables log of real GDP per capita, debt as percent of GNI and default history. All three have the expected signs, although only GDP is significant. Countries with higher incomes have lower default probability; countries with higher debt as a percent of GNI and that have been more years in default are likely to default more often. Column 2 uses ICRG as a measure of countries' institutional quality. Not surprisingly, the coefficient is negative and highly significant, indicating that countries with better overall institutions are less likely to default. As argued before, these institutional quality measures tend to improve with income level. Note that real GDP per capita is not significant in this case. When using regulation of participation (parreg) in column 3, real GDP per capita becomes significant and with the correct sign. Rich countries are associated with lower default probability. Countries with better regulation of participation, capturing how much limits are set to control the influence of powerful groups in government decisions, are less likely to default. In column 4, government polarization is entered alone. Although the coefficient is positive, it is not significant, consistent with Figure 3.

Fact 2: High government polarization is associated with high default probabilities conditional on weak institutions.

Column 5 includes both ICRG and polarization to assess whether polarization is associated with default probability once the analysis controls for the overall quality of institutions. Indeed, government polarization is a relevant determinant of default probability. Given a certain level of institutional quality, a higher degree of government polarization is

associated with higher default probabilities. In column 7, the analysis uses regulation of polarization and government polarization, and the results are similar to column 5.

In columns 6 and 8, I try to show the interplay between institutions and government polarization. The idea is that government polarization only matters when there are weak institutions, in particular, when powerful groups can influence government's policies. In this case, the more polarized is the government, the harder it is for the groups to coordinate and/or to agree upon policies that benefit them all together, the more defaults occur in equilibrium. Thus, government polarization affects default probability conditional on the level of institutional quality. To capture that, I introduce an interaction term $ICRG*polarization$ in column 6 and $parreg*polarization$ in column 8. $ICRG*polarization$ has the correct sign (negative) but is not significant. The preferred measure of institutions, regulation of participation, when interacted with polarization, shows the intuition described above. The coefficient $parreg*polarization$ is -3.774. To interpret this, assume that $parreg$ equals 2, the lowest level of regulation of participation in the sample, the marginal effect of government polarization in default probability is then $17.24 - 3.774*2$, which is 9.692. Now, assume that $parreg$ equals 5, the highest level of regulation of participation. In this case, the marginal effect of government polarization in default probability is then $17.24 - 3.774*5$, which is -1.63. This means that polarization contributes to default probability positively *only* when the degree of regulation of participation is low. Furthermore, the magnitude of the impact of having polarized government is much higher when the interaction term is included ($parreg*polarization$) compared with only controlled for $parreg$, column 7.

Since Latin American countries as a group have the highest default probability, I want to assess whether they are driving the results.¹² Table 5 reports the results excluding Latin America. The results are similar to those found above. Furthermore, the magnitudes of the effects of $parreg$ and polarization are larger in this case. Similar to the exercise above, assuming the highest level of $parreg$, the marginal effect of government polarization is -0.84; and assuming the lowest level of $parreg$, the marginal effect of government polarization is 12.81. Note that in this case the coefficient of the interacting term $ICRG*polarization$ is significant. This means that the better

¹² We could have added Latin America as a dummy variable into the analysis. But since the dummy variable is highly correlated with the two institutional variables, the results would be misleading, thus we decide to exclude them instead.

are the institutions, the smaller is the marginal effect of government polarization in default risk. And this mechanism works not just for Latin American countries.¹³

To further demonstrate that government polarization matters for default probability only in countries with weak institutions (i.e., low *parreg*), I regress default probability for countries with *parreg* smaller than 3.55 (sample median), and countries with *parreg* higher than 3.55. Columns 1 and 2 of Table 7 show that polarization is positively correlated with default probability only when *parreg* is below the median. When *parreg* is above the median, polarization has a negative coefficient and it is not significant. Figure 4 shows default probability against polarization dividing the sample into countries with *parreg* below and above 3.55. For countries with weak institutions (*parreg*<3.55), default probability and polarization are positively correlated; for countries with good institutions (*parreg*>3.55), the correlation is negative but not significant.

In columns 3 and 4 of Table 7, I divide the sample into countries with *parreg* smaller than 2.72 (the mean minus one standard deviation) and countries with *parreg* larger than 4.48 (the mean plus one standard deviation). In this case, the effect of polarization is even stronger at the lower level of *parreg*. Tables 8 and 9 exclude Latin America and countries that became independent after 1959, respectively, and the effect of government polarization is even stronger.¹⁴

Based on these results, I conclude that institutions, in particular, the degree of influence pressure groups have on government decisions, are an important factor determining countries' likelihood to default. Moreover, in countries that have weak institutions, the more polarized is the government, the higher is the default risk.

2.3 Anecdotal Evidence

From the empirical analysis, I conclude that institutions and default are correlated. The insight is that many countries are plagued by a weak institutional environment. Spending and borrowing decisions are often the result of negotiation within the politico-business elite. The determination of macro policies in such an economy depends on the interaction between these groups. Unless

¹³ The results are qualitatively similar if we exclude countries that are independent after 1959. Table 6.

¹⁴ For table 9, the analysis is done only for countries with *parreg* above and below 3.55 due to its small sample size.

these groups perfectly cooperate, this interaction needs not result in collective efficient outcomes.

An example of a country with these characteristics is Argentina during the 1980s, one of the most decentralized countries in Latin America, with approximately 50% of total public spending occurring at the subnational level.¹⁵ Argentina defaulted on its external debt two times during this period, 1982 and 1989. Since 1935 it has had a “revenue sharing scheme”, under which the central government administers a number of national taxes. Revenues are then distributed between the federal government and provincial jurisdictions. This scheme is complemented by a regime of Extraordinary Treasury Transfers (ETT) with the objective to transfer funds to local governments in case of unusual events. The legal framework has changed since 1935 many times. Two events that took place in the 1980s illustrate well the type of problems this regime has had. First, the tax reform of 1980 eliminated the employer’s social security contribution and determined that the associated deficit of the social security system should be partly met using the tax revenues that were subject to the revenue sharing rule. Therefore, since that year, the actual amount of funds received by the provinces became dependent on another public agency: the social security system.

The second event is the complete absence of a legal rule for tax-sharing between 1985 and 1987, when the regime established by the 1973 law expired in 1984. It took three years to approve a new one. During that period, the transfers to the provinces were subject to the arbitrariness of the bilateral negotiations between the federal government and local governments.

On the whole, changes in regulation made the amount of resources that the provinces could obtain from the tax sharing system very unpredictable and unstable. Hence, whatever the difference between what provincial governments considered a normal or historical level for the transfers and the actual ones, it was covered using the ETT. The otherwise unrestricted character of the ETT was exemplified in the fact that no maximum limit for their use was established.

As a result, during 1981-1983, when the consolidated public deficit reached more than 15% of GDP, there was an increase in participation of the provinces and state owned enterprises in the aggregate level of the deficit. Local governments contributed with 5.2% and public

¹⁵ Argentina’s mean *parreg* is 2.81, smaller than the sample average (3.55), and government polarization 0.15, larger than the sample average (0.09).

enterprises 5.9% of GDP. Sanguinetti (1994) concludes that in cases where the fiscal regime that regulates the financial relationship between different government jurisdictions is not properly designed, non-cooperative behavior among these agents can develop.

Another interesting case is Brazil, which experienced three major state-level debt crises since the late 1980s, one of which ended up in sovereign crisis (1983).¹⁶ In each of the crises, the first reaction was to demand bailouts from the central government, and in each case the federal government federalized state debts. The constitution and the basic structure of intergovernmental relations have sabotaged the most important mechanisms that enforce subnational fiscal discipline. Voters have neither the incentives nor the information they need to use the electoral mechanism effectively. The credit market did not discipline states because they believed that state debt was backed by the federal government. The central government, despite its proclamations, could not credibly commit to abstain from bailing out the troubled states in case of crisis. This was because the states had influence on relevant central government decisions regarding subnational finance due to their strong representation in the legislature.

Constitutional revenue sharing provision ensures massive revenue flow from the center to the states but subnational governments have a wide range of budgetary autonomy. In spite of numerous federal attempts to restrict their borrowing, they had access to credit through a wide range of sources and instruments through the 1980s. The constitution stipulates that the Senate can regulate all state borrowing. However the rule of numerical restriction on new borrowing was just a guideline because the Senate was allowed to grant exceptions, which it did many times. Given that the Senate is dominated by the interests of the states, it was a very poor overseer of state borrowing.

This political and fiscal system not only sabotages hierarchical mechanisms but market mechanisms as well. Voters have the idea that state level deficits and debts are not the fault of local governors. This may have its roots in the role of the states prior to the democratic constitution, when they borrowed on behalf of the central government. Starting in the late 1980s, elected governors could claim that their inherited burdens actually belonged to the federal government.

¹⁶ Brazil's mean *parreg* is 2.83, smaller than the sample average (3.55), and government polarization 0.34, larger than the sample average (0.09).

In 1983 states were unable to roll over external debt and failed to service their debt. The federal government honored the states' federally guaranteed obligations to their respective creditors. In 1989, after an extended period of negotiations, the federal government agreed to transform the accumulated state arrears and remaining principal into a single debt to the federal treasury.

3 A Simple Theory of Government Polarization and Default Risk

This section builds a model in which powerful groups and lenders choose their actions optimally, taking the institutional quality of the country as given. It demonstrates that the probability of default depends both on institutional quality and the degree of polarization. Polarization in the model is captured by the distribution of shares of government resources allocated to the groups.¹⁷ In countries with good institutions -- where there is a well-defined government structure that limits the influence of powerful groups on government policies -- even if there are many powerful groups, socially optimal allocation for aggregate consumption and borrowing is achieved. By contrast, in countries with weak institutions, powerful groups have direct influence on government policies. Furthermore, when they are polarized, they do not coordinate with each other; instead each group optimally chooses independently how much to spend and to borrow at a level that is suboptimal from the point of view of the country overall. This is because each group internalizes only its own cost of borrowing an additional unit of debt, which is lower than the aggregate cost taking into account the effect of its action on other groups' financing costs. I want to emphasize that government polarization by itself is not a problem; it causes inefficiency only when institutions are weak.

To study the relationship between the frequency of sovereign default, institutions and government polarization, I first build a two-period model in which a closed form solution can be derived. There are four assumptions in the model: 1) There are n powerful groups that want to influence government's spending and borrowing decisions. Powerful groups' source of income comes from government transfers. These groups can only save and borrow through the central

¹⁷ Woo (2003) used income distribution to measure polarization. If we use GINI coefficient instead of ideological different in the governing parties for our empirical analysis, the positive relationship between polarization and default probabilities is preserved.

government. 2) I take the institutional quality of the country as exogenous. Countries with good institutions are those that either have powerful groups coordinating and acting as one agent or when a well-developed legal and institutional structure exists to limit the influence of powerful groups on central government fiscal and debt decisions. In both cases, a central planner's solution that maximizes collective welfare is achieved. I call this the unified government case. In countries with weak institutions, the central government is weak and powerful groups have direct influence on central government decisions. Furthermore, groups act in a non-cooperative manner; each group maximizes its individual welfare and ignores the effect of its action on other groups. I call this the polarized government case. 3) I assume that failure to repay the full amount of the debt constitutes default, and borrowers are excluded from the capital market as part of the default penalty.¹⁸ 4) International lenders know the quality of institutions of the country. They observe the number of powerful groups, the degree of polarization and how much debt the country (as a whole) demands, but they cannot match the group with the part of the debt that is allocated to it. When a default decision is made, lenders cannot discern whether the decision is made by all the groups or one group, and which group. Hence when one group defaults, all groups are shut down from the international capital market. A less extreme case is when one group (for example a state) defaults; investors perceive a higher risk of default in other states too, and therefore the risk premium increases for all groups. This means the behavior of one group has effects beyond its own.¹⁹

The model structure is based on Vegh (2010) Chapter 2. There is a small open economy that takes the international price as given. The saving or borrowing decision is made in period one; the repayment or default decision is made in period two. Since this is a finite horizon model, debt is sustainable if and only if default does not occur with probability one. For this reason, I assume a default cost in period two. For simplicity, I assume $n=2$. The two groups share the tax revenue Y collected by the central government. I denote η group 1's and $1-\eta$ group 2's share of government debt and revenue that they receive as transfers, as well as the weights their welfare

¹⁸ It is true that most defaults end up being partial, not complete, although sometimes after long negotiations. We do not model the renegotiation process or how long it takes. We simply assume that during this renegotiation process, the country lives in autarky.

¹⁹ The case of the Brazilian state Minas Gerais constitutes a clear example. The declaration of liquidation of its debt at the end of 1998 caused not only doubts about the ability of repayment of other states, but also produced a national crisis the following year.

enters into the planner's problem. Let $\eta \in (0, 0.5]$, hence group 1 has less power than group 2. The unequal power distribution between groups indicates how polarized the government is. Similar to Alesina and Drazen (1991), I use η to measure the degree of government polarization. That is, the more unequal are the shares of resources that correspond to groups, the larger is the degree of polarization.²⁰ Revenue in period 2 (Y_2) is the only source of uncertainty in this economy. It is a random variable drawn from a uniform distribution with support $[0, Y_2^H]$.

3.1 Optimization Problem of the Unified Government

This section solves the unified government case, which is the central planner solution. The objective of the planner is to maximize the sum of the two groups' lifetime utility weighted by their relative power η^i subject to the economy-wide resource constraint, where $\sum_{i=1}^2 \eta^i = 1$. In period one, the planner chooses aggregate spending, aggregate debt given the revenue shock and the schedule of interest rates.²¹ In period two, the planner decides to repay or default the debt; when it chooses to default, there is a cost associated that is proportional to revenue. The objective function of the planner is given by

$$\max_B U^U = \sum_{i=1}^2 \eta^i g_1^i + \beta E\{\eta^i g_2^i\} \quad (1)$$

where superscripts denote groups and subscripts denote periods. $0 < \beta < 1$ denotes the discounting factor. The aggregate budget constraint in each period is given by

$$\begin{aligned} t = 1 & \quad \sum_{i=1}^2 g_1^i = Y_1 + B^U \\ t = 2 \text{ (default)} & \quad \sum_{i=1}^2 g_D^i = Y_2(1 - \phi) \\ t = 2 \text{ (repay)} & \quad \sum_{i=1}^2 g_R^i = Y_2 - (1 + r^U)B^U \end{aligned} \quad (2)$$

Where g_1^i denotes group i 's consumption in period one; g_D^i and g_R^i denote consumptions of group i in period two in the event of default and repayment, respectively. B^U denotes the level of debt engaged by the planner in period 1 to be repaid in period 2 in case that it chooses to. Y_1 denotes period 1's revenue, Y_2 denotes period 2's revenue, not known in period 1. ϕ denotes the

²⁰Alesina and Drazen (1991) use the fraction of tax burden borne by groups as measure of the degree of polarization.

²¹ We focus on the case of borrowing in period 1 to be optimal by assuming $1 - \beta(1 + r) > 0$.

share of the revenue that is lost if default is chosen; and r^U denotes the real interest rate charged by lenders to countries with a unified government.

In the second period, the planner will repay the debt only if the cost of repaying it, given by $(1 + r^U)B^U$, is smaller than the cost of default $Y_2\phi$. Therefore, default is optimal for low realizations of the revenue shock in period 2, that is, if $Y_2 \leq Y_2^{U*}$; and repayment is optimal otherwise. Y_2^{U*} is the threshold at which if the revenue shock is smaller, default will be optimal.

$$Y_2^{U*} = \frac{(1+r^U)B^U}{\phi} \quad (3)$$

Let π^U denote the probability of default in the case of a unified government:

$$\pi^U = \Pr [Y_2 \leq Y_2^{U*}] \quad (4)$$

3.2 Optimization Problem of the Polarized Government

In the case of a polarized government, in addition to having weak institutions, it does not coordinate, giving rise to negative externalities that harm the collective welfare. Unlike the unified government case, each group makes spending, borrowing and default decisions independently.

The objective of each is to maximize its lifetime utility given by

$$\max_{b_i} U^i = g_1^i + \beta E\{g_2^i\} \quad (5)$$

subject to the budget constraints

$$\begin{aligned} t = 1 & \quad g_1^i = \eta^i Y_1 + b^i \\ t = 2 \text{ (default)} & \quad g_D^i = \eta^i Y_2 (1 - \phi) \\ t = 2 \text{ (repay)} & \quad g_R^i = \eta^i Y_2 - (1 + r^P)b^i \\ i=1,2 & \end{aligned} \quad (6)$$

where b^i denotes the level of debt engaged by group i , and r^P denotes the interest rate charged by lenders to countries with a polarized government.

In the second period, group i will repay its debt only if the cost of repaying, given by $(1 + r^P)b^i$, is smaller than the cost of default $\eta^i Y_2 \phi$. Default is optimal for low realizations of

the revenue shock, that is, if $Y_2 \leq Y_2^{P*}$, and repayment is optimal otherwise. Y_2^{P*} is the threshold at which if the revenue shock is smaller, default will be optimal for group i .

$$Y_2^{i,P*} = \frac{(1+r^P)b^i}{\eta^i\phi} \quad (7)$$

Let π^i denote the default probability of group i :

$$\pi^i = \Pr [Y_2 \leq Y_2^{i,P*}] \quad (8)$$

3.3 Foreign Lenders

Lenders are international investors with a funding cost of r , the risk-free interest rate. They are competitive and risk neutral. They know whether the country has a unified government or a polarized government. They also know the degree of polarization, captured by η , and the distribution of revenue shock in period two. However, investors cannot identify which portion of the total debt lent to the country corresponds to each group. Whenever investors do not collect the full amount of the contracted debt; that is, if at least one group fails to repay or both groups fail to repay; it constitutes a default. Similarly, when the country demands one unit more of debt, lenders will charge the same interest rate regardless of which group is actually receiving that unit.

When facing a country with a unified government, lenders know the default probability in period two is given by π^U . Using the zero profit condition, we can pin down the equilibrium real interest rate charged by lenders to a unified government

$$(1 + r^U)(1 - \pi^U) = 1 + r \quad (9)$$

where π^U is given by (4) and r is the risk free interest rate.

When the borrowing country has a polarized government with η degree of polarization, the equilibrium real interest rate charged by lenders is given by

$$(1 + r^P)(1 - \pi^P) = 1 + r \quad (10)$$

where

$$\pi^P = \max \{\pi^i\}_{i=1}^2 \quad (11)$$

Equation (11) means that the probability of default used by lenders to determine the interest rate they charge to the country with a polarized government is that of the group with the highest default probability. This is because failure to repay the full amount constitutes default in

the model.²² As long as one group decides not to repay its portion of the debt, the country will not be able to repay the full amount even if the other group chooses to repay.²³ Hence, the relevant default probability for investors is the highest probability of the two groups. This is a negative externality in the case of countries with a polarized government. Assume that group i has the highest default probability. When it chooses to increase the amount of debt it borrows, it does not take into account the effect of its action on the other group, which is to increase the cost of borrowing, and in the case it chooses to default it forces the other group to default as well. The cost of not repaying for group i is simply $\eta^i Y_2 \phi$ but the aggregate cost to the country is $Y_2 \phi$. For all values of η^i , the individual cost of default is strictly lower than the aggregate cost.

3.4 Timing of the Events

Unified Government

t=0 The planner chooses B^U .

The interest rate is determined satisfying investors' zero profit condition.

The planner transfers to each group debt and revenue according to its share.

t=1 The revenue shock is realized.

If $Y_2 < Y_2^U$, it chooses to default, if $Y_2 \geq Y_2^U$ it chooses to repay.

If it defaults, each group receives its share of the revenue net of default cost,

$\eta Y_2(1 - \phi), (1 - \eta)Y_2(1 - \phi)$, for group 1 and 2, respectively.

If it repays, each group receives its share of revenue net of repayment,

$\eta[Y_2 - (1 + r^U)B], (1 - \eta)[Y_2 - (1 + r^U)B]$, for group 1 and 2, respectively.

Polarized Government

t=0 Group i receives its share of revenue and chooses b^i .

Total debt is the sum of the b^i s, $B^P = \sum_{i=1}^2 b^i$.

The central government goes to the international capital market and demands B^P .

²² Reinhart and Rogoff (2010) define as external default crisis the failure of a government to meet a principal or interest payment on the due date. These episodes include instances in which rescheduled debt is ultimately extinguished in terms less favorable than the original obligation.

²³ In equilibrium, if one group chooses to default, the other group will find optimal to default as well. This is because it has to incur the default cost regardless it repays or not. Hence, the other group is better off defaulting too.

Interest rate is determined satisfying investors' zero profit condition.

t=1 The revenue shock is realized.

If $Y_2 < Y_2^P$, groups choose to default; if $Y_2 \geq Y_2^P$ groups choose to repay.

If they default, each group receives the share of revenue net of default cost according to its power, $\eta^i Y_2 (1 - \phi)$, for $i=1,2$.

If they repay, each group receives the share of revenue net of repayment according to its power and its debt, $\eta^i Y_2 - (1 + r^P)b^i$, for $i=1,2$.

3.5 The Equilibrium

In this section solves the equilibrium default probabilities for the cases of a unified government and a polarized government. Note that, conditional on the country having defaulted, Y_2 varies uniformly between 0 and Y_2^{U*} in the case of a unified government, and between 0 and Y_2^{P*} in the case of a polarized government. Similarly, conditional on the country having repaid, revenue varies uniformly between Y_2^{U*} and Y_2^H , and between Y_2^{P*} and Y_2^H .

Unified Government

The expected revenue in period 2 is given by

$$E\{Y_2\} = E\{Y_2|D\} + E\{Y_2|R\}$$

where D denotes default and R denotes repayment. Given that revenue when default is chosen varies between 0 and Y_2^{U*} , the expected revenue conditional on default is given by

$$E\{Y_2|D\} = \frac{Y_2^{U*}}{2} = \frac{\pi^U Y_2^H}{2} \quad (12)$$

Similarly, conditional on the country having repaid, revenue varies uniformly between Y_2^{U*} and Y_2^H , the expected revenue conditional in repayment is given by

$$E\{Y_2|R\} = \frac{Y_2^{U*} + Y_2^H}{2} = \frac{(1 + \pi^U) Y_2^H}{2} \quad (13)$$

Rewriting (1) as

$$\max_B U^U = \sum_{i=1}^2 g_1^i + \beta E\{\sum_{i=1}^2 g_2^i\} \quad (14)$$

The maximization problem (14) subject to (2) is equivalent to maximizing (1) subject to (2) because the planner can always maximize the total resource first and then distribute to the two groups according to their weights.

Using (2), (9), (12) and (13), (14) can be written as

$$\max_B U^U = Y_1 + \beta E\{Y_2\} + B^U[1 - \beta(1 + r)] - \frac{\phi\beta(\pi^U)^2 Y_2^H}{2} \quad (15)$$

The first order condition is given by:

$$1 = \beta(1 + r) + \beta\phi\pi^U Y_2^H \frac{d\pi^U}{dB^U} \quad (16)$$

The above marginal condition has a straightforward economic interpretation. In choosing the optimal amount of debt, the marginal benefit of increasing an additional unit of debt in period 1 equals the marginal cost of increasing one unit of debt in period 2 discounted. The marginal cost is composed by the sum of $1+r$, the risk free interest rate, and the marginal increase in the default probability times the revenue loss in case of default.

Combining (3), (4), (9) and (16):

$$\pi^U = \frac{1-\beta(1+r)}{2-\beta(1+r)} \quad (17)$$

Note that the default probability is independent of the degree of polarization η . This is because in the planner's solution, there is no negative externality, all default costs are internalized.

The equilibrium debt and interest rate are the following:

$$B^U = \frac{[1-\beta(1+r)]\phi Y_2^H}{(1+r)[2-\beta(1+r)]^2} \quad (18)$$

$$1 + r^U = (1 + r)[2 - \beta(1 + r)] \quad (19)$$

Polarized Government

In a polarized government, each group maximizes its lifetime utility subject to its budget constraint taking as given the interest rate schedule the country faces. In equilibrium, the total debt that the central government borrows on the international capital market will be the sum of the chosen levels of debt by the two groups, each group contributing accordingly. That is,

$$\sum_{i=1}^2 b^i = B^P, b^i = \eta^i B^P \quad (20)$$

In this case, the expected revenue in period 2 is given by

$$E\{Y_2|D\} = \frac{Y_2^{P*}}{2} = \frac{\pi^P Y_2^H}{2} \quad (21)$$

$$E\{Y_2|R\} = \frac{Y_2^{P*} + Y_2^H}{2} = \frac{(1 + \pi^P) Y_2^H}{2} \quad (22)$$

Combining (5), (6), (10), (20) and (21), group i 's problem can be expressed as the following

$$\max_{b_i} U^i = \eta^i Y_1 + \beta E\{\eta^i Y_2\} + [1 - \beta(1 + r)]b^i - \frac{\phi \beta \eta^i (\pi^P)^2 Y_2^H}{2}, i = 1, 2 \quad (23)$$

The first order condition is given by:

$$1 = \beta(1 + r) + \beta \phi \eta^i \pi^P Y_2^H \frac{d\pi^P}{db^i} \quad (24)$$

The economic interpretation of (24) is similar to the one given in the case of a unified government. However, a key difference should be noted: the second component of the marginal cost of increasing one unit of debt is only a portion η of the total cost. This shows that group i when deciding the optimal level of debt overlooks the additional effect that it imposes on the other group, a negative externality. Consequently, a lower η , higher polarization, is associated with greater externality, increasing the resultant debt level and default probability.

Given that lenders charge the same interest rate to all groups, the marginal increase in interest rate is the same for an additional unit of the total debt or an additional unit of a group's debt. That is

$$\frac{dr^P}{db^i} = \frac{dr^P}{dB^P}, i = 1, 2 \quad (25)$$

(10) and (25) implies

$$\frac{d\pi^P}{db^i} = \frac{d\pi^P}{dB^P} \quad (26)$$

Combining (7), (8), (10), (20), (24) and (26), group i 's default probability is

$$\pi^{i,P} = \frac{1 - \beta(1 + r)}{\beta(1 + r)(\eta^i - 2) + 2} \quad (27)$$

Taking into account (11) and the fact that $0 < \eta \leq 0.5$, the default probability of a polarized government is

$$\pi^P = \frac{1 - \beta(1+r)}{2 - \beta(1+r)(2-\eta)} \quad (28)$$

The equilibrium debt and interest rate are the following:

$$b^i = \phi Y_2^H \eta^i \Omega, \quad i = 1, 2 \quad (29)$$

$$B^P = \phi Y_2^H \Omega \quad (30)$$

$$1 + r^P = \frac{(1+r)[2 - \beta(1+r)(2-\eta)]}{1 - \beta(1+r)(1-\eta)} \quad (31)$$

where

$$\Omega = \frac{[1 - \beta(1+r)][1 - \beta(1+r)(1+\eta)]}{(1+r)[2 - \beta(1+r)(2-\eta)]^2}$$

Proposition 1: $\forall \eta$, *i*) the default probability, *ii*) the level of total debt, and *iii*) the equilibrium interest rate are strictly higher in the polarized government case than the unified government case, that is, $\pi^P > \pi^U, r^P > r^U, B^P > B^U$.

Proof. See the Appendix.

Proposition 2: If the government is polarized, $\forall \eta$, *i*) the default probability, *ii*) the level of total debt, and *iii*) the equilibrium interest rate are increasing in the degree of polarization, that is,

$$\frac{\partial \pi^P}{\partial \eta} < 0, \frac{\partial r^P}{\partial \eta} < 0, \frac{\partial B^P}{\partial \eta} < 0.$$

Proof. See the Appendix.

Proposition 1 is an intensive result. The quality of institution determines the likelihood of default independent of the distribution of powers. Given that the default probability is higher with a polarized government, the equilibrium interest rate is higher to satisfy investors' zero profit condition. The lack of coordination leads to overborrowing because groups do not internalize the aggregate cost of a marginal increase in the debt. Proposition 2 is an extensive result: the higher the degree of polarization, the higher the default probability, the higher the total

level of debt, and the higher is the equilibrium interest rate. This is due to the fact that the size of the negative externality is increasing in the degree of polarization.

4 Extending the Model to Infinite Periods

This section extends the two-period model into the infinite horizon framework of Eaton and Gersovitz (1981), and adopts the quantitative analysis technique developed by Aguiar and Gopinath (2006) and Arellano (2008).

There is an additional default cost in the infinite horizon setup that is the risk of being excluded by the international capital market for certain periods, also known as the reputation cost.²⁴ This cost will dampen the incentive for the countries to default because while the country is excluded from the capital market, it lives in autarky and consumption smoothing is not possible.

4.1 Model Setup

The preference of group i in period t is given by

$$E_0 \sum_{t=0}^{\infty} \beta^t u(g_t^i) \quad (32)$$

where $u(\cdot)$ is strictly concave and differentiable, $\beta \in (0,1)$ is the discount factor and g_t^i is the consumption of group i in period t . The central government receives a stochastic stream of revenue Y . I assume that Y follows a Markov process with transition function $f(Y', Y)$. The country has access to the international capital markets, where it can buy one period discount bonds B' at price $q(B', Y)$. The bond price is a function of the amount of bonds B' and the current revenue shock Y . When B' is a negative number, it means the country borrows $-q(B', Y)B'$ units of goods and promises to repay, conditional on not defaulting, B' units of goods the following period. The timing of events can be summarized as follows: at the beginning of the period, the country starts with a level of debt B . The revenue Y is realized and it is revealed to lenders. In the unified government case, the planner decides to repay or default on the previous period's debt. If it chooses to repay, it also chooses how much to borrow. The equilibrium bond price is determined satisfying lenders' zero profit condition. After receiving $-q(B', Y)B'$, $Y + B - q(B', Y)B'$

²⁴ For discussion on cost of the exclusion, read Arellano (2008).

is split between the two groups according to their shares η^i . If it chooses to default, from that period onward the country will be in financial autarky until re-access. In the case of the polarized government, each group decides to repay or to default on its previous period's debt simultaneously. If both groups repay, then each group also chooses how much to borrow. The central government then goes to the international capital market and sells sovereign bonds for the amount that is the sum of the two groups' chosen debt. The equilibrium bond price is determined. If at least one group decides to default, lenders shut down the capital market to the country since failure of full repayment constitutes default. The country will remain in financial autarky until re-access.

4.2 Default Decision in a Unified Government

Like the two-period model, the planner's problem is to maximize the aggregate welfare of the two groups weighted by their relative power η^i :

$$E_0 \sum_{t=0}^{\infty} \beta^t \sum_{i=1}^2 \eta^i u(g_t^i) \quad (33)$$

The planner solves the following problem: if the country is active in the international capital market (i.e., it has not defaulted in the previous period) and has debt, it chooses to default or to repay; and in the case of repayment, how much new bonds to issue (B').²⁵

I define the optimization as a recursive problem. The state variables are the level of debt inherited from the previous period B and current revenue realization Y . We denote the value function for the unified government being active at state (B, Y) as $V_U(B, Y)$. With the option to default, $V_U(B, Y)$ satisfies

$$V_U(B, Y) = \max_{\{D, R\}} \{V_U^D(Y), V_U^R(B, Y)\} \quad (34)$$

where $V_U^D(Y)$ is the value associated with default and $V_U^R(B, Y)$ is the value associated with repayment. If the planner chooses to default, the country is in temporary financial autarky, total consumption equals revenue net of default loss. The value of default is given by:

$$V_U^D(Y) = \sum_{i=1}^2 \eta^i u(g_t^i) + \beta \int_Y \mu V_U(0, Y') + (1 - \mu) V_U^D(Y') f(Y', Y) dY' \quad (35)$$

$$s.t. \quad \sum_{i=1}^2 g_t^i = Y^{def}$$

²⁵ As in the two-period model, we will assume parameter values that make the agent always want to consume more in the current period relatively to next period; hence, we will only analyze the case of borrowing.

where μ is the probability that the country will regain access to the international credit market. Following Arellano (2008) $Y^{def} = h(Y) \leq Y$, $h(\cdot)$, an increasing function.

If the central planner chooses to repay, the value of remaining in the credit relation is given by:

$$V_U^R(B, Y) = \max_{B'} \{ \sum_{i=1}^2 \eta^i u(g_t^i) + \beta \int_{Y'} V_U(B', Y') f(Y', Y) dY' \} \quad (36)$$

$$s.t. \quad \sum_{i=1}^2 g_t^i = Y + B - q(B', Y) B'$$

The decision to default or to repay is a period-by-period decision. The default probability in the unified government case is

$$\pi_U(B, Y) = \Pr [V_U^D(Y) > V_U^R(B, Y)] \quad (37)$$

4.3 Default Decision in the Polarized Government

Powerful groups maximize their lifetime utility given by

$$E_0 \sum_{t=0}^{\infty} \beta^t u(g_t^i) \quad i = 1, 2 \quad (38)$$

Each group solves the following problem simultaneously: if the country is active in the international credit market and group i has debt (b^i), it chooses to default or to repay; and in the case of repayment, how much new bonds to issue ($b^{i'}$). The state variables for each group are the level of debt inherited from the previous period b^i , the revenue realization Y and the aggregate bonds B' . I denote the value function of interest group i of a country with a polarized government being active at state (b^i, B, Y) as $V_{P_i}(b^i, B, Y)$. Group i decides whether to default or repay its debt to maximize its individual utility function. With the option to default, $V_{P_i}(b^i, B, Y)$ satisfies

$$V_{P_i}(b^i, B, Y) = \max_{\{D, R\}} \{V_{P_i}^D(Y), V_{P_i}^R(b^i, B, Y)\} \quad (39)$$

When **at least one** group decides to default, the country is in temporary financial autarky; total expenditure equals revenue net of default loss. The value of default is given by:

$$V_{P_i}^D(Y) = u(g^i) + \beta \int_{Y'} \mu V_{P_i}(0, 0, Y') + (1 - \mu) V_{P_i}^D(Y') f(Y', Y) dY'$$

$$s.t. \quad g^i = \eta^i Y^{def} \quad (40)$$

When **both groups** decide to repay, the value of remaining in the credit relation is given by:

$$V_{P_i}^R(Y) = \max_{b^i, \{u(g^1) + \beta \int_{Y'} V_{P_i}(b^i, B', Y') f(Y', Y) dY'\}} \\ \text{s.t.} \quad g^i = \eta^i Y + b^i - q(B', Y) b^{i'} \quad (41)$$

The default probability of group i is given by

$$\pi_{P_i}(b^i, B, Y) = \Pr [V_{P_i}^D(Y) > V_{P_i}^R(b^i, B, Y)]$$

Whenever the country fails to repay the full amount (i.e., at least one group decides to default on its debt) lenders exclude the country (i.e., all groups) from the capital market. Therefore the default risk that is relevant to determine the equilibrium bond price is the maximum default probability of the two groups:

$$\pi_P(B, Y) = \max \{\pi_{P_i}\}_{i=1}^2$$

4.4 The Equilibrium Bond Price

Foreign investors are risk neutral and competitive. Given B' , the country's total amount of debt, the revenue Y and the default risk, the bond price for both unified and polarized government satisfies

$$q(B', Y) = \frac{1 - \pi(B', Y)}{1 + r} \quad (42)$$

where $\pi(B', Y)$ equals π_U or π_P , for a unified or polarized government, respectively, and r is the risk free interest rate.

5 Quantitative Analysis

This section tests the success of the model in matching the stylized facts identified in section 2. The numerical analysis uses parameter values that are standard in the literature.

5.1 Functional Forms and Parameters

The model is solved numerically using value function iteration. A CRRA utility function is used:

$$u(g) = \frac{g^{1-\sigma}}{1-\sigma}$$

The revenue process is assumed to be a log-normal AR(1)

$$\log(Y_t) = \rho \log(Y_{t-1}) + \varepsilon_t, E[\varepsilon] = 0, E[\varepsilon^2] = \sigma_y$$

I use Arellano's (2008) output cost structure, which takes the following form: ²⁶

$$Y^{def} = \begin{cases} (1 - \phi)Y & \text{if } Y > \hat{Y} \\ Y & \text{if } Y \leq \hat{Y} \end{cases}$$

Each period refers to a quarter. The discount factor β is set to 0.95; the risk free interest rate 2%; the coefficient of relative risk aversion 2; the probability of re-access to the capital market after default $\mu=0.1$ which implies an average duration of 2.5 years of staying in autarky, similar to the estimate by Gelos et al. (2004) and the output loss when staying in autarky, 2%. Values for parameters of the revenue process are: $\rho=0.9$ and $\sigma_y=3.4\%$, which is the value used in Aguiar and Gopinath (2006), also similar to many business cycle models.

5.2 Simulation Results

I simulate the model for the unified government and polarized government cases. In the polarized government case, the simulation is conducted for three degrees of polarization: high ($\eta=0.1$), medium ($\eta=0.3$) and low ($\eta=0.5$). The computational algorithm used to solve the model can be found in Appendix 3.

Figure 5 shows the bond price schedule faced by countries with a unified government as a function of assets B' for two revenue shocks that are one standard deviation above and below the trend. Bond prices are an increasing function of the asset, so that larger levels of debt are associated with lower price. Booms are associated with higher bond price, which implies lower interest rate. This is because revenue is persistent; higher revenue in the current period predicts higher revenue in the next period, therefore making default less likely. This endogenous countercyclical interest rate is consistent with the data. Figure 6 shows the default decision rule as a function of revenue at a given level of debt: 1 denotes default, 0 denotes repayment. Default is optimal when revenue shock is low. This is also consistent with the data since most defaults occur in recessions. Due to the fact that the central planner maximizes the collective welfare, the

²⁶ Arellano (2008) discusses the advantage of using this asymmetric default cost structure.

relative power of the groups, i.e., η , does not affect the optimal decision; therefore, the price schedule and default decision rule are the same using different η 's.

Figures 7 and 8 correspond to the case of countries with a low degree of polarization, that is $\eta=0.5$. Compared with the unified government case, the bond price is lower for any given Y and B' . This is because the probability of default is higher for countries with a polarized government; to compensate for the higher default risk, the interest rate is higher (the bond price is lower). Price zero means there is no market for bonds at that level because at that level of debt, the probability of default is one. This is known as the default set. Comparing Figure 5 with Figure 7, the default set is larger in the case of the polarized government than the unified government. Comparing Figure 6 with Figure 8, countries with a polarized government default in more states of the revenue realization than the countries with a unified government. Figures 9 and 10 show the case of countries with a high degree of polarization, $\eta=0.1$. The default set becomes even larger and there are more states of revenue in which default is optimal.

In order to study the long-run default probabilities, I simulate the model 10,000 periods 100 times for the unified government case and for the polarized government case. I compare the simulation results with the data. The median polarization in the data given that there is some degree of polarization ($\eta \neq 0$) and that there are weak institutions ($\text{parreg} < 4.48$) is 0.12; 75% of the sample has polarization below 0.23. I divide the sample into four groups: i) countries without polarization ($\eta=0$) that have good institutions ($\text{parreg} > 4.48$); ii) countries with low polarization ($\eta < 0.12$) and weak institutions ($\text{parreg} < 4.48$); iii) countries with medium polarization ($0.12 \leq \eta < 0.23$) and weak institutions ($\text{parreg} < 4.48$), and iv) countries with high polarization ($\eta \geq 0.23$) and weak institutions ($\text{parreg} < 4.48$). I then take the average default probability of each group and compare it with the simulation results in table 10. For the simulation, default probability is calculated as the number of periods that the country defaults divided by the total number of periods that the country has access to the capital market. Autarky periods are excluded.

The results of the two-period model are confirmed in this infinite horizon setting. Default probability is higher for countries with a polarized government. Furthermore, it is increasing in the degree of polarization. Compared with the data, the model explains more than 50% of the observed default frequencies for each group. Note that the simulations use the same set of

parameter values for all countries; the only differences among countries are the degree of polarization and quality of institutions. In the data, there is heterogeneity among countries other than the degree of polarization, which in principle accounts for the remaining 50%.

6 Conclusion

This paper has provided an explanation for the cross-country difference in sovereign default frequencies and institutions. The key factor that determines the likelihood of default is the institutional setting. If institutions set clear rules to limit the influence of powerful groups in the central government's spending and borrowing decisions, the central planner solution that maximizes collective welfare can be achieved. If such institutions do not work properly, individual behaviors of powerful groups lead to an inefficient equilibrium in which default occurs more often. Furthermore, given that powerful groups do not coordinate in the polarized government case, more polarization results in higher default probabilities.

In a two-period model, a country with a unified government is less likely to default than a country with a polarized government. This is because in the unified government case, there are either good institutions that limit the influence of powerful groups in the central government's decisions, or groups can coordinate; thus, the central planner's solution that maximizes the collective welfare can be achieved. In contrast, in a polarized government, each powerful group makes decisions ignoring the effects of its actions on other groups. As a result, suboptimal choices are made and default is more likely at any given level of debt.

Numerical simulation of the infinite horizon model succeeds in showing the cross-country difference in terms of default probability and degree of polarization given the quality of institutions. The analysis was able to match the empirical positive relationship between degrees of polarization and default probabilities using standard parameters in the sovereign default literature.

The policy implication of the paper is that efforts of international organizations in helping serial defaulters to prevent future sovereign debt crisis must be spent on tackling the root of the problem, institutions, in addition to providing assistance in designing better fiscal policies.

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Appendix 1

Proposition 1: $\forall \eta$, i) the default probability, ii) the level of total debt, and iii) the equilibrium interest rate are strictly higher in countries with a polarized government than those with a unified government, that is, $\pi^P > \pi^U, r^P > r^U, B^P > B^U$.

Proof:

i) Comparing (17) to (29)

$$\pi^P > \pi^U \text{ iff } \beta(1+r)(\eta-2) + 2 < 2 - \beta(1+r)$$

$$\beta(1+r)(\eta-1) < 0$$

ii) Comparing (18) to (30)

$$B^P > B^U \text{ iff } \frac{[1 - \beta(1+r)(1-\eta)]}{[2 - \beta(1+r)(2-\eta)]^2} > \frac{1}{[2 - \beta(1+r)]^2}$$

First we will prove show that $\frac{\partial B^P - B^U}{\partial \eta} < 0$

$$\frac{\partial B^P - B^U}{\partial \eta} < 0 \text{ iff } \frac{\partial B^P}{\partial \eta} < 0$$

$$\frac{\partial B^P}{\partial \eta} = \frac{\phi Y_2^H [1 - \beta(1+r)] \{ \beta(1+r)^2 [\beta(1+r)(\eta-2) + 2]^2 - 2[\beta(1+r)(\eta-1) + 1][\beta(1+r)(\eta-2) + 2]\beta(1+r)^2 \}}{(1+r)^2 [\beta(1+r)(\eta-2) + 2]^4}$$

$$\frac{\partial B^P}{\partial \eta} < 0 \text{ iff } [\beta(1+r)(\eta-2) + 2]^2 - [\beta(1+r)(\eta-1) + 1]2[\beta(1+r)(\eta-2) + 2] < 0$$

$$[\beta(1+r)(\eta-2) + 2]^2 - [\beta(1+r)(\eta-1) + 1]2[\beta(1+r)(\eta-2) + 2]$$

$$= [\beta(1+r)(\eta-2) + 2][\beta(1+r)(\eta-2) + 2 - \{2[\beta(1+r)(\eta-1) + 1]\}] = (\eta-2) - 2(\eta-1) < 0$$

$$\Rightarrow \frac{\partial B^P - B^U}{\partial \eta} < 0$$

Since $(B^P - B^U)$ is strictly increasing in η , it is suffice to show $B^P - B^U > 0 \forall \eta$ if $B^P - B^U > 0$ at $\eta=0$ and $\eta=0.5$.

$B^P - B^U$ evaluated at $\eta=0$

$$B^P - B^U = [1 - \beta(1+r)][2 - \beta(1+r)]^2 - [2 - 2\beta(1+r)]^2$$

$$= [1 - \beta(1+r)][4 - 4\beta(1+r) + \beta^2(1+r)^2] - 4 + 8\beta(1+r) - 4\beta^2(1+r)^2$$

$$= 4\beta(1+r) - \beta^2(1+r)^2 - 3\beta(1+r)$$

$$= 1 - \beta(1+r) > 0$$

$B^P - B^U$ evaluated at $\eta=0.5$

$$\begin{aligned}
B^P - B^U &= [1 - \beta(1+r)0.5][2 - \beta(1+r)]^2 - [2 - \beta(1+r)1.5]^2 \\
&= [1 - \beta(1+r)0.5][4 - 4\beta(1+r) + \beta^2(1+r)^2] - 4 + 6\beta(1+r) - 2.25\beta^2(1+r)^2 \\
&= 2\beta(1+r) - \beta(1+r)0.5[4 - 4\beta(1+r) + \beta^2(1+r)^2] - 1.25\beta^2(1+r)^2 \\
&= 1.5 - \beta(1+r) > 0
\end{aligned}$$

iii) Given that $\pi^P > \pi^U$, using (9) and (10), it is easy to see that $r^P > r^U$.

Proposition 2: Given that there is polarization in the government, $\forall \eta$, i) the default probability, ii) the level of total debt, and iii) the equilibrium interest rate are increasing in the degree of polarization, that is, $\frac{\partial \pi^P}{\partial \eta} < 0$, $\frac{\partial r^P}{\partial \eta} < 0$, $\frac{\partial B^P}{\partial \eta} < 0$.

Proof:

$$i) \pi^P = \frac{1 - \beta(1+r)}{2 - \beta(1+r)(2 - \eta)}$$

$$\frac{\partial \pi^P}{\partial \eta} = \frac{[1 - \beta(1+r)]\beta(1+r)}{[2 - \beta(1+r)(2 - \eta)]^2} < 0$$

ii) Proved in Proposition 1.

$$iii) 1 + r^P = \frac{(1+r)[2 - \beta(1+r)(2 - \eta)]}{1 - \beta(1+r)(1 - \eta)}$$

$$\begin{aligned}
\frac{\partial r^P}{\partial \eta} &= \frac{\beta(1+r)^2[1 - \beta(1+r)(1 - \eta)] - (1+r)[2 - \beta(1+r)(2 - \eta)]\beta(1+r)}{[1 - \beta(1+r)(1 - \eta)]^2} \\
&= \frac{[1 - \beta(1+r)(1 - \eta)] - [2 - \beta(1+r)(2 - \eta)]}{[1 - \beta(1+r)(1 - \eta)]^2} \\
&= \frac{-\beta(1+r) - 1}{[1 - \beta(1+r)(1 - \eta)]^2} < 0.
\end{aligned}$$

Appendix 2

Table 1- Summary Statistics

| | N | mean | SD | min | max |
|---|----------|-------------|-----------|------------|------------|
| Default probability | 95 | 3.51 | 3.13 | 0.00 | 12.24 |
| Default history (years in default or restructuring) | 95 | 11.32 | 18.16 | 0.00 | 70.00 |
| Total external debt / GNI | 95 | 51.08 | 45.02 | 0.00 | 255.78 |
| Log of real GDP per capita | 95 | 7.54 | 1.47 | 4.94 | 10.31 |
| ICRG | 90 | 0.55 | 0.21 | 0.12 | 1.00 |
| Regulation of participation | 93 | 3.60 | 0.88 | 2.00 | 5.00 |
| Government polarization index | 94 | 0.09 | 0.15 | 0.00 | 0.62 |

Table 2- Correlation among explanatory variables

| | Default history | Debt/GNI | log GDPpc | ICRG | Regulation of participation | Polarization Index |
|-----------------------------|-----------------|----------|-----------|---------|-----------------------------|--------------------|
| Default history | 1 | | | | | |
| Debt/GNI | -0.03 | 1 | | | | |
| log GDP per capita | 0.14 | -0.52*** | 1 | | | |
| ICRG | -0.09 | -0.57*** | 0.81*** | 1 | | |
| Regulation of participation | -0.23** | -0.24** | 0.46*** | 0.61*** | 1 | |
| Polarization Index | 0.09 | -0.24*** | 0.20** | 0.29** | 0.08 | 1 |

Table 3- Summary Statistics of Institutions, Polarization and Default Probability

| | ICRG index | Regulation of participation | Government Polarization |
|---------------------|------------|-----------------------------|-------------------------|
| Non-defaulters | 0.79 | 4.34 | 0.12 |
| Defaulter | 0.44 | 3.28 | 0.08 |
| One-time Defaulters | 0.46 | 3.16 | 0.03 |
| Serial Defaulters* | 0.44 | 3.30 | 0.09 |

* Countries that had two or more default episodes.

Samples size: 90 countries, 27 non-defaulters, 14 one-time defaulter and 49 serial defaulters.

Source: POLITY IV, The PRS Group, DPI Database and Reinhart & Rogoff (2009).

Table 4 – Cross-country regression of sovereign default risk and institutions
Dependent Variable: Default Probability

| Variable | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---------------------|----------------------|-----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| IGDPpc | -0.963*** (0.254) | -0.282 (0.395) | -0.671** (0.312) | -1.002*** (0.256) | -0.308 (0.389) | -0.326 (0.387) | -0.722** (0.313) | -0.709** (0.308) |
| Debt_GNI | 0.00340 (0.00819) | 0.000172 (0.00822) | 0.00422 (0.00822) | 0.00497 (0.00831) | 0.00205 (0.00814) | 0.00344 (0.00814) | 0.00578 (0.00826) | 0.00633 (0.00812) |
| Default history | 0.0253 (0.0160) | 0.0113 (0.0172) | 0.0144 (0.0174) | 0.0241 (0.0161) | 0.00798 (0.0169) | 0.00634 (0.0169) | 0.0138 (0.0174) | 0.0128 (0.0171) |
| ICRG | | -6.276** (2.642) | | | -6.702** (2.606) | -5.143* (2.811) | | |
| parreg | | | -0.779* (0.437) | | | | -0.737* (0.436) | -0.219 (0.501) |
| polarization | | | | 2.797 (2.001) | 4.113** (2.063) | 12.04** (5.929) | 2.720 (1.983) | 17.24** (7.502) |
| ICRG*polarization | | | | | | -11.65 (8.171) | | |
| parreg*polarization | | | | | | | | -3.774** (1.883) |
| Constant | 10.32*** (2.199) | 8.937*** (2.325) | 10.97*** (2.207) | 10.28*** (2.208) | 8.949*** (2.285) | 8.138*** (2.342) | 10.87*** (2.197) | 8.837*** (2.387) |
| Observations | 95 | 90 | 93 | 94 | 90 | 90 | 93 | 93 |
| R-squared | 0.237 | 0.291 | 0.271 | 0.254 | 0.323 | 0.339 | 0.286 | 0.318 |

Note: * significant at 10%, ** significant at 5%, *** significant at 1%

Source: Worldwide Governance Indicators (WGI) project, Political Institutions Database DPI (2009) and Reinhart & Rogoff (2009).

Table 5 – Cross-country regression of sovereign default risk and institutions excluding Latin America

| Dependent Variable: Default Probability | | | | | | | | |
|--|----------------------|-----------------------|----------------------|----------------------|-----------------------|-----------------------|----------------------|----------------------|
| Variable | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| IGDPpc | -1.140*** (0.225) | -0.546 (0.349) | -0.774*** (0.273) | -1.192*** (0.226) | -0.568* (0.332) | -0.602* (0.317) | -0.821*** (0.269) | -0.809*** (0.256) |
| Debt_GNI | 0.00129 (0.00831) | -0.00623 (0.00847) | 0.00268 (0.00811) | 0.00299 (0.00837) | -0.00467 (0.00808) | -0.00110 (0.00782) | 0.00480 (0.00802) | 0.00578 (0.00764) |
| Default history | -0.00218 (0.0210) | -0.00910 (0.0206) | -0.00316 (0.0202) | -0.00405 (0.0208) | -0.0145 (0.0197) | -0.0187 (0.0189) | -0.00548 (0.0198) | -0.00865 (0.0189) |
| ICRG | | -6.335** (2.597) | | | -7.151*** (2.487) | -4.731* (2.535) | | |
| parreg | | | -1.003** (0.395) | | | | -0.996** (0.387) | -0.430 (0.419) |
| polarization | | | | 3.094* (1.748) | 4.956*** (1.759) | 20.74*** (6.049) | 3.263* (1.660) | 21.92*** (6.779) |
| ICRG*polarization | | | | | | -20.64*** (7.597) | | |
| parreg*polarization | | | | | | | | -4.553*** (1.608) |
| Constant | 11.57*** (2.020) | 11.15*** (2.039) | 12.45*** (1.962) | 11.61*** (2.013) | 11.34*** (1.941) | 9.977*** (1.919) | 12.41*** (1.923) | 10.13*** (2.000) |
| Observations | 76 | 71 | 74 | 75 | 71 | 71 | 74 | 74 |
| R-squared | 0.433 | 0.498 | 0.495 | 0.458 | 0.552 | 0.599 | 0.522 | 0.573 |

Note: * significant at 10%, ** significant at 5%, *** significant at 1%

Source: Worldwide Governance Indicators (WGI) project, Political Institutions Database DPI (2009) and Reinhart & Rogoff (2009).

Table 6 – Cross-country regression of sovereign default risk and institutions excluding countries independent after 1959
Dependent Variable: Default Probability

| VARIABLES | (1) | (2) | (3) | (4) | (5) | (7) | (6) | (8) |
|---------------------|----------------------|----------------------|----------------------|----------------------|-----------------------|----------------------|---------------------|-----------------------|
| IGDPpc | -1.146*** (0.286) | -0.754 (0.483) | -0.863** (0.379) | -1.224*** (0.276) | -0.703 (0.458) | -0.712* (0.422) | -0.952** (0.365) | -1.018*** (0.320) |
| Debt_GNI | -0.00132 (0.0129) | -0.00413 (0.0132) | 0.000378 (0.0129) | 0.000804 (0.0124) | -0.00276 (0.0125) | 0.00119 (0.0116) | 0.00240 (0.0124) | 0.00130 (0.0109) |
| Default history | 0.00951 (0.0192) | 0.00351 (0.0201) | 0.00700 (0.0192) | 0.00743 (0.0184) | -0.000867 (0.0191) | -0.00470 (0.0176) | 0.00507 (0.0185) | -0.000750 (0.0162) |
| ICRG | | -3.457 (3.433) | | | -4.659 (3.288) | -1.890 (3.181) | | |
| parreg | | | -0.553 (0.486) | | | | -0.527 (0.466) | 0.219 (0.458) |
| polarization | | | | 3.683** (1.705) | 4.054** (1.704) | 22.41*** (6.675) | 3.633** (1.700) | 30.51*** (7.634) |
| ICRG*polarization | | | | | | -22.93*** (8.104) | | |
| parreg*polarization | | | | | | | | -6.127*** (1.707) |
| Constant | 11.29*** (2.680) | 10.54*** (2.781) | 11.15*** (2.673) | 11.46*** (2.569) | 10.47*** (2.632) | 8.528*** (2.519) | 11.32*** (2.563) | 8.881*** (2.344) |
| Observations | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 |
| R-squared | 0.475 | 0.488 | 0.492 | 0.530 | 0.553 | 0.631 | 0.545 | 0.660 |

Note: * significant at 10%, ** significant at 5%, *** significant at 1%

Source: Worldwide Governance Indicators (WGI) project, Political Institutions Database DPI (2009) and Reinhart & Rogoff (2009).

Table 7 – Cross-country regression of sovereign default risk and institutions
High vs. Low Regulation of participation

| VARIABLES | (1) | (2) | (3) | (4) |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Y=Default probability | parreg<3.55 | parreg>3.55 | parreg<2.72 | parreg>4.48 |
| IGDPpc | -0.577 (0.604) | -0.512* (0.303) | -0.935 (1.381) | -1.381 (1.790) |
| debt_gni | 0.00202 (0.0131) | 0.0194* (0.0103) | 0.0115 (0.0443) | 0.0929 (0.0532) |
| history | 0.00308 (0.0279) | 0.0378* (0.0192) | -0.0326 (0.0327) | -0.00416 (0.0297) |
| polarization | 6.375* (3.554) | -1.240 (2.094) | 11.82** (4.272) | 0.949 (1.971) |
| Constant | 7.821* (4.419) | 5.548* (2.808) | 9.463 (10.03) | 13.44 (17.73) |
| Observations | 44 | 50 | 15 | 21 |
| R-squared | 0.097 | 0.429 | 0.510 | 0.734 |

Note: * significant at 10%, ** significant at 5%, *** significant at 1%

Source: Worldwide Governance Indicators (WGI) project, Political Institutions Database DPI (2009) and Reinhart & Rogoff (2009).

Table 8 – Cross-country regression of sovereign default risk and institutions excluding Latin America. High vs. Low Regulation of participation

| VARIABLES | (1) | (2) | (3) | (4) |
|-----------------------|---------------------|----------------------|--------------------|----------------------|
| Y=Default probability | parreg<3.55 | parreg>3.55 | parreg<2.72 | parreg>4.48 |
| IGDPpc | -1.311* (0.649) | -0.719*** (0.196) | -1.175 (2.070) | -0.803 (0.787) |
| debt_gni | 0.00512 (0.0195) | 0.0121* (0.00669) | 0.0374 (0.0926) | 0.0520** (0.0242) |
| history | 0.0612 (0.0714) | -0.00463 (0.0141) | 0.0168 (0.135) | -0.0146 (0.0139) |
| polarization | 8.418* (4.084) | -0.422 (1.347) | 17.72* (7.322) | 0.194 (0.868) |
| Constant | 12.12** (5.007) | 7.383*** (1.813) | 9.751 (12.84) | 7.915 (7.797) |
| Observations | 29 | 46 | 8 | 19 |
| R-squared | 0.283 | 0.658 | 0.679 | 0.746 |

Note: * significant at 10%, ** significant at 5%, *** significant at 1%

Source: Worldwide Governance Indicators (WGI) project, Political Institutions Database DPI (2009) and Reinhart & Rogoff (2009).

Table 9 – Cross-country regression of sovereign default risk and institutions excluding countries independent after 1959. High vs. Low Regulation of participation

| VARIABLES | Parreg<3.55 | Parreg>3.55 |
|-----------------|---------------------|-----------------------|
| IGDPpc | -1.520** (0.587) | -0.894*** (0.240) |
| Debt_GNI | 0.0290 (0.0316) | 0.00630 (0.00933) |
| Default history | 0.117** (0.0513) | -0.000984 (0.0122) |
| polarization | 17.69*** (4.224) | 0.534 (1.136) |
| Constant | 10.65** (4.525) | 8.738*** (2.287) |
| Observations | 15 | 30 |
| R-squared | 0.709 | 0.718 |

Note: * significant at 10%, ** significant at 5%, *** significant at 1%

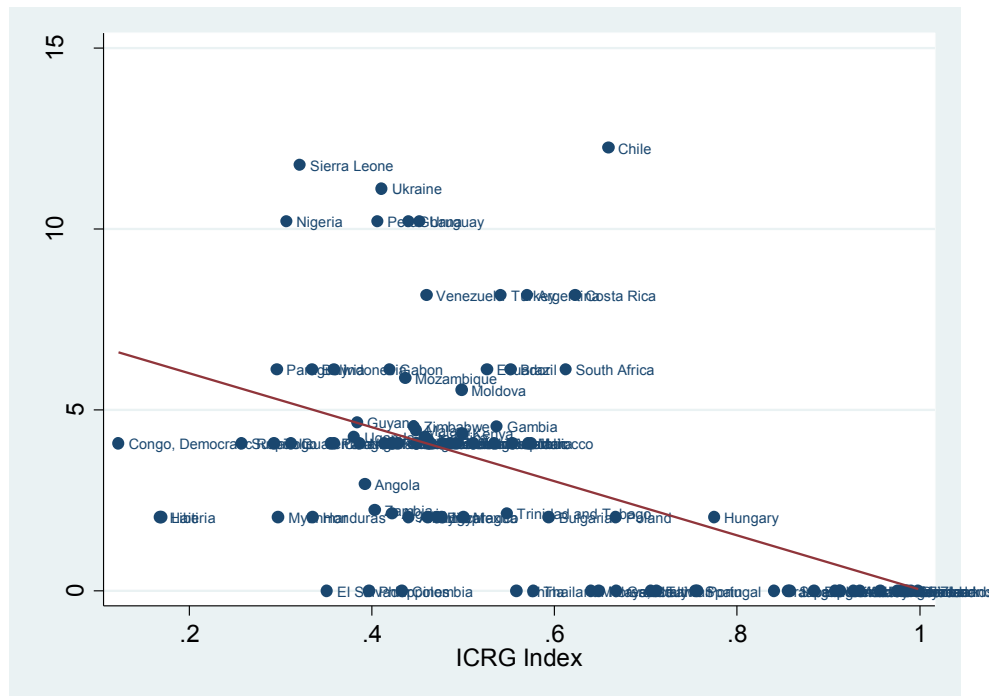
Source: Worldwide Governance Indicators (WGI) project, Political Institutions Database DPI (2009) and Reinhart & Rogoff (2009).

Table 10- Summary Statistics of Default Probabilities: Simulations Results

| | Default Probability | |
|-----------------------|---------------------|------------|
| | Data(average) | Simulation |
| Unified government | 3.01 | 1.78 |
| Polarized government | | |
| Low ($\eta=0.5$) | 3.71 | 2.04 |
| Medium ($\eta=0.3$) | 4.37 | 2.56 |
| High ($\eta=0.1$) | 6.24 | 3.34 |

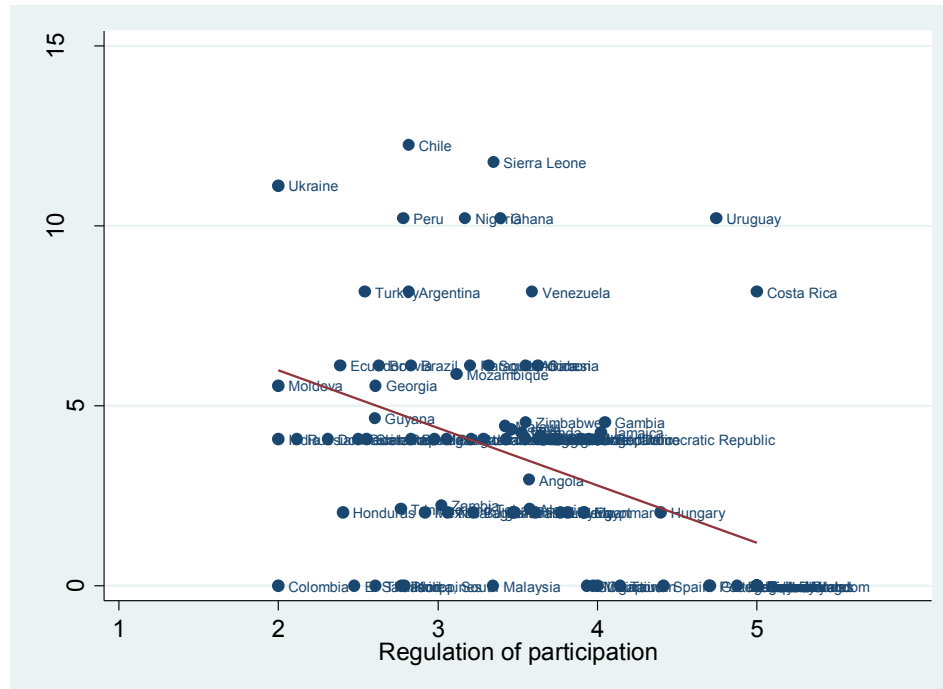
Note: in the data, unified governments are countries with zero polarization or having $\text{parreg} \geq 4.48$ (62); polarized governments with low degree of polarization are countries with polarization below 0.12 (18); polarized governments with medium polarized are countries with polarization between 0.12 and 0.23 (7) and polarized governments with high polarization are countries with polarization above 0.23 (8).

Figure 1- Default Probability versus ICRG institutional index



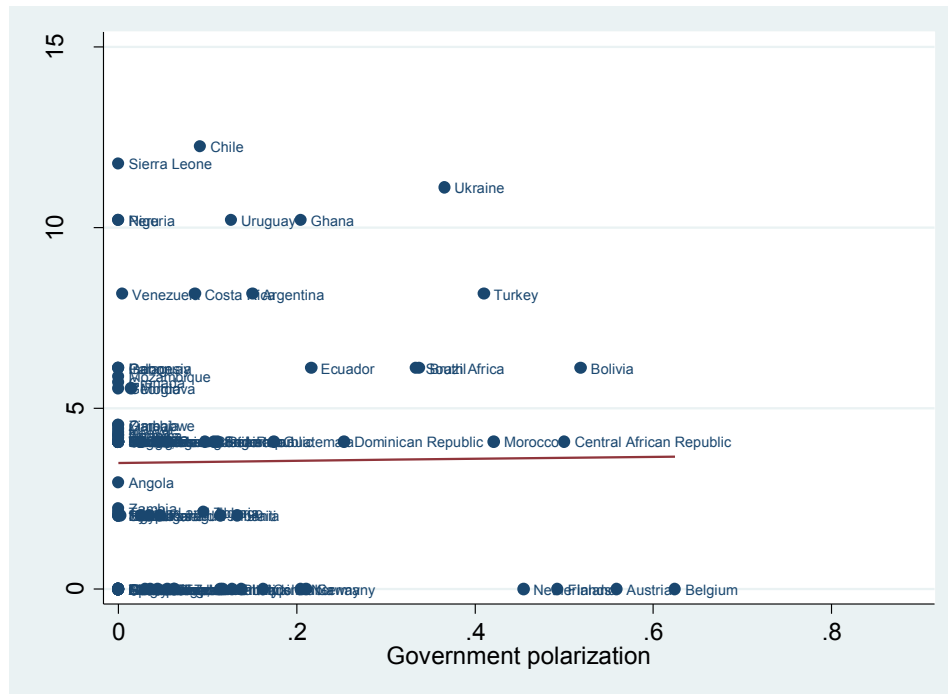
Source: Reinhart & Rogoff (2009), International Country Risk Guide, PRS Group.

Figure 2- Default Probability versus Regulation of Participation



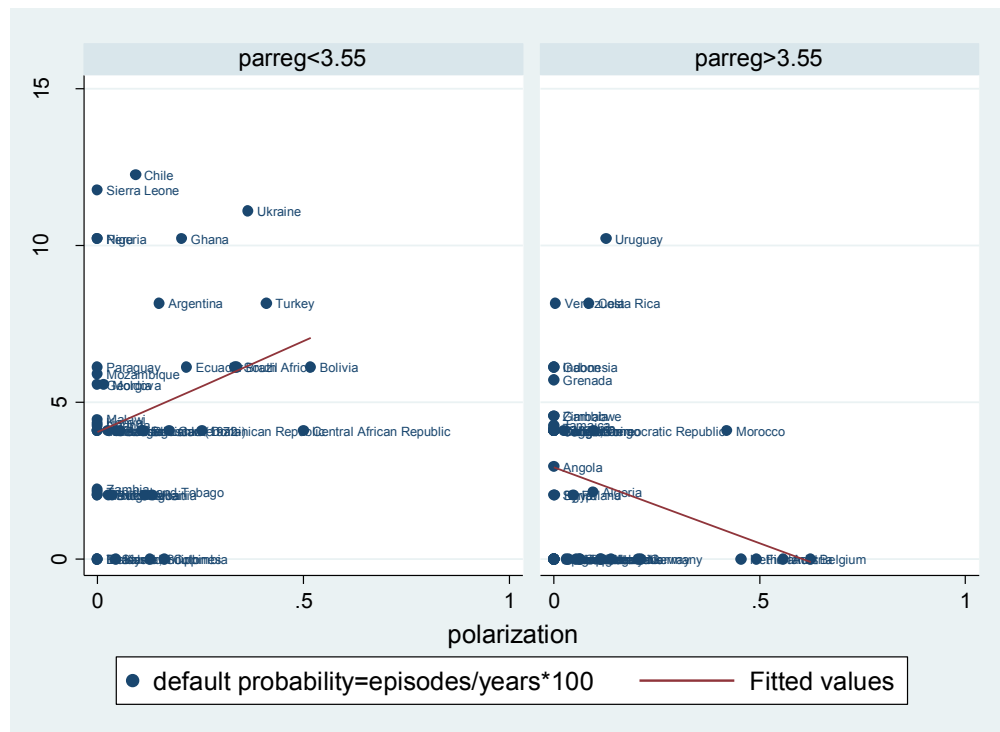
Source: author's calculation based on POLITY IV and Reinhart & Rogoff (2009).

Figure 3- Default Probability versus Polarization



Source: author's calculation based on DPI database and Reinhart & Rogoff (2009).

Figure 4- Default Probability versus Polarization by Institutions



Source: author's calculation based on DPI database and Reinhart & Rogoff (2009).

Figure 5- Bond price schedule: Unified government

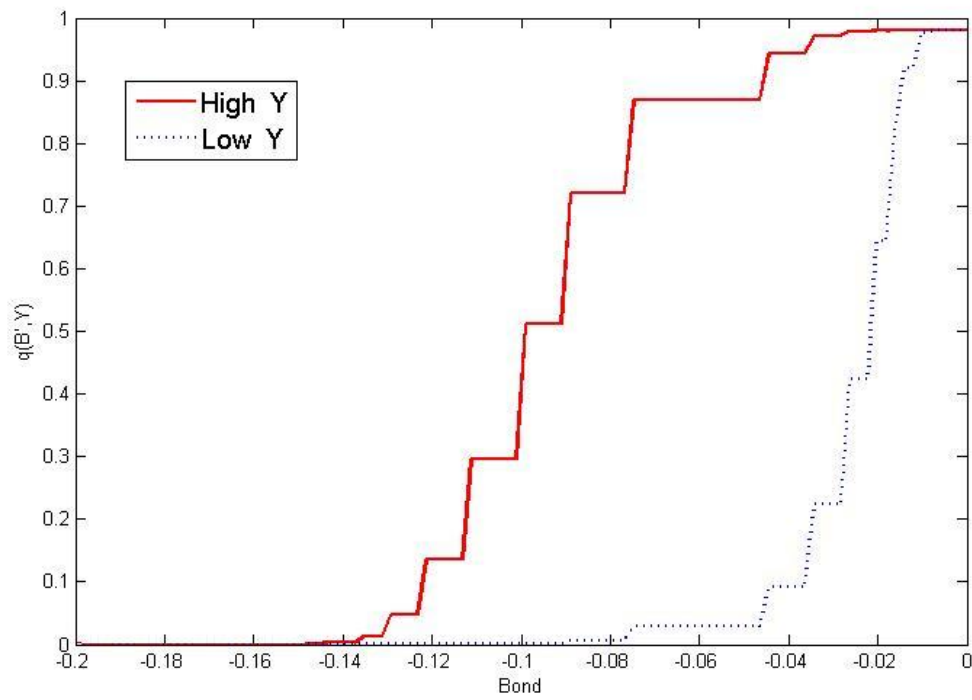


Figure 6- Default rule: Unified government

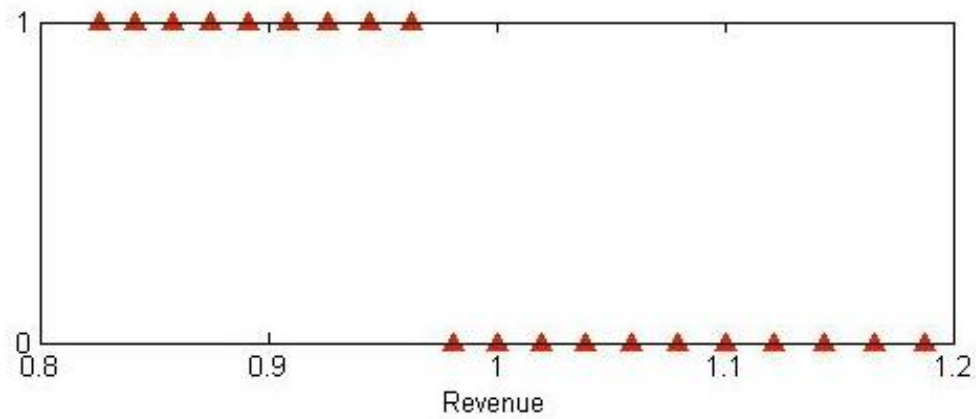


Figure 7- Bond price schedule: Polarized government ($\eta=0.5$)

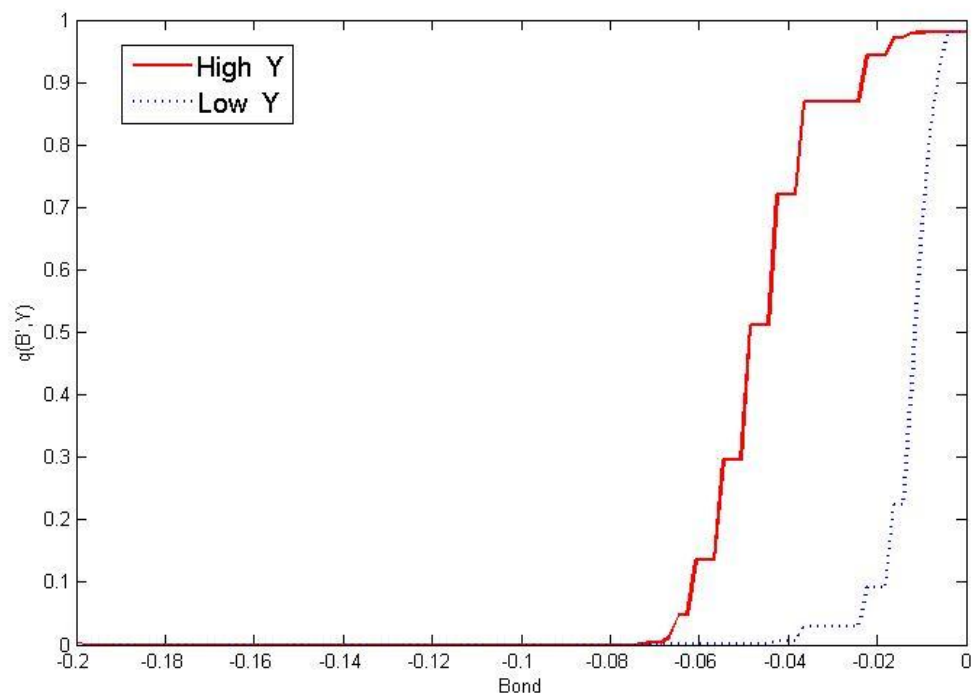


Figure 8- Default rule: Polarized government ($\eta=0.5$)

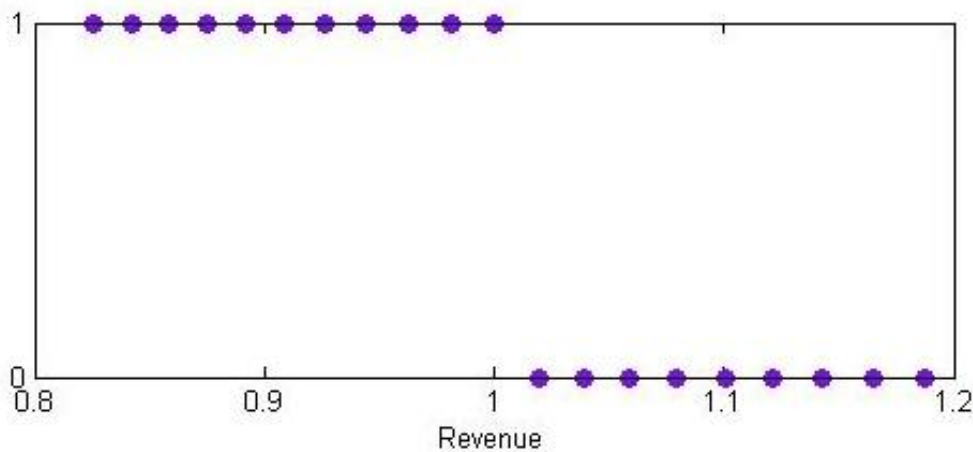


Figure 9- Bond price schedule: Polarized government ($\eta=0.1$)

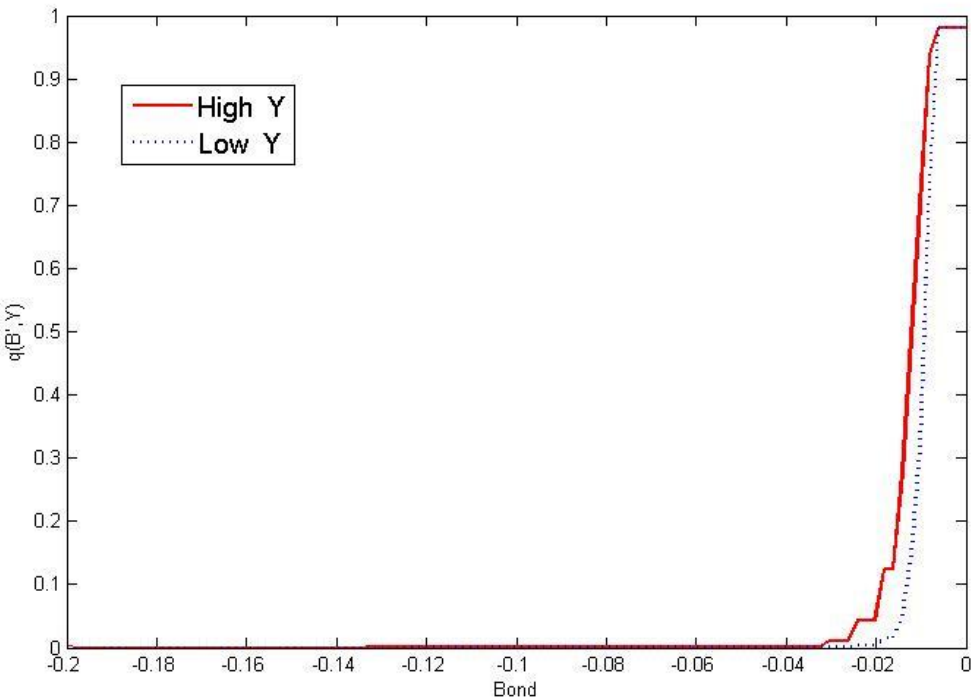
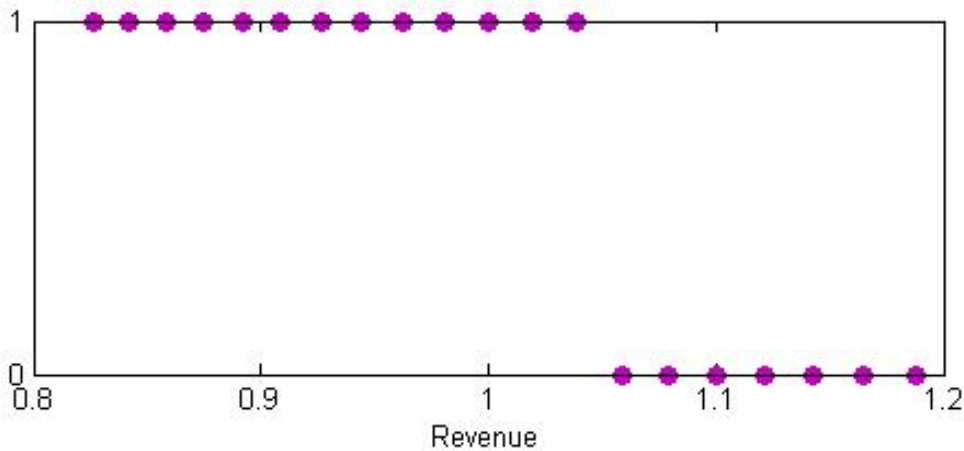


Figure 9- Default rule: Polarized government ($\eta=0.1$)



Appendix 3

We use the discrete state-space method. We generate the AR(1) process for revenue with a discrete Markov chain using 21 equally spaced grids. The asset space is discretized into 100 possible values. We make sure that the limits of our asset space never bind.

The computational algorithm used to solve the unified government case is the following:

1. Start with a guess for the bond price schedule such that $q^0(B', Y) = 1/(1 + r)$ for all B' and Y .
2. Given the bond price schedule and an initial guess for $V_U^{D,0}$ and $V_U^{R,0}$ iterate on the Bellman equations (37) and (38) to solve the optimal value function for $\hat{V}_U^D, \hat{V}_U^R, \hat{V}_U = \max\{\hat{V}_U^D, \hat{V}_U^R\}$ and the optimal policy functions.
3. We compute a new bond price schedule $q^1(B', Y)$ using default sets and repayment sets such that lenders' zero profit condition is satisfied. We then compare the new bond price schedule to the previous iteration's. If a convergence criterion is satisfied, that is, $\max\{q^0(B', Y) - q^1(B', Y)\} < \varepsilon$ then proceed to the next step. Otherwise update the price and go back to step 2.
4. Compute default probabilities from 10000 periods.

The computational algorithm used to solve the polarized government case is the following:

1. Start with a guess for the bond price schedule such that $q^0(B', Y) = 1/(1 + r)$ for all B' and Y .
2. Given the bond price schedule and an initial guess for $V_{Pi}^{D,0}$ and $V_{Pi}^{R,0}$, iterate on the Bellman equations (41) and (42) to solve the optimal value function for $\hat{V}_{Pi}^D, \hat{V}_{Pi}^R, \hat{V}_{Pi} = \max\{\hat{V}_{Pi}^D, \hat{V}_{Pi}^R\}$ and the optimal policy functions for each $i=1,2$.
3. We compute a new bond price schedule $q^1(B', Y)$ using default sets and repayment sets such that $\pi_P(B, Y) = \max\{\pi_{Pi}\}_{i=1}^2$ and lenders' zero profit condition are satisfied. We then compare the new bond price schedule to the previous iteration's. If a convergence criterion is satisfied, that is, $\max\{q^0(B', Y) - q^1(B', Y)\} < \varepsilon$ then proceed to the next step, otherwise update the price and go back to step 2.
4. Compute default probabilities from 10000 periods.

Data Appendix

Sovereign debt crisis: adopting Reinhart and Rogoff (2008) definition, a sovereign debt crisis occurs when there is outright default on payment of external debt obligations, repudiation, or the restructuring of debt into term less favorable to the lender than those in the original contract.

Default probability: calculated as number of episodes occurred between 1960-2008 (or since year of independence) divided by number of years.

Sample period: 1960-2008

Source: Reinhart and Rogoff (2009). We supplement it with dataset constructed by Laeven and Valencia (2008), De Paoli et al. (2006) and Levy-Yeyati and Panizza (2011).

Default history: calculated as percent of years between independence (or 1800, whichever is later) and 1959 in which a country was in default on its external borrowing.

Sample period: 1800-1959

Source: Reinhart and Rogoff (2009).

Debt as percent of GNI. Source: Global Development Finance, World Bank.

Sample period: 1970-2008

Real GDP per capita: GDP per capita at constant 2000 u\$.

Sample period: 1960-2008

Source: World Development Indicator, World bank.

ICRG (Institutional country risk guide) indicator of quality of government. The mean value of the ICRG variables “Corruption”, “Law and Order” and “Bureaucracy Quality”, scaled 0-1.

Higher values indicate higher quality of government.

Sample period: 1984-2008

Source: The PRS Groups. <http://www.prsgroup.com/CountryData.aspx>

Regulation of participation (parreg)

Participation is regulated to the extent that there are binding rules on when, whether, and how political preferences are expressed. One-party states and Western democracies both regulate participation but they do so in different ways, the former by channeling participation through a single party structure, with sharp limits on diversity of opinion; the latter by allowing relatively stable and enduring groups to compete nonviolently for political influence. The polar opposite is unregulated participation, in which there are no enduring national political organizations and no effective regime controls on political activity. In such situations political competition is fluid and often characterized by recurring coercion among shifting coalitions of partisan groups. A five-category scale is used to code this dimension:

(1) Unregulated: Political participation is fluid; there are no enduring national political organizations and no systematic regime controls on political activity. Political groupings tend to form around particular leaders, regional interests, religious or ethnic or clan groups, etc.

(2) Multiple Identity: There are relatively stable and enduring political groups which compete for political influence at the national level—parties, regional groups, or ethnic groups, not necessarily elected—but there are few, recognized overlapping (common) interests.

(3) Sectarian: Political demands are characterized by incompatible interests and intransigent posturing among multiple identity groups and oscillate more or less regularly between intense factionalism and government favoritism, that is, when one identity group secures central power it favors group members in central allocations and restricts competing groups' political activities, until it is displaced in turn (i.e., active factionalism).

(4) Restricted: Some organized political participation is permitted without intense factionalism but significant groups, issues, and/or types of conventional participation are regularly excluded from the political process.

(5) Regulated: Relatively stable and enduring political groups regularly compete for political influence and positions with little use of coercion. No significant groups, issues, or types of conventional political action are regularly excluded from the political process.

Sample period: 1960-2008

Source: POLITY IV <http://www.systemicpeace.org/polity/polity4.htm> (Marshall and Jaggers 2010)

Government polarization: weighted standard deviation of ideologies of the three largest parties in the government, where the weight given to each party corresponds is its number of seats in the legislature.

Sample period: 1960-2008

Source: DPI database.

| List of countries in the sample | | |
|---------------------------------|--------------|---------------------|
| Albania | Guinea | Sierra Leone |
| Algeria | Haiti | Singapore |
| Angola | Honduras | South Africa |
| Argentina | India | Spain |
| Australia | Indonesia | Sri Lanka |
| Austria | Iran | Sudan |
| Belgium | Italy | Sweden |
| Bolivia | Jamaica | Syria |
| Brazil | Japan | Tanzania |
| Bulgaria | Jordan | Thailand |
| Cameroon | Kenya | Togo |
| Canada | Korea, South | Trinidad and Tobago |
| Central African Republic | Madagascar | Tunisia |
| Chile | Malawi | Turkey |
| China | Malaysia | Uganda |
| Colombia | Mauritius | Ukraine |
| Congo | Mexico | United Kingdom |
| Congo, Democratic Republic | Moldova | United States |
| Costa Rica | Morocco | Uruguay |
| Cote d'Ivoire | Mozambique | Venezuela |
| Denmark | Netherlands | Vietnam |
| Dominica | New Zealand | Zambia |
| Dominican Republic | Nicaragua | Zimbabwe |
| Ecuador | Niger | |
| Egypt | Nigeria | |
| El Salvador | Norway | |
| Finland | Pakistan | |
| France | Panama | |
| Gabon | Paraguay | |
| Gambia | Peru | |
| Georgia | Philippines | |
| Germany | Poland | |
| Ghana | Portugal | |
| Greece | Romania | |
| Grenada | Russia | |
| Guatemala | Senegal | |