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Political constraints and sovereign default ☆

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ABSTRACT

We study how political constraints, characterized by the degree of flexibility to choose fiscal policies, affect the probability of sovereign default. To that end, we relax the assumption that policymakers always repay their debt in the dynamic model of fiscal policy developed by Battaglini and Coate (2008). In our setup, legislators bargain over taxes, general spending, debt repayment, and a local public good that can be targeted to the region they represent. Under tighter political constraints, more legislators have veto power, implying that local public goods need to be provided to a larger number of regions. The resources that are freed after a default have to be shared with a higher number of individuals, which reduces the benefits from defaulting in per-capita terms. This lowers the incentive to default compared to the case with lax political constraints. The model is calibrated to Argentina and the results conform to robust empirical evidence. An event study for the 2001/2002 sovereign debt crisis shows that political constraints had an important role in the buildup that led to the crisis.

1. Introduction

Political constraints play an important role in determining the fiscal policies of the government, including the decision to default on external debt. Conventional wisdom on the role of political constraints is divided. Less constrained governments are sometimes more powerful and able to take unpopular austerity measures whenever necessary. On the other hand, the same may tempt politicians to default and misuse available resources whenever possible. In such a case, stronger political constraints are seen as a better commitment device by international lenders. In this paper, we analyze the government's incentives to default under different degrees of political constraints using the political-economy model of fiscal policy from Battaglini and Coate (2008), augmented by lack of commitment to repay as in Arellano (2008).

In most countries, fiscal policies are enacted by legislation that requires consent from the legislature. Voting requirements in various spheres of the government represent political constraints. In countries run by authoritarian rulers, political constraints are weak or absent. On the other hand, in countries with stronger political institutions, majority or super-majority

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rules are required in order for the legislature to pass a policy. This process is further complicated by the distribution of power within the legislature of those supporting or opposing a policy. Even though a bill might require a simple majority to pass, political constraints may be effectively tighter because some salient political actors fiercely oppose it. In this paper, we consider a holistic measure of political constraints and focus on its interaction with default.

In our empirical analysis of Section 1.1 we use POLCONv, a measure of political constraints developed by Henisz (2000). It is constructed using a spatial model of policy preferences by political actors who hold significant veto power, such as the executive, legislature, and judiciary, adjusting for the partisan position within each power. The measure is annual and ranges from 0 (unconstrained) to 1 (highest possible constraints). Fig. 1 shows the evolution of POLCONv for Argentina (top panel) and Chile (bottom panel) between 1980 and 2016. The shaded areas represent periods when the countries were in default. We observe that, in both countries, default periods and periods with lower political constraints coincide. Section 1.1 shows that standard measures of political constraints are negatively related to sovereign spreads in a set of South American countries, even after controlling for other potential determinants of default.

To quantify the importance of these constraints on default decisions, we construct a political-economy model in which legislators, each representing a region, bargain every period over a set of policies. These include spending on a pure public good, distortionary taxes on labor income, spending on region-specific (local) public goods, external borrowing, and default. Within a period, for every round of bargaining, a proposer is picked at random. In order to be implemented, his policy proposal must obtain the support of a subset of legislators (minimum winning coalition, henceforth *mwc*). An arrangement that requires the support of a bigger *mwc* represents a more constrained government. An important innovation of this paper relative to existing work on bargaining is that we allow for the size of the required *mwc* to change stochastically over time. In other words, there will be periods in which the proposer has greater flexibility to change policy variables (e.g. without requiring the support of a large number of members in Congress) than others.

The government borrows from international risk-neutral lenders. They price the sovereign bonds by taking into account the government's ability to default on debt. The lenders discipline the government borrowing by offering lower prices if the probability of a default is high. The lenders thus also take into account the current (and future) political constraints faced by the government.

The ability to provide local public goods by the government is key to understanding the relationship between political constraints and the probability of default. A less constrained government levies taxes and borrows on behalf of the entire polity, but cares only about the consent of the few members of the *mwc*. Whenever possible, it needs to provide local public goods to these members to obtain their support. Based on this, there are three main channels through which political constraints influence the probability of default. First, a smaller *mwc* induces the government to borrow more. This is because the borrowed resources are distributed as local public goods among fewer legislators. Lenders perceive higher borrowing to be associated with a higher probability of future default and offer a lower price on the debt. The lower prices increase the chances of current default. We call this channel *overborrowing*.

Second, for a given level of debt, default is more rewarding for the less constrained government because the released resources are distributed as local public goods among fewer legislators. This is the *static* channel. Finally, the *dynamic* channel affects the probability of default through the continuation value of the government in the current period. Even if defaulting does not release resources to provide for local public goods in the current period, current default incentives are affected by the possibility of wasteful local public goods provision in future periods. Lenders price the current debt accordingly. Because political constraints are stochastic, the strength of each one of these forces will vary. And this will, of course, impact both, borrowing levels and the probability of default.

Restricting attention to a Markov perfect equilibrium, we solve an infinite horizon version of the model numerically and calibrate it to Argentina in the period surrounding the 2001/2002 crisis. A novel calibration target is the process followed by political constraints before and after the crisis. We find a negative relationship between political constraints and spreads in the calibrated economy. In the model, a one standard deviation increase in political constraints reduces spreads by 4.26 percentage points.

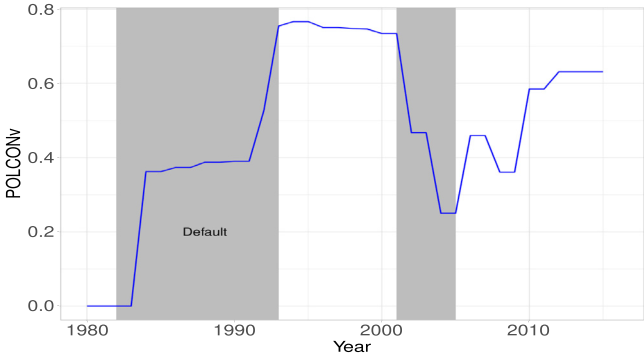
The rest of the paper is organized as follows. Section 1.1 provides empirical evidence of the relationship between political constraints and spreads. Section 2 describes the related literature. Section 3 describes the economic environment, including the government policies and the political process. Section 4 defines the political equilibrium. Section 5 partially characterizes the equilibrium and discusses the mechanisms of the model. Section 6 describes the calibration and quantitative results. Section 7 concludes.

1.1. Empirical evidence

In this section, we show that political constraints and sovereign spreads are negatively related in a set of Latin American countries. In other words, the probability of default is lower when policymakers are more constrained.

We use annual data for Brazil, Mexico, Argentina, Peru, Ecuador, Venezuela, and Chile between 1995 and 2016. Our measure of country risk is given by the **EMBIG spreads** published by J.P.Morgan.[1] Among many possible measures used in

[1] Data is obtained from the World Bank, J.P. Morgan Ltd., and the Central Bank of Chile.



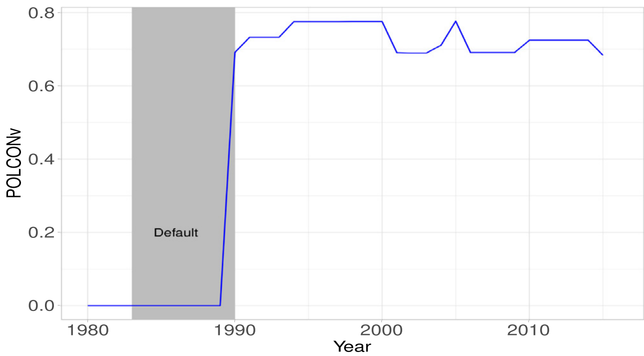


Fig. 1. Evolution of POLCONv for Argentina (top) and Chile (bottom). *Note:* POLCONv ranges from 0 to 1 with 1 representing the highest degree of political constraints. POLCONv for each year is as measured on January 1st of that year.

the political economy literature that capture political constraints in countries with varying degrees of institutional development we pick two. These are "POLCONv" by Henisz (2000) and "XCONST" from the Polity IV database.

POLCONv is computed by first pointing out the number of veto powers, as mentioned above, and then it is adjusted for the partisan position within each power: for example, if the legislature is controlled by the executive's party, POLCONv is low. If the legislature is controlled by opponents but is highly fragmented based on seat distribution across various parties, POLCONv is low as well. On the other hand, if opponents control the legislature, but have a single-party majority, POLCONv is high. POLCONv takes into account five such veto powers for each country. It is an annual measure[2]. This measure is constructed using tangible, objective parameters of power distribution within the government. It does not rely on subjective perceptions about constraints. Hence, this measure often displays sharp changes and motivates consideration of political constraints as a stochastic shock in our analysis.

XCONST, a component of the Polity IV database, also captures the extent of institutionalized constraints on executive power. Unlike POLCONv, it is a subjective measure that can take seven discrete values (1 to 7), based on the degree of constraints. The measure takes the value 1 if the executive has unlimited authority and 7 if "accountability groups have effective authority equal to or greater than the executive in most areas of activity"[3]

Fig. 2 shows that both of these measures are negatively related to interest rate spreads in South-American countries, suggesting that tighter political constraints are indeed associated with lower sovereign default risk in the data.

Table 1 reports the results of a panel regression of EMBIG Spreads on political constraints. The first and second column uses POLCONv for political constraints, whereas the third and fourth column uses XCONST. In all the specifications, we control for the country and year fixed effects, *Default*, lagged external public debt to GDP ratio, and the growth rate of real GDP. In column (1) we report heteroskedasticity-robust standard errors and find POLCONv to be significant at 1% level. All the other control variables are also statistically significant with the expected sign: Higher external debt implies higher spreads due to higher chances of default, higher growth rate on the other hand reduces spreads, and spreads are higher when a country is in default. To interpret the size of the coefficients, it is useful to express them as normalized measures. In this specification, a 1 standard deviation increase in POLCONv implies a 1.30 % decline in spreads. Following Cotoc et al. (2021), we also include political leaning (*Pol.Lean*)[4] of the government as an additional control variable. Results are displayed in the second column of the table (where we also cluster standard errors by country). *Pol. Lean* has the expected sign: left-leaning governments are more likely to face higher spreads due to higher chances of default, but the coefficient on it is not

[2] measured as on January 1 each year.

[3] as defined in the Polity IV dataset user's manual.

[4] The data on political leaning is from IADB. We would like to thank an anonymous referee for suggesting we include this variable as an additional control.

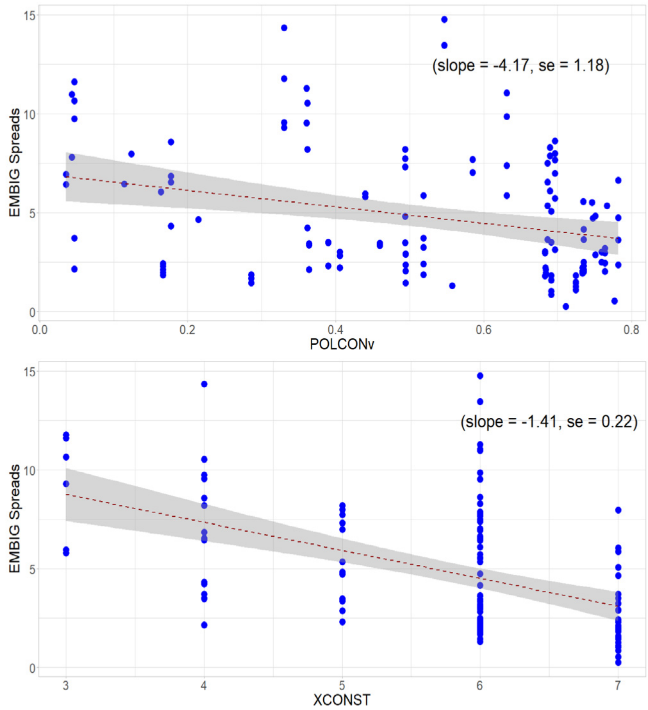


Fig. 2. Relationship between political constraints and country spreads. *Note:* Each point in the above figure represents a country-year observation. The shaded area around the line of best fit represents the 95% confidence interval. The data source for EMBIG spreads is J.P. Morgan Ltd. POLCONv ranges from 0 to 1 and XCONST between 1 to 7, with higher values representing tighter constraints.

Table 1
Fixed effects regressions with time effects.

	Dependent variable:			
	EMBIG Spreads			
	(1)	(2)	(3)	(4)
POLCONv	-7.261^{***}	-7.700^{**}		
	(1.872)	(2.082)		
XCONST			-1.050^{***}	-1.133
			(0.370)	(0.778)
Pol. Lean		-0.862		-0.972^{*}
		(0.629)		(0.473)
$\left(\frac{\text{Ext.Pub.Debt}}{\text{GDP}}\right)_{-1}$	16.51^{***}	16.56^{**}	15.63^{***}	15.17^{*}
	(4.679)	(6.092)	(4.784)	(6.462)
Growth Rate	-0.270^{*}	-0.367	-0.234	-0.337
	(0.147)	(0.221)	(0.157)	(0.212)
Default	8.661^{***}	8.216^{***}	8.684^{***}	8.680^{***}
	(1.832)	(1.846)	(2.036)	(1.807)
Observations	141	113	140	112
R^2	0.798	0.820	0.784	0.810
Adjusted R^2	0.741	0.748	0.721	0.733
Country FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Cluster	✗	✓	✗	✓

Note: *** implies statistical significance at 1% percent level. ** and * implies statistical significance at 5% and 10% level respectively. *Pol. Lean* is the ideological leaning of the ruling executive. It is coded as −1 (Left), 0 (Center), and 1 (Right). We omit observations that declare no clear leaning of the executive. Default takes the value 1 if the country is in default in a given year, and 0 otherwise. *Growth Rate* is that of real GDP. Lagged values of external public debt to GDP are used to account for existing/maturing debt stocks as opposed to new borrowings.

statistically different from zero. POLCONv is still negative and statistically significant: a one standard deviation increase in POLCONv implies a 1.38% decline in spreads according to this specification.

In column (3) XCONST is negative and significant, without *Pol. Lean* and with heteroskedasticity robust standard errors. One standard deviation increase in XCONST leads to a 0.54% fall in spreads. In column (4) we add *Pol Lean* and cluster standard errors by country. Here XCONST is no longer significant. This may be because of the subjective and discrete nature of XCONST that are not always based on observable measures of political constraints, which makes it more persistent.

2. Related literature

This paper is at the intersection of two literatures: (i) the large quantitative literature on sovereign default and (ii) the literature on legislative bargaining.

We model sovereign default with one-period debt using an environment similar to Eaton and Gersovitz (1981) and Arellano (2008). Chatterjee and Eyigungor (2012) and Mihalache (2020) use a similar environment to analyze the long-term debt and the impact of debt maturity choice on macroeconomic outcomes. Hatchondo et al. (2009) analyzes how turnover, specifically among heterogeneous governments, can impact default incentives. They focus on the role of the effective discount factor induced by political friction. Chatterjee and Eyigungor (2019) develop a model of endogenous political turnover linked to growth outcomes that leads to myopic behavior of the government in periods of low growth. We do not explicitly model turnover, but link exogenous politically induced constraints (that may be present with or without political turnover) to sovereign default incentives. Unlike Chatterjee and Eyigungor (2019) our model accounts for the contingency that even if a low growth regime results in a political turnover, the new government may be less constrained and choose to default on its external debt. Carlos Hatchondo and Martinez (2010) presents an excellent early survey of the literature on the interaction of politics and sovereign default.

We also relate to the literature studying policy making under legislative bargaining, which started with the seminal work of Baron and Ferejohn (1989). Battaglini and Coate (2008) extended their environment to include macroeconomic characteristics (e.g., production and an endogenous labor supply), government spending, distortionary taxation, and debt. While the fiscal policy space was greatly expanded, the authors assumed the government could not default. In order for the long-run distribution of debt not to grow unrealistically, an exogenous upper bound on the level of debt issued by the government (e.g. a borrowing limit) had to be imposed. Azzimonti et al. (2016) study the effects of further constraining borrowing by introducing balanced budget rules that do not allow the government to have deficits. In all these models, it is assumed that the government has a commitment to repay its debt obligations. A main departure in our work is to allow for strategic default.

Our economy is similar to Barseghyan et al. (2013)—which in turn builds on Battaglini and Coate (2008)—but an important difference is that we allow for concavity in the utility of private consumption. This introduces an incentive to smooth consumption (and not just taxes) over time, that, while slightly complicating the analysis, is important for calibration purposes. In particular, because the marginal utility of consumption is more elastic to TFP shocks, it affects the timing of default decisions.

Like us, Cusato Novelli (2020) is at the intersection of the sovereign default and legislative bargaining literature. His paper extends Arellano (2008) by introducing legislators who bargain over default decisions, in order to explain how political myopia can result in excessive borrowing and higher spreads. Our work, which can be seen as complementary, differs along three important dimensions. First, we analyze how changes in the degree of political constraints affect country risk over the business cycle. We model political constraints as a stochastic shock and find that it impacts default decisions in the short run. In particular, that loosening constraints may *trigger* a default That is, political constraints in our environment are time-varying, whereas they are constant in his. Second, we map data on political constraints to our quantitative model to explain the quarterly movement in spreads. To the best of our knowledge, we are the first ones to do so. Third, like Arellano (2008); Cusato Novelli (2020) considers an exogenous production process and non-distortionary taxation to finance debt repayment. In our environment, instead, policies are distortionary, affecting labor supply and production. This behavior has implications for sovereign default.

3. Environment

Time is discrete. The economy is populated by a continuum of infinitely lived agents distributed uniformly across n regions. The population in each district $i = 1, 2, \ldots, n$ is normalized to 1. There is a single non-storable consumption good c, produced using a single factor, labor l, and a linear technology $c = h(z)l$, where $h(z)$ is the labor productivity[5]. There is a pure public good g, produced from the consumption good using a linear technology $g = c$ and a region-specific local public good s_i for region i, produced from the consumption good using a similar linear technology $s_i = c$. Agents consume c, supply labor for production, and derive utility from both the pure public good and the local public good. They discount the future at a rate β. Each citizen living in region i has a period utility function given by

[5] The form of $h(z)$ is discussed later. It takes different forms in states of repayment and default.

$$U(c, l, g, s_i) = u(c, l) + \pi v(g) + s_i \tag{1}$$

where π is the utility weight on pure public goods relative to the consumption-leisure aggregate. The utility function is additively separable in g and s_i, whereas $u(c, l)$ is assumed to have a GHH specification, as in (Greenwood et al. (1988)) in consumption and labor. More specifically,

$$u(c, l) = \frac{1}{1-\sigma}\left(c - \frac{l^{1+\gamma}}{1+\gamma}\right)^{1-\sigma} \quad \text{and} \quad v(g) = \frac{g^{1-\sigma}}{1-\sigma},$$

with $\sigma > 0$ representing the risk-aversion parameter and $\gamma > 0$ the Frisch elasticity of the labor supply.

Following Barseghyan et al. (2013), $z \in Z$ follows a first-order Markov process $\mu(z\prime|z)$. Labor markets in the economy are competitive. Given the linear production technology for the consumption good, the wage rate in the economy (w) fluctuates one-to-one with the labor productivity shock $h(z)$ in equilibrium.[6]

In line with Arellano (2008), we consider imperfect capital markets that prevent individuals from using assets to smooth aggregate fluctuations.[7] The government, on the other hand, can issue one period bonds that can be bought and sold in international markets. A key departure from Battaglini and Coate (2008) and Barseghyan et al. (2013) is that the government does not have commitment to repay its debt obligations. Government policies, including default decisions, are described in detail in the next section.

3.1. Government policies and politics

At the beginning of each period, the government finds itself either in good standing with the international capital markets, denoted by $\Omega = 1$, or in default, denoted by $\Omega = 0$. In good standing, the government is free to borrow or save, by buying or selling respectively, one-period non-contingent bonds from/to international investors. The net resources raised by the government from capital markets are denoted by $-qb\prime + b$, where a positive value of $b\prime$ is the face value of the current assets of the government and a positive value of b, the face value of the last period's assets (e.g. a negative value implies debt). Here, q denotes the unit price of the new issuance.

In periods with good financial standing, the government supplements the resources raised by borrowing with a proportional income tax, τ. The tax revenue and the borrowed funds are used to finance pure public goods and region-specific local public goods. However, there is a limited commitment to repay the maturing debt. If the government reneges on its current debt obligations, it is immediately excluded from international credit markets, and its credit standing is downgraded to $\Omega = 0$. This exclusion continues for a stochastic number of periods determined by the parameter θ. The decision to default on its debt is denoted by the indicator $d\prime$, which takes the value 1 if the government defaults, and 0 otherwise. If the government defaults, it only relies on tax revenues to finance both pure and local public goods.

Government policies are decided by a legislative bargaining process following Battaglini and Coate (2008). Representatives from n regions bargain over fiscal policy instruments, namely the level of taxes, the provision of pure public goods and local public goods, whether to default or not, and (if in good standing with international markets) how much new debt to issue. Since individuals are identical in all regions, the identity of the representative is irrelevant.

The legislature meets at the beginning of a period, and one legislator is chosen at random to make a policy proposal. A proposal is a set of feasible policies denoted by $\{\tau, g, d\prime, b\prime, s_1, s_2, \ldots, s_n\}$, when Ω takes the value 1, and $\{\tau, g, s_1, s_2, \ldots, s_n\}$, when Ω takes the value 0. The proposal requires $m \leqslant n$ votes to be implemented. If the proposal succeeds to obtain the required number of votes, the policy is implemented and the legislature adjourns. If the proposal fails to obtain the required number of votes, the legislative process moves to the next proposal round in which another legislator is chosen at random to propose. If no agreement can be reached in $T \geqslant 2$ proposal rounds, a legislator is appointed to choose a reference policy. As usually assumed in this literature, the reference policy is restricted to having the same allocation of local public goods for every region. Clearly, m is an important parameter of the model, as it captures how constrained a legislator is in choosing policy when given proposal power. A key innovation of our environment is to allow for m to change stochastically over time. This captures the dynamics of political constraints and allows us to accommodate the observation that a proposer has more flexibility to dictate policy in some periods than in others. The stringency of political constraints is assumed to follow a first-order Markov process, with transition probability $p(m\prime|m)$. Note that m, corresponding to the size of the minimum winning coalition, is thus a relevant state variable in this economy.

Model timeline: Fig. 3 illustrates the timeline of events in our model. The government starts a period with a realized productivity shock z, a given level of assets b, the current degree of political constraints $m \in M = \{1, 2, \ldots, n\}$, and its standing on international capital markets, $\Omega \in \{0, 1\}$. The state of the economy can thus be summarized by $\Pi = (z, b, m, \Omega)$.

When the government is excluded from international capital markets (Ω=0), it cannot borrow or lend, so $b\prime = 0$ and $d\prime = 1$. The only available choices are the policies $\{\tau, g, s_1, s_2, \ldots, s_n\}$, as illustrated in the first top branch of Fig. 3. When in good standing (Ω=1), we follow Eaton and Gersovitz (1981) and assume that the government chooses first whether to default

[6] In the original environment by Battaglini and Coate (2008), shocks are to the value of public relative to private goods, π, whereas TFP $h(z)$ was assumed to be time-invariant. In our setup, we keep π constant instead and allow $h(z)$ to vary with the business cycle.

[7] This is akin to assuming that agents are hand-to-mouth, as the model abstracts from idiosyncratic shocks.

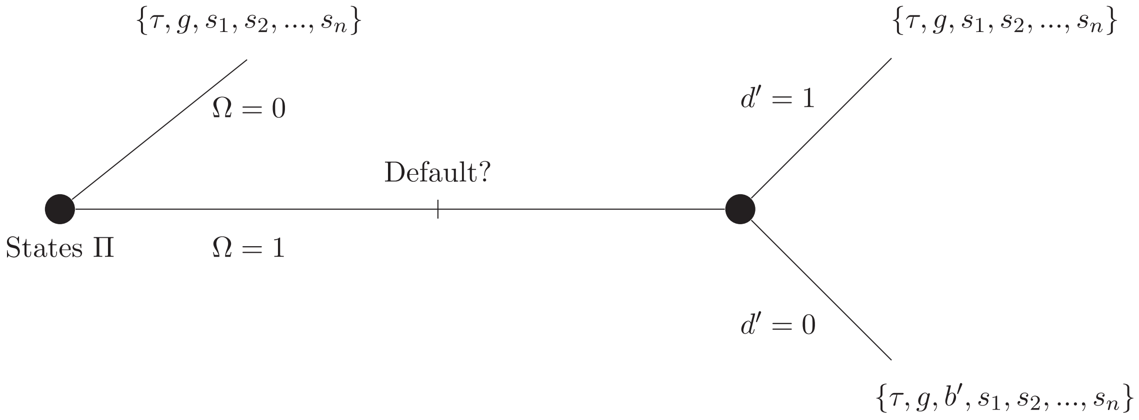


Fig. 3. Timeline of Events.

or not, and then chooses the other policies contingent on its default decision. If the government defaults, its debt obligations are set to zero, and the policy instruments available to the government are the same as those in the first top branch. If it chooses to repay, it maintains good standing, and its policy choice is described by the $n+3$ tuple $\{\tau, g, b\prime, s_1, s_2, \ldots, s_n\}$. That is, it can also modify the level of asset holdings $b\prime$.

Labor markets: Because agents are excluded from capital markets, their only relevant decision is how much labor to supply given policies and wages (which in turn are determined by the productivity shock). Their maximization problem is static,

$$l^*(\tau, z) = \arg\max_l \left\{ \frac{1}{1-\sigma} \left((1-\tau)h(z)l - \frac{l^{1+\gamma}}{1+\gamma} \right)^{1-\sigma} + \frac{\pi}{1-\sigma} g^{1-\sigma} + s_i \right\} \tag{2}$$

where $(1-\tau)h(z)l$ is the disposable income of a citizen and $l^*(\tau, z)$ denotes the labor supply. It is easy to show that optimal consumption and labor satisfy

$$l^*(\tau, z) = [h(z)(1-\tau)]^{\frac{1}{\gamma}} \quad \text{and} \quad c^*(\tau, z) = (1-\tau)h(z)l^*(\tau, z).$$

It is useful to write the indirect utility of the representative agent in region i as

$$\underbrace{u(c^*(\tau, z), l^*(\tau, z)) + \pi v(g)}_{\equiv U(c^*, l^*, g)} + s_i. \tag{3}$$

The government budget must satisfy two feasibility constraints. First, revenues must cover public expenditures. Given the policy choice of the government, $\{\tau, g, (1-d\prime)b\prime, d\prime, s_1, s_2, \ldots, s_n\}$, revenues are given by

$$n\tau h(z)l^*(\tau, z) = n\tau h(z)[h(z)(1-\tau)]^{\frac{1}{\gamma}} \tag{4}$$

Feasibility requires that the government's net surplus, denoted by $B(\tau, g, b\prime, d\prime; \Pi) = n\tau h(z)l^*(\tau, z) - g + (1-d\prime)[b - qb\prime]$ cannot exceed the total amount of resources allocated for pure public good provision across all regions, $\sum_{i=1}^n s_i$:

$$B(\tau, g, b\prime, d\prime; \Pi) \geqslant \sum_{i=1}^n s_i \tag{5}$$

Second, local public goods cannot be negative: $s_i \geqslant 0$.

4. Political equilibrium

In this section, we describe the proposer's optimization problem given households' policy functions, the problem of the foreign lenders, and then define the politico-economic equilibrium for this economy.

[8] Even though the behavior in the current period depends on the history of defaults, the only relevant state variable is Ω. That is, whether the country is in good standing in international markets or not.

4.1. The proposer's problem

We focus on symmetric a Markov-perfect equilibrium for this environment.[8] Since the equilibrium is symmetric, any proposer in round $k \in \{1, 2, \ldots, T\}$ will choose the same policies.

The proposer's choice in round k, given state Π, is described by the policies $\{\tau^k, g^k, d\prime^k, b\prime^k, s_1^k, \ldots, s_n^k\}_{k=1}^T$ when $\Omega = 1$ and by $\{\tau^k, g^k, s_1^k, \ldots, s_n^k\}_{k=1}^T$ when $\Omega = 0$.[9] Here τ^k denotes the proposed tax rate, g^k denotes the proposed level of pure public goods, and $s_i^k \; \forall i = 1, 2, \ldots, n$ denote the level of local public goods suggested by the proposer. Since the other $n-1$ legislators are ex-ante identical, the $m-1$ coalition members whose consent is required to pass the legislation are randomly chosen from them. The proposer obtains consent to implement the proposed policy by providing local public goods to the *mwc*. In equilibrium, the proposer does not provide local public goods to the legislators outside the *mwc*. Because of symmetry, it is optimal to provide other members of the *mwc* with an equal amount of the good s. Since the total surplus after repayment of debt (if at all) and pure public good provision is $B(.)$, the proposer keeps $B(.) - (m-1)s$ for her/his own region. This can be higher than s. This characterization is analogous to the one in Battaglini and Coate (2008) and Barseghyan et al. (2013). The proposer's region receives an allocation of local public goods of the value $B(\tau^k, g^k, b\prime^k, d\prime^k; \Pi) - (m-1)s^k$ if the period starts with good credit standing. Otherwise, the allocation is $B(\tau^k, g^k; \Pi) - (m-1)s^k$. This may be different from the local public goods provided to the other members of the minimum winning coalition.

When in good standing ($\Omega = 1$), the proposer chooses whether to include a default in its policy proposal. The proposer decides to default in proposal round k if the value obtained under default, denoted as V_d^k, is higher than the value under repayment, V_c^k. The welfare associated to this choice, V_0^k, can thus be defined as:

$$V_0^k = \max\left\{V_c^k, V_d^k\right\}. \tag{6}$$

If, on the other hand, $\Omega = 0$, the value obtained by the proposer corresponds to that under exclusion, which we denote by V_n^k. The values in round $T+1$ represent the reference values if all proposal rounds fail. The value expected by the legislators in round $k+1$ if the economy is in good credit standing in the current period is given by J_0^{k+1}, otherwise, the legislators expect J_d^{k+1}. Expected values differ from the proposer's current values because the current proposer may not be chosen to propose in the following round. They take an expectation over their status in the legislature in round $k+1$ while formulating the current proposal. Policies in round $k+1$ reflect the choices of a randomly chosen proposer in round $k+1$. Overall, the value functions that need to be characterized in equilibrium are given by $\left\{V_0^k, V_c^k, V_d^k, V_n^k, J_0^k, J_d^k\right\}_{k=1}^{T+1}$ for each bargaining round k. The problem is more involved than in the standard legislative bargaining model because of the complication introduced by the possibility of default.

To reduce the dimensionality of the problem, and following previous work, we focus on an equilibrium such that in any proposal round k, the proposal is accepted immediately and the legislature dissolves. This is without loss of generality in this environment. On the equilibrium path, proposal rounds $2, \ldots, T$ do not occur. This reflects the assumption that any coalition member accepts a policy mix that ensures that he/she is weakly better off than waiting to the next round. To ensure that this indeed happens, the condition enters the current proposer's problem as an incentive compatibility constraint. The proposer's problem in round k, if the economy is in good credit standing and repayment is optimal, is given by:

$$\begin{aligned} V_c^k(\Pi) = \quad & \max_{\{\tau,g,s,b'\}} U(c^*, l^*, g) + B(\tau, g, b'; \Pi) - (m-1)s + \beta \mathbb{E}_{z',m'} J_0(\Pi') \\ \text{s.t.} \quad & U(c^*, l^*, g) + s + \beta \mathbb{E}_{z',m'} J_0(\Pi') \geqslant J_0^{k+1}(\Pi) \\ & B(\tau, g, b'; \Pi) \geqslant (m-1)s \\ & s \geqslant 0. \end{aligned} \tag{7}$$

In this problem, $U(c^*, l^*, g)$ satisfies Eq. (3) and $B(.)$ is defined as $n\tau h(z)l^* - g + b - q(z, b')b'$. The first constraint is the incentive compatibility constraint for the members of the *mwc*. The second constraint ensures the feasibility of government policies. The net surplus must be higher than the resources diverted to provide the local public goods to the coalition members. Finally, as already mentioned before, the level of local public goods provided to any region must be non-negative. The expected future value in proposal round 1 in the following period is $J_0(\Pi')$. This takes into account the fact that all equilibrium proposals are accepted in the first round. The superscript for proposal round 1 is dropped for convenience.

[8] Even though the behavior in the current period depends on the history of defaults, the only relevant state variable is Ω. That is, whether the country is in good standing in international markets or not.

[9] All the fiscal policies and value functions are functions of the state Π. It is suppressed for convenience of notation.

If the economy is in good credit standing, and the proposer defaults, then the proposer's problem is as follows:

$$\begin{aligned} V_d^k(\Pi) = \quad & \max_{\{\tau,g,s\}} U(c^*, l^*, g) + B(\tau, g; \Pi) - (m-1)s + \beta \mathbb{E}_{z',m'}\left[\theta J_0(\Pi') + (1-\theta) J_d(\Pi')\right] \\ \text{s.t.} \quad & U(c^*, l^*, g) + s + \beta \mathbb{E}_{z',m'}\left[\theta J_0(\Pi') + (1-\theta) J_d(\Pi')\right] \geqslant J_0^{k+1}(\Pi) \\ & B(\tau, g; \Pi) \geqslant (m-1)s \\ & s \geqslant 0 \end{aligned} \tag{8}$$

After default, the government can gain access to the capital markets with probability θ. In this contingency, the proposer expects J_0 in the following period. However, with the remaining probability, it stays in default and obtains the value J_d. The default policy of the proposer, in round k is given by

$$d'^k(\Pi) = \begin{cases} 1 & \text{if} V_c^k < V_d^k \\ 0 & \text{otherwise} \end{cases} \tag{9}$$

If the economy is already in default, the default policy function, d' is constrained to take the value 1. The proposer's problem, in this case, is given as:

$$\begin{aligned} V_n^k(\Pi) = \quad & \max_{\{\tau,g,s\}} U(c^*, l^*, g) + B(\tau, g; \Pi) - (m-1)s + \beta \mathbb{E}_{z',m'}\left[\theta J_0(\Pi') + (1-\theta) J_d(\Pi')\right] \\ \text{s.t.} \quad & U(c^*, l^*, g) + s + \beta \mathbb{E}_{z',m'}\left[\theta J_0(\Pi') + (1-\theta) J_d(\Pi')\right] \geqslant J_d^{k+1}(\Pi) \\ & B(\tau, g; \Pi) \geqslant (m-1)s \\ & s \geqslant 0 \end{aligned} \tag{10}$$

The only difference between the problem in which the proposer *chooses* to default, and the one in which the economy is already in default, is the expected value in round $k+1$. This is because, in good standing, the proposer in round k expects the future proposer to optimally choose the default policy. However, on the equilibrium path, both default period problems are identical.

The repayment set, $\Psi(b)$, is defined as the set of (z, m) pairs such that the proposer chooses to repay.

$$\Psi(b) = \left\{(z, m) \in Z \times M : d'^k(\Pi) = 0\right\} \tag{11}$$

In equilibrium, given the future expected values, the proposer chooses policies consistent with problems (6)-(10). The future expected value functions are in turn determined by the policies chosen by the proposer in the following period. In equilibrium, if the proposer in a given period, with state Π, proposal round k, and $\Omega = 1$, chooses policies $\{\tau, g, s, b', d'\}$ then

$$J_0^k(\Pi) = U\left(c^*, l^*, g^k\right) + \frac{B\left(\tau^k, g^k, b'^k; \Pi\right)}{n} + \beta \mathbb{E}_{z',m'} J_0(\Pi') \tag{12}$$

if it is optimal to repay. If the proposer defaults or enters the period with no market access ($\Omega = 0$), then

$$J_d^k = J_0^k = U\left(c^*, l^*, g^k\right) + \frac{B\left(\tau^k, g^k; \Pi\right)}{n} + \beta \mathbb{E}_{z',m'}\left[\theta J_0(\Pi') + (1-\theta) J_d(\Pi')\right] \tag{13}$$

To understand the logic behind the above value functions, consider J_0. In every proposal round, the proposer is chosen with probability $\frac{1}{n}$. If the optimal policy in the current period is repayment, the proposer receives $U(c^*, l^*, g) + B(\tau, g, b'; \Pi) - (m-1)s + \beta \mathbb{E}_{z',m'} J_0(\Pi')$. If the current legislator is not chosen to propose but is part of the *mwc*, which happens with probability $\frac{m-1}{n}$, he or she receives $U(c^*, l^*, g) + s + \beta \mathbb{E}_{z',m'} J_0(\Pi')$. If the legislator is neither a proposer nor part of the *mwc*, with unconditional probability $\frac{n-m}{n}$, he or she receives $U(c^*, l^*, g) + \beta \mathbb{E}_{z',m'} J_0(\Pi')$. Taking expectation over these three possibilities, we obtain $J_0(\Pi)$.

Finally, off the equilibrium path, if all the T proposal rounds fail, then the reference proposal round is activated. The proposer is restricted to choosing a policy such that the local public good is distributed equally across all the n regions. If the proposer decides to repay in a state Π, with $\Omega = 1$, then his/her problem is

$$\begin{aligned} V_c^{T+1}(\Pi) = \quad & \max_{\{\tau,g,s,b'\}} U(c^*, l^*, g) + \tfrac{B(\tau,g,b';\Pi)}{n} + \beta \mathbb{E}_{z',m'} J_0(\Pi') \\ \text{s.t.} \quad & B(\tau, g, b'; \Pi) \geqslant 0 \end{aligned} \tag{14}$$

Similar to the proposer's problem in round k, the reference round proposer is also restricted from accessing international capital markets in periods of no market access, or when the proposer decides to default in a period that starts with $\Omega = 1$. The proposer's problem in these two *default* situations is given by

$$\begin{aligned} V_d^{T+1}(\Pi) = \quad & \max_{\{\tau,g,s\}} U(c^*, l^*, g) + \tfrac{B(\tau,g;\Pi)}{n} + \beta \mathbb{E}_{z',m'}\left[\theta J_0(\Pi') + (1-\theta) J_d(\Pi')\right] \\ \text{s.t.} \quad & B(\tau, g; \Pi) \geqslant 0 \end{aligned} \tag{15}$$

4.2. International lenders

We model international lenders following Arellano (2008). In particular, we assume that there is an infinite number of identical, risk-neutral international lenders. These creditors have the option to borrow and lend at a risk-free rate of r from the international capital market. They can also lend to the government of a small open economy in a perfectly competitive market. This assumption ensures that lenders earn zero profits in equilibrium. The break-even bond prices charged by the lenders are given by the expression:

$$q(z,b',m) = \int_{(z',m')\in\Psi(b')} [k(z') \times \mu(z'|z) \times p(m'|m)]dz'dm' \tag{16}$$

Here $k(z')$ is the stochastic discount factor defined as: $k_{t+1} = \frac{1}{1+r} - \lambda\epsilon^z_{t+1}$, such that $\mathbb{E}k = \frac{1}{1+r}$ and $Var(k) = \lambda^2\sigma^2_z$. As shown in Arellano (2008), this helps to de-link equilibrium spreads with the default probability.

4.3. Equilibrium definition

A symmetric, competitive Markov-Perfect equilibrium for this economy is characterized by a set of policy functions, $\left\{\tau^k(\Pi), g^k(\Pi), b'^k(\Pi), s^k(\Pi), d'^k(\Pi)\right\}_{k=1}^{T+1}$, a set of value functions $\left\{V^k_0, V^k_c, V^k_d, V^k_n, J^k_0, J^k_d\right\}_{k=1}^{T+1}$, a repayment set $\Psi(b)$, a labor supply policy $l^*(z,\tau)$, a consumption policy $c^*(z,\tau)$, and a bond price schedule $q(z,b',m)$ such that.

1. Given fiscal policies, households solve their problem described in Eq. (2) to obtain the labor supply and consumption policy functions, $l^*(\tau,z)$ and $c^*(\tau,z)$.
2. Given the household's policy functions in (1), the bond price schedule $q(z,b',m)$, and the expected future value functions, $\left\{J^k_0, J^k_d\right\}_{k=1}^{T+1}$, the government solves for policy functions, $\left\{\tau^k(\Pi), g^k(\Pi), b'^k(\Pi), s^k(\Pi), d'^k(\Pi)\right\}_{k=1}^{T+1}$ in periods starting with $\Omega = 1$, and $\{\tau^k(\Pi), g^k(\Pi), s^k(\Pi)\}_{k=1}^{T+1}$ in periods starting with $\Omega = 0$ from the Eqs. (6)–(10), (14) and (15). In the process, the government obtains the value functions $\left\{V^k_0, V^k_c, V^k_d, V^k_n\right\}_{k=1}^{T+1}$.
3. The policy functions and the value functions must be consistent with the expected value functions $\left\{J^k_0, J^k_d\right\}_{k=1}^{T+1}$ as described in 12 and 13.
4. The bond price schedule $q(z,b',m)$ must be consistent with 16 and the repayment set defined in 11.

5. Characterization and mechanism

In this section, we (partially) characterize the equilibrium and provide intuition for the main result of this paper: that political constraints increase the probability of default.

5.1. Characterization

In Proposition 1, we present an equivalence result that allows us to make the problem more tractable. It is analogous to the proposition in Battaglini and Coate (2008) but extended to an environment with default.

Proposition 1. Under repayment, the proposer's problem can be re-written as

$$\begin{aligned} H_c(\Pi) = \quad & \max_{\{\tau,g,b'\}} U(c^*, l^*, g) + \tfrac{B(\tau,g,b';z,b)}{m} + \beta\mathbb{E}_{z',m'} J_0(\Pi) \\ \text{s.t.} \quad & B(\tau,g,b';z,b) \geqslant 0. \end{aligned} \tag{17}$$

and under default, as

$$\begin{aligned} H_d(\Pi) = \quad & \max_{\{\tau,g\}} U(c^*, l^*, g) + \tfrac{B(\tau,g;z)}{m} + \beta\mathbb{E}_{z',m'}\left[\theta J_0(\Pi') + (1-\theta)J_d(\Pi')\right] \\ \text{s.t.} \quad & B(\tau,g;z) \geqslant 0. \end{aligned} \tag{18}$$

When $\Omega = 1$, the proposer chooses to default whenever $H_d(\Pi) > H_c(\Pi)$.

Proof: See Appendix A.

The above equivalent problem states that the proposer's optimization problem is *as if* he or she distributes the surplus (net of public good provision and debt repayment) evenly between the members of the *mwc*. It also makes clear that the tighter the political constraints are, the smaller the benefit of belonging to the *mwc* would be. At an extreme, when $m = n$, the proposer behaves like a benevolent planner (without commitment to repay debt obligations). Finally, note that political constraints affect incentives to default only when $B > 0$. When it is optimal not to provide local public goods (which happens for some configurations of the state space), political constraints are irrelevant in a static sense. However, because the decision to provide such goods is endogenous, and dynamic (e.g. it may be optimal to provide them in the future), m will affect current decisions as well. This is studied in detail next.

5.2. Mechanism

There are three channels through which political constraints (m) affect the probability of default. First, governments with lax political constraints (low m) issue more debt. Even though a higher debt level is associated with a lower price charged by international lenders, the incentive to borrow more may dominate. This trade-off can be easily seen from the borrowing decision of the proposer in periods of market access. If the government's budget is not constrained, then the borrowing decision of the proposer can be summarized by the following condition.

$$b' = \arg\max_{b'} \frac{-q(z, b', m)b'}{m} + \beta \mathbb{E}_{z',m'} J_0(\Pi') \tag{19}$$

A lower value of m implies a higher marginal benefit from borrowing today, given by the term $\frac{-q(z,b',m)b'}{m}$ (recall that $b' < 0$ when the government borrows). However, the marginal cost of borrowed resources is spread between all regions. This is the case because higher borrowing today requires higher future taxes, which are paid by all members of society. This explains a greater incentive to borrow for a smaller *mwc*. Intuitively, the lower the number of members that need to be included in the *mwc*, the higher the provision of local public goods per member that can be financed with a given amount of debt. We call this the *Overborrowing* channel.

Second, for any given level of debt, the incentive to default varies with the size of the *mwc*. This incentive can be broken down into two parts. The *static* channel creates incentives for the proposer to default and provide local public goods to the coalition members in the current period. The *dynamic* channel influences the current default decision through the continuation value of the proposer even if no local public goods can be provided in the current period. In what follows, we use a one-period model to analytically characterize the *static* channel. The *dynamic* channel will be explained in the quantitative section.

5.2.1. Intuition from a one-period model

In the one-period model environment, the government enters with market access, that is, $\Omega = 1$, and inherits a debt stock $-b$. The productivity shock for the current period is z. For this simple model, consider a utility cost of defaulting, k.[10] The government provides pure public goods and local public goods and imposes taxes on the citizens as in the full model. The only difference is that the government cannot borrow[11]. In this environment, Proposition 1 holds trivially. The following lemmas summarize the behavior of fiscal policies in this one-period economy. We start by characterizing policy under default.

Lemma 1. If the government is in default, then $\exists$ a $z^*(m)$ such that

1. Below the threshold, $z \leqslant z^*(m)$, public good provision is increasing in z, but taxes and local public goods are independent of it.

$$\frac{\partial \tau}{\partial z} = 0, \quad \frac{\partial g}{\partial z} > 0, \quad \text{and} \quad \frac{\partial B}{\partial z} = 0.$$

2. Above the threshold, $z > z^*(m)$, taxes and local public goods increase with z, whereas public good provision is independent of it.

$$\frac{\partial \tau}{\partial z} > 0, \quad \frac{\partial g}{\partial z} = 0, \quad \text{and} \quad \frac{\partial B}{\partial z} > 0.$$

3. The threshold $z^*(m)$ increases with m (as political constraints become tighter).

[10] For this model, we assume that there is no productivity cost of default. We consider this cost in the infinite horizon extension presented later. That is why we use z instead of $h(z)$ here.

[11] No period follows the current period. Hence, no lender will lend to the government, neither will the government want to save.

Proof: See Appendix B

Intuitively, if the government defaults, the current debt obligation becomes 0. The surplus net of pure public goods is given as $B(.) = n\tau z l^* - g$. If the government's budget constraint does not bind, the first-order condition for the pure public good provision yields $g^* = (\pi m)^{\frac{1}{\sigma}}$. We define $z^*(m)$ such that $n\tau^* z^*(m) l^* = g^*$, where τ^* is the tax floor implicitly defined from this equation.

If $z < z^*(m)$, since the government's tax revenue is increasing in z, the pure public good is under-provided, that is, $g < g^*(m)$. In this case, the marginal benefit from providing g is much higher than that obtained from providing local public goods ($\frac{1}{m}$). All the tax revenue is used to provide g, and no local public goods are provided. This implies $B = 0$. A higher realization of z, with z still less than $z^*(m)$, increases the tax revenue and the provision of g. Higher z, with $z < z^*(m)$ reduces the marginal cost of taxes. But taxes are still costly. Any increase in tax rates completely cancels out the additional gain from increased pure public good provision with the higher revenue. Thus, taxes do not respond to z[12]. This explains statement (1) in the lemma.

If $z > z^*(m)$, the government's budget no longer binds. In this situation, g equals $g^*(m)$. If z is higher, the marginal resources are diverted toward the provision of local public goods. The marginal benefit from local public goods ($\frac{1}{m}$) exceeds that from pure public goods beyond $g^*(m)$. For higher realizations of z, with $z > z^*(m)$, the marginal cost of a higher tax rate declines, but the benefit is constant since the proceeds are used to pay for local public goods. Then, it is optimal to increase tax rates. This explains statement (2) of the lemma. The proof of statement (3) follows trivially from the definition of $z^*(m)$. We now discuss what happens under repayment.

Lemma 2. If the government decides to repay, then, for a given $z, \exists$ a $b^*(z,m)$ such that.

1. Above the threshold $b \geqslant b^*(z,m)$

$$\frac{\partial \tau}{\partial b} = 0, \quad \frac{\partial g}{\partial b} = 0, \quad \text{and} \quad \frac{\partial B}{\partial b} > 0.$$

2. Below the threshold $b < b^*(z,m)$

$$\frac{\partial \tau}{\partial b} < 0, \quad \frac{\partial g}{\partial b} > 0, \quad \text{and} \quad \frac{\partial B}{\partial b} = 0.$$

3. $b^*(z,m)$ is increasing in m, decreasing in z, and the fiscal policies are independent of m when $b < b^*(z,m)$.

Proof: See Appendix C.

First, consider the net of pure public goods and debt repayment surplus, denoted by $B(.) = n\tau z l^* - g + b$, where $-b$ is the debt stock outstanding in the current period. Given $z, b^*(z,m)$ is defined implicitly by the equation, $n\tau^* z l^* - g^*(m) + b^*(z,m) = 0$. Here, $g^*(m)$ is the maximum pure public goods the government chooses to provide, $(\pi m)^{\frac{1}{\sigma}}$, and τ^* is the tax floor implicitly defined above.

For $b \geqslant b^*(z,m)$, the government's assets are high and the budget is not constrained. Since the provision of pure public goods in this situation equals $g^*(m)$, the higher savings are used to finance local public goods, which gives a constant marginal utility ($\frac{1}{m}$). The benefit from lowering taxes to absorb the higher assets is less than $\frac{1}{m}$. Hence taxes are constant. This explains statement (1) of Lemma 2.

If $b < b^*(m)$, the government's budget constraint binds. An additional unit of assets is now used to reduce taxes and increase the provision of g. Local public goods are not provided, since their benefits are constant and lower than those associated with the provision of pure public goods. At any level of assets above the threshold, providing for local public goods is cheaper, while at levels below the threshold, it is optimal to increase g and/or reduce τ than providing local public goods. This explains statement (2). As before, statement (3) follows trivially from the definition of $b^*(z,m)$.

In what follows, we use the above results to compare two economies, one with $m = m_1$, and the other with $m = m_2$, and $m_1 > m_2$. This implies that the government in economy 1 faces tighter constraints. We assume that in both cases the governments have market access, and the productivity shock z and level of outstanding debt is the same. The objective is to show how the default incentives differ for different degrees of political constraints, captured by m.

[12] This is caused by the same curvature in both g and the consumption-labor supply part of the utility function.

5.2.2. Case 1: constraints are slack in both economies

Let (z, b) be such that $z > z^*(m_1) > z^*(m_2)$, and, both $b^*(m_1)$[13] and $b^*(m_2)$ are low enough such that the governments' budgets are not constrained either in repayment or in default.

Fig. 4 plots the gain from default for the two economies characterized by different *mwc*s. Since both governments are unconstrained, they use the resources released from default to provide local public goods. None of the policies, except for local public goods' provision, differ between repayment and default in these two economies[14]. Thus, the associated gains from default are given by $-\frac{b}{m_i} - k$, in the two economics $i = \{1, 2\}$. The government facing laxer political constraints, m_2 needs to split local public goods among fewer members in the *mwc*. As a result, it has a higher incentive to default and sustains a lower level of debt. The government with $m = m_1$ can sustain debt $-b_1$, while the government with $m = m_2$ can sustain debt $-b_2$ before it defaults.

5.2.3. Case 2: constraint is slack in the economy with tighter constraints (m_1)

Now, consider the case with (z, b) such that $z > z^*(m_1) > z^*(m_2)$, but $b^*(m_1)$ is large enough to constrain the budget of the government with $m = m_1$ in repayment. In this case, both governments provide local public goods in default, but only the one facing $m = m_2$ provides local public goods under repayment. Fig. 5 plots the gains from default for these two economies. For $m = m_2$, the gains are linear, the same as in Case 1. However, for $m = m_1$ the government's budget is constrained when debt is higher than $-b_1^*(m_1)$. For debt levels lower than $-b^*(m_1)$, gains are linear since the marginal benefit from the defaultable resources is constant. For higher levels of debt, the marginal value of resources released by default is higher than $\frac{1}{m_1}$, and increases with higher levels of debt. This explains the convex rise in gains from default for the government with $m = m_1$. Still, the higher *mwc* government sustains a higher level of debt before it defaults ($-b_1$).

5.2.4. Case 3: constraint binds in both economies

Consider the case where z is such that $z^*(m_1) > z^*(m_2) > z$. In this case, local public goods are not provided in default, as evident from Lemma 1. In the one-period model environment, this also implies that there is no local public good provision in repayment as well. This implies that (from Lemma 2), $b^*(m_1)$ and $b^*(m_2)$ are both greater than 0. It follows that the fiscal policies in both repayment and default are the same for both economies. In this situation, the gains from default can be summarized by Fig. 6. Since all the fiscal policies are the same, the gains from default for both governments coincide in this case. Both governments can sustain the same stock of debt, $b_1 = b_2$.

Note that the one-period model only informs about the *static* incentives to default induced by political constraints for a given level of initial debt. In order to analyze the dynamic channel, it is necessary to consider the continuation values. This is difficult to show using an analytical example and hence relegated to the quantitative section, which we analyze next.

6. Quantitative results

This section summarizes the calibration technique and the quantitative results. First, we describe the calibration. In the following two sub-sections, we show the quantitative effect of political constraints on country risk and illustrate the dynamic channel using the calibrated model. In the final sub-section, we discuss the results from a case study of the default event in Argentina during the 2001/02 crisis.

6.1. Calibration

We calibrate the model to Argentina for the period 1992:Q1 to 2001:Q3. This is the run-up to the 2001 default episode. We use quarterly data for real GDP, consumption, and trade balance (TB) as a share of GDP from Chatterjee and Eyigungor (2012). We retrieve the data on government spending and tax revenues from Argentina's national accounts using CEIC data. The series on real consumption, real GDP, real government spending, and tax as a percentage of GDP are seasonally adjusted, logged, and linearly detrended.

Table 2 reports the calibrated parameters and their respective targets in the data. A period is one quarter. The risk aversion parameter in the utility function σ is set to 2, as is common in the literature. The inverse of the Frisch elasticity of labor supply, γ is set to 2. This is a conservative choice, well within the standard range in the literature. The exogenous productivity shock is assumed to follow an $AR(1)$ process of the form:

$$z_{t+1} = (1 - \zeta_z)\psi_z + \zeta_z z_t + \epsilon_{t+1}^z \tag{20}$$

where $\mathbb{E}\epsilon_{t+1}^z = 0$ and $\mathbb{E}(\epsilon_{t+1}^z)^2 = \sigma_z^2$. The income process parameters ζ_z and σ_z are chosen by fitting the above AR(1) process to the detrended real GDP per employed person series. The average value of the process is normalized to 1. The fitted AR(1) process is discretized to 31 possible realizations of the productivity shock using Tauchen and Hussey (1991). We use 200 equally spaced grid points for the borrowing level ranging from 0 to 125 percent of average GDP in the model.

[13] $b^*(z, m)$= $b^*(m)$ for a given z. I drop z to reduce the burden of notation.

[14] follows from Lemma 2

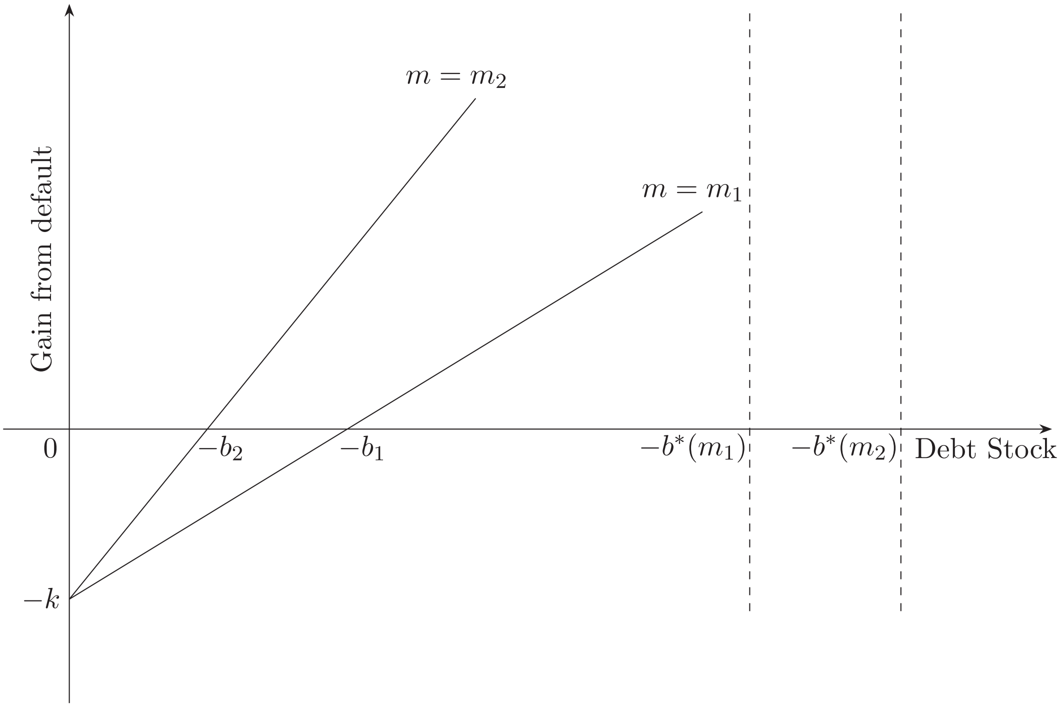


Fig. 4. Case 1.

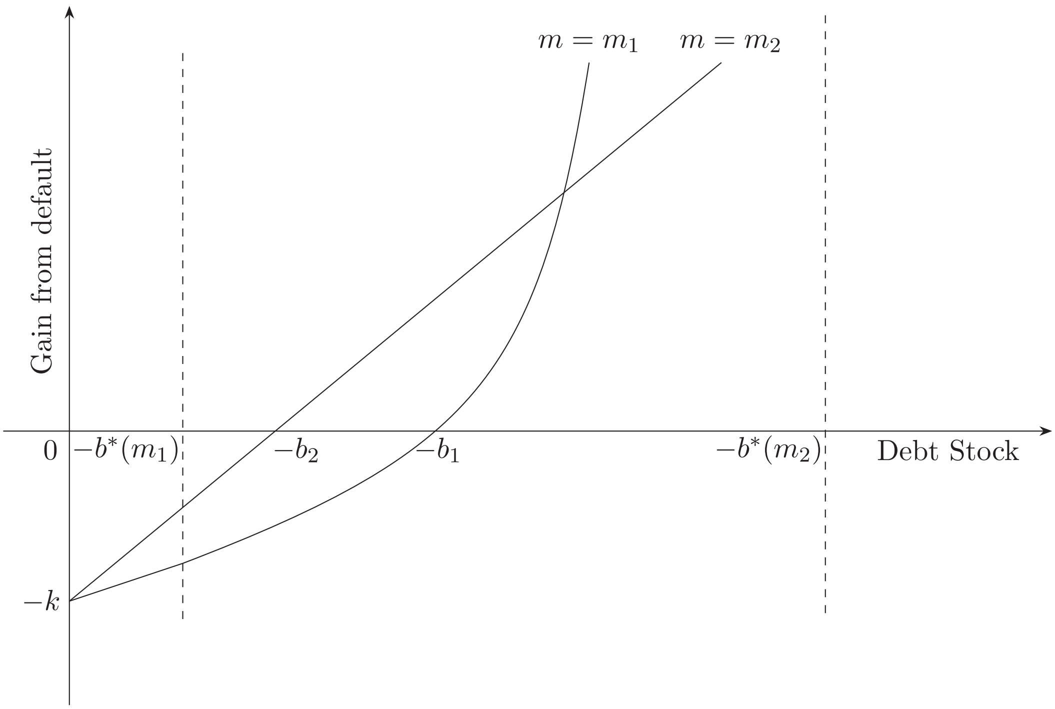


Fig. 5. Case 2.

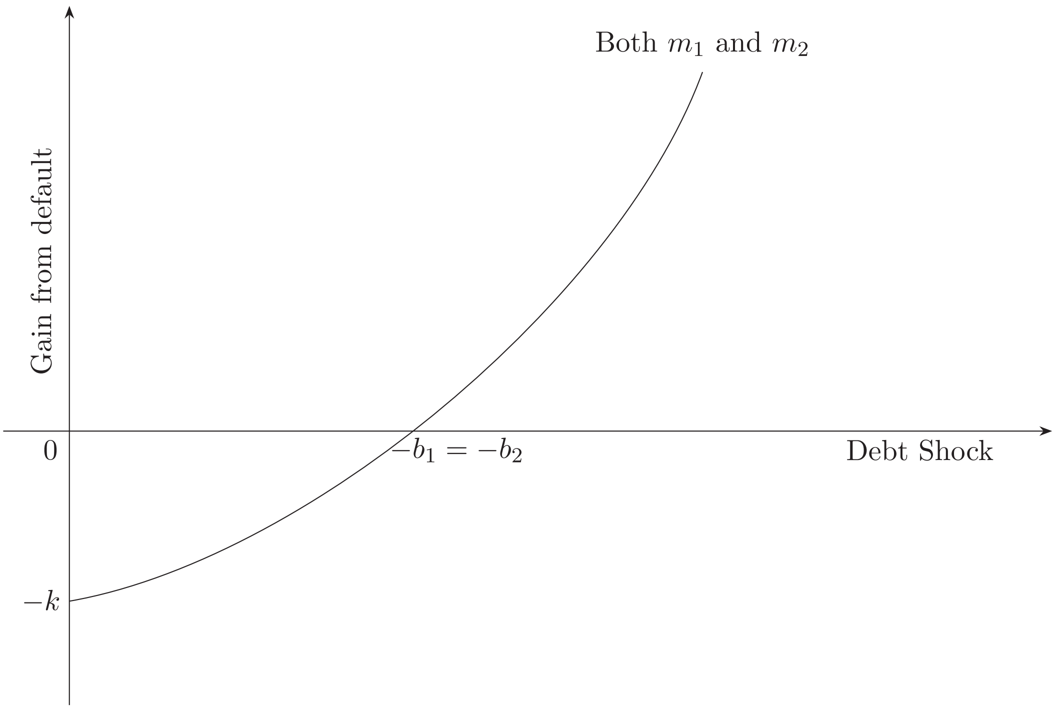


Fig. 6. Case 3.

Table 2
Calibrated parameters.

Parameter	Value	Target	Description
σ	2		CRRA
γ	2		Frisch Elasticity
r	0.01		90 day U.S. Treasury
θ	0.038	6.5 Years of Exclusion	
ψ_m	51		Avg. Majority Rule
ψ_z	1		Normalized
ζ_z	0.949	Detrended Real GDP	[AR(1)]
σ_z	0.023	Volatility of Real GDP	
ζ_m	0.939	POLCONv	[AR(1)]
σ_m	6.73	Volatility of POLCONv	
β	0.876	$\frac{\text{Ext.Debt}}{\text{GDP}} = 0.22$	[Jointly Calibrated]
α_0	-0.210	$\mathbb{E}(\text{Spreads}) = 8.15\%$	
α_1	0.250	$sd(\text{Spreads}) = 4.43$	
π	5.3	$\frac{g}{Y} = 0.12$	
λ	10.57	Default-frequency = 3%	

Note: Total number of regions: n is normalized to 100. The default frequency is annualized. Argentina defaulted 3 times in the 20$^{\text{th}}$ century including the 2001 default (Arellano (2008))

The political constraints in the model are also assumed to follow an AR(1) process of the form:

$$m_{t+1} = (1 - \zeta_m)\psi_m + \zeta_m m_t + \epsilon^m_{t+1} \tag{21}$$

Similar to the productivity shock, we assume $\mathbb{E}\epsilon^m_{t+1} = 0$ and $\mathbb{E}(\epsilon^m_{t+1})^2 = \sigma^2_m$. The values for ζ_m and σ_m are chosen by estimating an AR(1) process on POLCONv for Argentina from 1990 to 2016. The mean ζ_m is set to 51 since legislative protocols, on average, follow a simple majority rule in most countries. In the model, m can take 100 discrete values ranging from 1 to 100.

The probability of re-entry into the market following default, θ is set to 0.0385, following Chatterjee and Eyigungor (2012). This is approximately equal to $\frac{1}{\theta} \cong 26$ quarters (6.5 years) of exclusion from the financial markets after a default event. This value is consistent with the estimates by Gaston Gelos et al. (2011) and Richmond and Dias (2009). The model results are not very sensitive to the exclusion parameter, hence our assumption is robust to other choices of θ. We also assume that default entails a loss in productivity. This captures possible trade disruptions hindering domestic production as in Rose (2005), or decreases in private investment due to overexposure of domestic banks to sovereign bonds as in Broner et al. (2014) or Bocola (2016). While we do not formally model these, we take a reduced-form approach following Chatterjee and Eyigungor (2012). In particular, we assume that total factor productivity (TFP) takes the following form:

$$h(z) = \begin{cases} z & \text{if } d' = 0 \\ z - \max\{0, \alpha_0 z + \alpha_1 z^2\},\ \alpha_1 \geqslant 0 & \text{if } d' = 1 \end{cases} \tag{22}$$

The curvature of the default cost function is disciplined by the parameters α_0 and α_1. If $\alpha_0 > 0$, and $\alpha_1 = 0$, then the cost of default is proportional. If $\alpha_1 > 0$, and $\alpha_0 = 0$, then the cost rises more than proportionally to the rise in productivity. If $\alpha_0 < 0$, and $\alpha_1 > 0$, then for $z < -\frac{\alpha_0}{\alpha_1}$, the default cost is 0, but the cost rises more than proportionally for higher realizations of z.

The risk-free interest rate r is set to 1 percent. It is matched to the 3-month U.S. Treasury bill interest rate for the period under consideration. The discount factor $\beta, \alpha_0, \alpha_1$ and λ are calibrated to match the mean and standard deviation of annualized spreads, the average external debt to GDP ratio, and the annualized default probability for Argentina for the period between 1992 Q2 to 2001 Q4. The relative weight-preference for public goods, π, is calibrated to match the ratio of government spending to GDP in the data. We assume that the number of regions, n, equals 100. Finally, $\beta, \alpha_0, \alpha_1, \pi$ and λ are jointly calibrated by minimizing a quadratic loss function. The model is simulated for the endogenous allocations for one million model periods. The values of the initial and final five thousand periods are discarded. Then, the moments for external debt to GDP ratio, the mean and standard deviation of spreads, and the government spending to output ratio are computed for forty model periods, conditional on no default, and leading up to a default event in the forty-first period. These moments are matched to those in the data to pin down the parameter values.

6.2. Model Fit

Table 3 summarizes the values of the targeted and the non-targeted moments from the model simulations and the corresponding moments from the data. Column 1 reports the data moments. The moments reported below the horizontal line are the ones targeted in the calibration. The non-targeted moments are reported in column 2, above the horizontal line. The calibration exercise matches most of the moments well. The model overestimates the standard deviation of the spreads and the default frequency slightly. The model also generates correlation coefficients of all the macroeconomic fundamentals and policy variables with GDP, of the same sign as in the data: spreads and trade balance to GDP ratios are negatively correlated to GDP while consumption is positively correlated to GDP. This is also in line with the evidence in most emerging market economies.

6.3. Lax political constraints lead to elevated country risk

We now analyze the effects of political constraints on the probability of default. To that end, we perform a similar regression to the one in Section 1.1, based on the simulation of our model over a long number of periods. Because TFP and political constraints vary over time, the resulting time series of m and spreads can be used to estimate the effect of a change in political constraints on country risk, after controlling for model GDP and the debt-to-GDP ratio.

Table 4 reports the results from a linear regression of simulated annualized spreads on m, controlling for the corresponding GDP and the debt-to-GDP ratio from the model. Column 1 reports the model results. A one standard deviation increase in m results in a 4.26% increase in model spreads, as reported in the parenthesis beside the point estimate.

Column 2 reproduces the result of the regression in column (2) of Table 1. The model overestimates the effect of political constraints on default risk by 2.88 percentage points. One of the reasons for the difference in magnitude is the use of short-term debt in our model. This results in steeper bond price schedules that result in higher volatility of spreads. This also makes spreads more sensitive to political constraints. In any case, the direction of the impact is negative and significant, as observed in the data.

To better understand the intuition in the dynamic model, we plot bond prices against the degree of political constraints in Fig. 7 and Fig. 8.

Fig. 7 holds the productivity shock z fixed at the average level. Each line corresponds to a different level of new debt issuance as a percentage of output. The middle (dashed red) schedule corresponds to the mean debt-to-GDP ratio reported in the simulations. The one to the right (dotted blue) schedule corresponds to higher than mean debt-to-GDP, while the one to the left (dot-dashed green) schedule reports the bond prices with lower than mean debt-to-GDP. In all three cases, bond prices are increasing with the degree of political constraints. The effect is non-linear and weakly monotonic. The effect on spreads weakens for a significantly higher degree of political constraints. For a given lower level of political constraints, spreads are higher for a higher level of debt issuance, consistent with the sovereign default literature. As explained in Section 5, the effect shrinks with m because political constraints enter the current period objective as $\frac{B(.)}{m}$. As m increases beyond a certain threshold, for a given z and b', the effect on the allocations becomes negligible. Moreover, the default incentives in the following period are also negligible because of the high persistence of the m shock. This is why the two schedules corresponding to low values of debt in Fig. 7 (red and green) coincide for higher degrees of political constraints. However, if the debt issuance is too

Table 3
Model fit.

Moment	Data	Benchmark
$\sigma(\mathrm{c})$	0.079	0.095
$\sigma(\mathrm{GDP})$	0.072	0.071
$\rho(\mathrm{r}-\mathrm{r}^*,\mathrm{GDP})$	−0.79	−0.37
$\rho(\frac{\mathrm{TB}}{\mathrm{GDP}},\mathrm{GDP})$	−0.88	−0.45
$\rho(\mathrm{GDP},\mathrm{c})$	0.98	0.91
$\mathbb{E}(\mathrm{r}-\mathrm{r}^*)$	8.15%	8.11%
$\sigma(\mathrm{r}-\mathrm{r}^*)$	4.40%	7.99%
$\frac{\mathrm{Ext.Debt}}{\mathrm{GDP}}$	0.22	0.23
$\frac{g}{\mathrm{GDP}}$	0.12	0.12
Default freq.	3%	4%

Table 4
Model simulation vs. data regression results.

Spreads	Model	Data
POLCONv	-	−7.70 (1.38%)
m	−0.251 (4.26%)	-

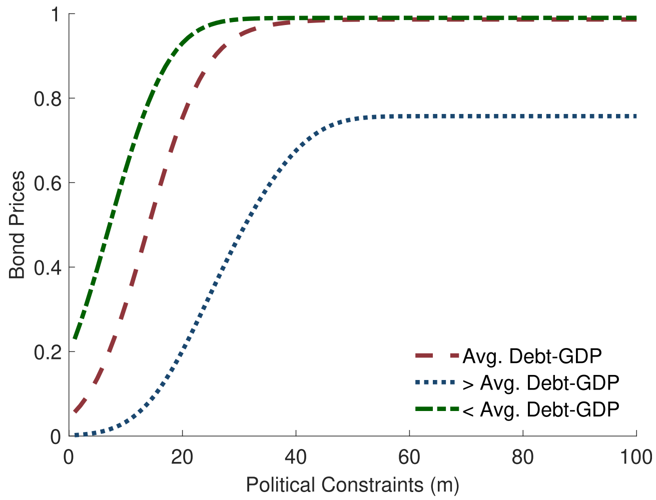


Fig. 7. Bond Price Schedule for Average z.

high, as in the case of the high-debt-GDP (blue) schedule, this also implies a higher default risk in the following period that cannot be mitigated by tighter political constraints alone. This is why this schedule flattens but stays below the others for all possible values of m.

Fig. 8 plots the bond price schedules by keeping b' fixed to the average debt to GDP level and varies the productivity shock z. The middle schedule (dashed red) corresponds to the average productivity shock. The leftmost (dot-dashed green) and rightmost (dotted blue) schedules correspond to higher and lower-than-average productivity shocks, respectively. Similar to Fig. 7, higher m is associated with lower spreads in all cases, and the effect weakens for higher degrees of political constraints. For a given level of m, higher productivity is associated with lower spreads, implying a lower probability of default. The schedules corresponding to the average TFP shock or higher coincide for large values of m. Higher m mitigates the increased risk of default due to lower productivity. However, for the schedule with a low productivity shock (blue), the default risk in the following period is higher even for tighter degrees of political constraints. In this case, the government can never issue risk-free debt due to the persistence in z.

6.4. Dynamic channel

This section explains the incentive of the government to default in the current period even if the default does not involve increased provision of local public goods (e.g. when the static channel described in the one-period model is not active). First, note that the political constraints are persistent and that foreign investors (who determine spreads) are forward-looking. If

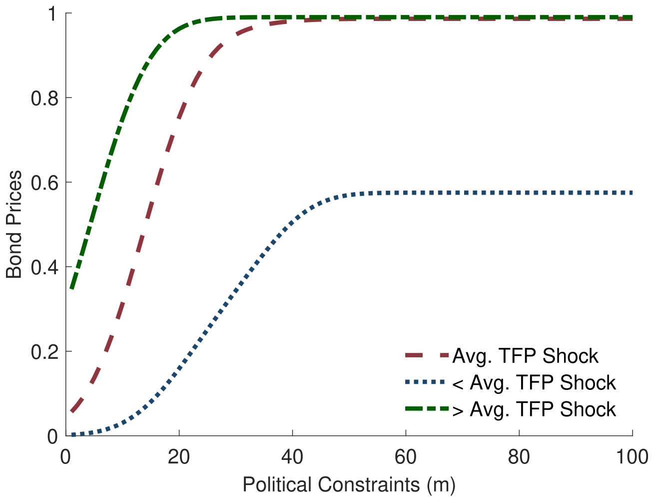


Fig. 8. Bond Price Schedule for Average b.

political constraints are lax in the current period (e.g. low m), this implies a higher probability of local public good provision in the future periods. This, in turn, implies higher default risk in the future, which is reflected in current spreads. Higher current spreads further increase the chances of a default in the current period. In other words, the expectation of higher possible defaults due to expected lax political constraints in the future increases the incentives to default today. This channel is purely dynamic and expectation-driven.

Fig. 9 and Fig. 10 summarize the effect of this channel using the calibrated model. Fig. 9 plots the policy function for local public goods for two different levels of political constraints (m = 30 and 65). When constraints are lax (low m, in red), the government provides a positive amount of local public goods up to a higher level of current debt. The latter corresponds to 16 percent of debt-to-GDP (where the red line crosses the x-axis), as opposed to 0 when constraints are tight. The vertical lines mark the debt thresholds where the governments default. The solid (blue) vertical line corresponds to the default threshold for tighter political constraints and the dashed (black) line is the debt threshold for lax political constraints. Note that none of the governments provide local public goods in the current period when they choose to default. The *static channel*, as explained in the one-period model, is absent by construction in this example.

Fig. 10 plots the annualized spreads faced by the same two m's. The schedule on the left (dashed red) is the spread faced by the government with a lower degree of political constraints, while the schedule on the right (dotted blue) is the one faced by the government with a higher degree of political constraints. Both of them can issue risk-free debt when the borrowing level is low. For debt levels higher than 14 percent of debt-to-GDP, the country with tighter political constraints (higher m, in blue) faces lower spreads. Higher spreads, due to expected future local public good provision, reduce the total resources that can be borrowed in the current period. This creates incentives to default in the present. The following event study is an example of the dynamic channel at work.

6.5. Event study: Argentina during the 2001/02 crisis

In this section, we analyze the 2001/02 sovereign default episode in Argentina using the calibrated model. The objective is to highlight the importance of political constraints in explaining this episode. More specifically, we construct a counterfactual in which political constraints are significantly tighter than they were in the data and show how this could have reduced the likelihood of a subsequent crisis.

Historical background: Argentina went through two default events in the 1980s, a period where the country was under a military dictatorship (e.g. a low political constraints period, with POLCONv= 0). The first democratic elections were held in 1983, and as institutions strengthened, political constraints increased (as seen in Fig. 1, sustaining high values until 2001. During this period, structural changes aimed at increasing credibility in the government and economic stability in the country were implemented. Among them, it was the 'Convertibility Plan' in 1991, a currency board that pegged the Argentinean peso to the US dollar (in response to the 1989 hyperinflation episode). The country entered a deep recession in 1998. In the 1999 presidential elections, Fernando de la Rua became the president, supported by a coalition of FrePaSo and the 'Union Civica Radical' (which is one of the two largest political parties in the country). The senate ('Senado'), as well as the chamber of deputies ('Camara de Diputados'), was still controlled by the 'Peronists' (the other largest party in the country). The coalition had also lost elections in major provinces to the Peronists. In terms of our model, this was a situation in which political constraints were tight (large m), as any policy implementation would require the approval of a large number of key players

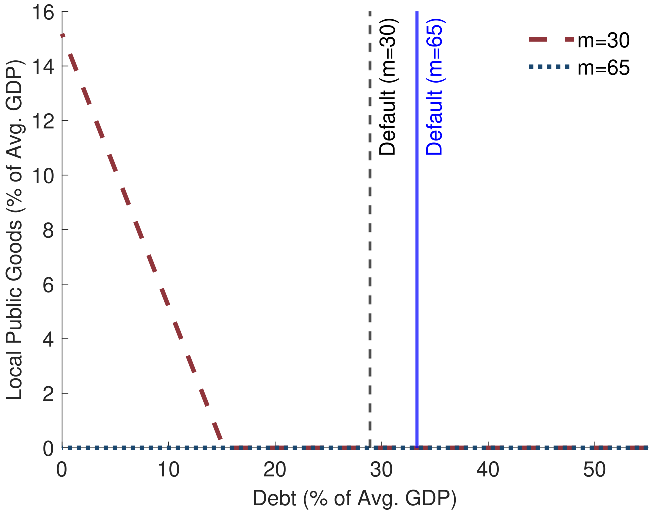


Fig. 9. Local public goods for different degrees of political constraints.

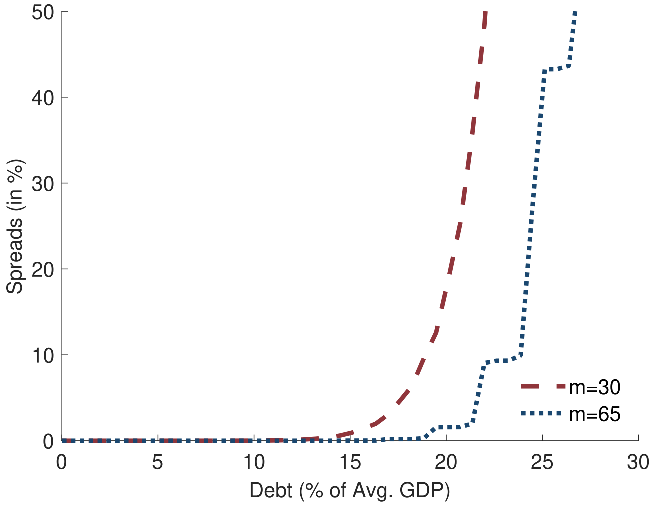


Fig. 10. Spreads for different degrees of political constraints.

in different layers of the government. Since the new government came into power with the promise to uphold the convertibility plan that had been there since 1990, default and devaluation were not an option.

The de la Rua presidency was unstable from the beginning. In 2001, the executive quickly lost the support of FrePaSo. In December 2001, there was a large protest (the 'cacerolazos', with people storming the streets with pots and pans), followed by riots and encounters between protesters and the police. This prompted the fall of the government, with President de la Rua forced to flee the Casa Rosada (e.g. the White House). The power vacuum shifted the presidency to a caretaker Peronist president, Rodriguez Saa. This implied a shift in political constraints, which in terms of our model, is characterized by a reduction in the value of m: the reason being that the objectives of the president and Congress were now aligned. Rodriguez Saa's first action was to default on foreign debt and eventually devalue the currency. This was widely supported by the Senate and the Chamber of Deputies. This illustrates that the decisive action to default and give up on the decade-long convertibility plan happened when political constraints were low, and when the presidency and both houses of Congress were controlled by the Peronists.

Counterfactual exercise: Here we proceed in two steps. First, we match the detrended evolution of GDP and spreads from the data to that in the model for 39 quarters prior to the default, that is, from 1992:Q1 to 2001:Q3. This step gives us the series $\{z_i, m_i\}_{i=1}^{39}$, that is then used to back out the series of debt implied by the model[15]. Fig. 11 (top left) plots the

[15] POLCONv for the same period and the m series predicted by the model are positively correlated, with a correlation coefficient of 0.29.

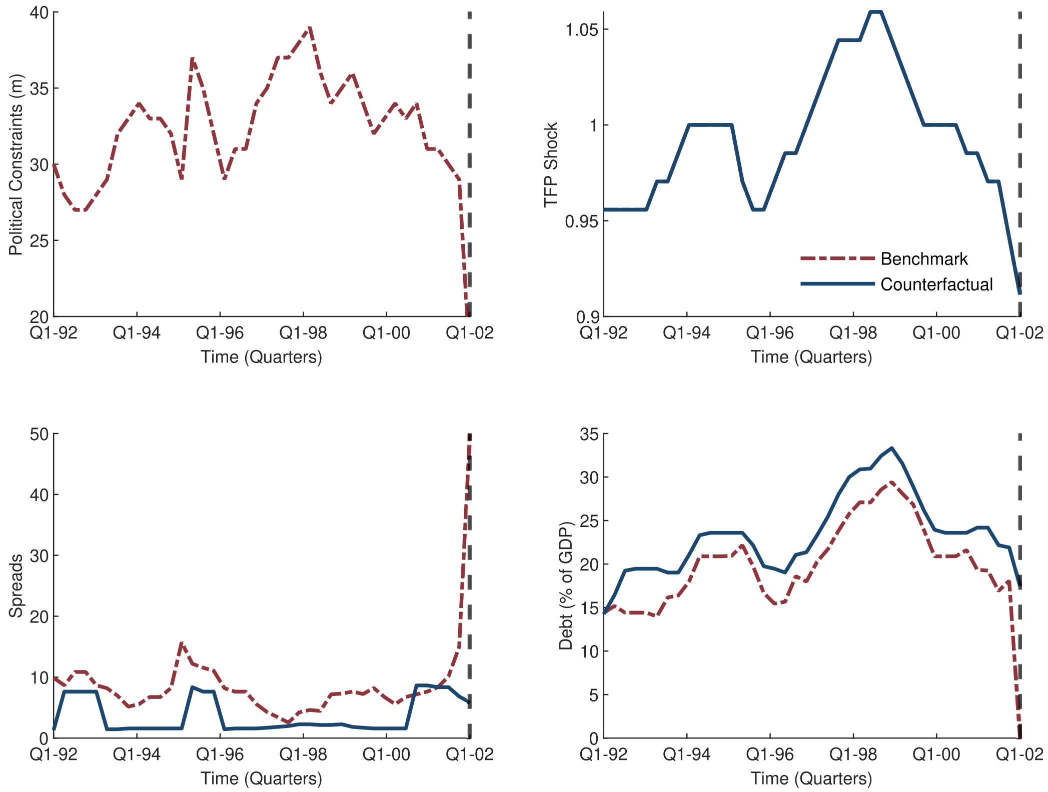


Fig. 11. Counterfactual Study for Argentina.

implied m series derived from the exercise between 1992:Q1 and 2001:Q4. The last period (default period) is not matched to the data, as explained later.

We use the penultimate period z and m, i.e. $\{z_{39}, m_{39}\}$ along with the implied debt level for the period 40 to find the implied default probability for period 40, when the default actually happened. We find that the probability of default in the final period is 2.12%. In the second step, we run a counterfactual experiment. Keeping the $\{z_i\}_{i=1}^{39}$ fixed as in the first step, we set $m_i = 100 \; \forall \; i = 1, 2, .., 39$. A similar exercise shows that the probability of default in the final period reduces to 1.46%. This indicates that the evolution of political constraints leading to the default episode could explain the high default risk in Argentina.

To illustrate a realization of the default event in the final period, we allow for z_{40} to drop a bit for both types of governments, as seen in Fig. 11 (top right), but allow m_{40} to drop only for the benchmark model. In the period the default happened, POLCONv also shows a sharp drop, motivating our experiment. We find that the benchmark model (one with lower constraints) defaults. This can be seen in Fig. 11 (bottom left) where the spreads jump in the final period. However, for the counterfactual case, spreads stabilize (blue solid line). This is because facing a downturn, the counterfactual model with high political constraints finds it optimal to reduce debt than to default, as seen in Fig. 11 (bottom right). Debt-to-GDP throughout the sample period is higher in the counterfactual situation. The same drops to 0 in the final period for the less constrained government as the default happens in the final period.

In this exercise, none of the governments (benchmark or counterfactual) provide local public goods (not shown) for the entire sample period, neither is it the case that the low m government borrows more than the high m government. But the low m government ends up facing higher spreads for almost the entire sample period and is more likely to default in the final period. This implies that absent the *overborrowing* channel or the *static* channel, it is the *dynamic* channel that is more influential in explaining the default.

7. Conclusion

This paper studies the relationship between political constraints and the probability of default on external sovereign debt. Political constraints affect the default decision through the provision of region-specific, excludable local public goods, through three exclusive channels. First, defaulting today is more beneficial under lax political constraints, as it releases resources that can be distributed among fewer *mwc* members in the form of local public goods. This is the *static channel*.

Second, even when local public goods are not provided in the current period, less constrained governments are more likely to provide these goods in the future. Forward-looking risk-neutral lenders anticipate this risk and charge higher interest rates on newly issued debt. This is the *dynamic channel*. Finally, when political constraints are low, the government finds it more beneficial to borrow more, simply because the released resources are distributed among fewer legislators. Higher borrowing implies lower debt prices and more chances of future default. This is the *overborrowing channel*. The model, calibrated to Argentina, delivers a negative relationship between political constraints and spreads that is quantitatively aligned with the one we have estimated from the data.

Finally, we conduct a counterfactual experiment where we impose tighter political constraints than those observed during the period leading up to the 2001/02 sovereign default crisis in Argentina. We find that had political constraints remained tight, the probability of default would have been much lower. In other words, the experiment suggests that political constraints had a significant impact on the decision to default in December 2001.

This model can be extended in several dimensions. For example, we assume that public spending is devoted to public goods that are consumed within the period. It would be interesting to analyze how legislative bargaining and default affect productive public investment such as infrastructure. In addition, we have not analyzed in detail the implications of our model to the cyclicality of policy and macroeconomic outcomes. It would be interesting to analyze whether political constraints affect the ability to smooth taxes over time.

Data availability

Data will be made available on request.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Proof of Proposition 1

The proof is similar to Battaglini and Coate (2008). We show that the proposer effectively maximizes the joint utility of m coalition members who vote in favor of the proposed policies. The main assumption behind this result is that utility is transferable across legislators in the form of local public goods. In what follows, we provide the proof for the problem of the proposer if he/she decides to repay in a given period. The one where he/she decides to default or enters a period already in default is similar.

Proof. Let us start with proposal round T. The proposer's problem, if he/she repays in a period with state Π, is given as

$$\begin{aligned} V_c^T(\Pi) = \quad & \max_{\{\tau,g,s,b'\}} U(c^*,l^*,g) + B(\tau,g,b';\Pi) - (m-1)s + \beta\mathbb{E}_{z',m'}J_0(\Pi') \\ \text{s.t.} \quad & U(c^*,l^*,g) + s + \beta\mathbb{E}_{z',m'}J_0(\Pi') \geqslant J_0^{T+1}(\Pi) \\ & B(\tau,g,b';\Pi) \geqslant (m-1)s \\ & s \geqslant 0 \end{aligned} \tag{A.1}$$

If $\{\tau_T, g_T, b'_T, s_T\}$ solves the above proposer's problem, then we prove that $\{\tau_T, g_T, b'_T\}$ solves the equivalent problem as mentioned in the main text.

$$\begin{aligned} H_c^T(\Pi) = \quad & \max_{\{\tau,g,b'\}} U(c^*,l^*,g) + \tfrac{B(\tau,g,b';\Pi)}{m} + \beta\mathbb{E}_{z',m'}J_0(\Pi') \\ \text{s.t.} \quad & B(\tau,g,b';\Pi) \geqslant 0 \end{aligned} \tag{A.2}$$

Furthermore, the local public good provision to the coalition members is given as $s_T = J_0^{T+1}(\Pi) - U(c^*,l^*,g) - \beta\mathbb{E}_{z',m'}J_0(\Pi')$.

Given the state Π, the equivalent problem can be multiplied throughout by m to obtain the following problem.

$$\begin{aligned} & \max_{\{\tau,g,b'\}} m\left[U(c^*,l^*,g) + \beta\mathbb{E}_{z',m'}J_0(\Pi')\right] + B(\tau,g,b';\Pi) \\ \text{s.t.} \quad & B(\tau,l^*,g) \geqslant 0 \end{aligned} \tag{A.3}$$

First, it is easy to verify from the proposer's problem that $s_T = J_0^{T+1}(\Pi) - U(c^*,l^*,g) - \beta E_{z'}J_0(\Pi')$. Otherwise, from the definition of J_0^{T+1} it must be the case that $s_T > 0$. In this case, the proposer can easily find a better allocation by reducing s_T. Eliminating s from the proposer's problem, the proposer's payoff can be written as

$$m\left[U(c^*,l^*,g) + \beta\mathbb{E}_{z',m'}J_0(\Pi')\right] + B(\tau,g,b';\Pi) - (m-1)J_0^{T+1}(\Pi) \tag{A.4}$$

It is important to note that since the proposer cannot control the policies in the next proposal round, he/she takes $J_0^{T+1}(\Pi)$ as given. Hence the optimal choice of the tuple $\{\tau, g, b'\}$ are independent of the proposal round $\{1, 2, \ldots, T\}$. Only the local public good provision to the coalition members, s depends on the proposal round [16].

Assume that $\{\tau_T, g_T, b'_T\}$ does not solve the equivalent problem. Let the allocations $\{\tau_x, g_x, b'_x\}$ solve the equivalent problem. Further assume that $s_x = J_0^{T+1}(\Pi) - U(c_x^*, l_x^*, g_x) - \beta E_{z'} J_0(\Pi')$. Here $c_x^* = c(\tau_x, z)$, and $l_x^* = l^*(z, \tau_x)$. By construction, the incentive compatibility constraint of the coalition members is satisfied. From the definition of $J_0^{T+1}, s_x \geqslant 0$. Finally, we need to verify if $B(\tau_x, g_x, b'_x; \Pi) - (m-1)s_x \geqslant 0$. Eliminating s_x from this expression yields

$$\begin{aligned} B(\tau_x, g_x, b'_x; \Pi) - (m-1)s_x &= (m-1)\left[U(c_x^*, l_x^*, g_x) + \beta \mathbb{E}_{z',m'} J_0(\Pi')\right] + B(\tau_x, g_x, b'_x; \Pi) - (m-1)J_0^{T+1}(\Pi) \\ &= m\left[U(c_x^*, l_x^*, g_x) + \beta \mathbb{E}_{z',m'} J_0(\Pi')\right] + B(\tau_x, g_x, b'_x; \Pi) - mJ_0^{T+1}(\Pi) + s_x \geqslant 0 \end{aligned} \tag{A.5}$$

The last inequality follows from the fact that $\{\tau_x, g_x, b'_x\}$ maximizes the equivalent problem summarized by the first two terms on the left-hand side of the inequality, the definition of J_0^{T+1} and $s_x \geqslant 0$. Thus the policy tuple $\{\tau_x, g_x, b'_x, s_x\}$ is feasible and provides a better payoff to the proposer. This is a contradiction. Consider proposal round $T-1$. The proposer's problem in this round when he/she decides to repay is

$$\begin{aligned} V_c^{T-1}(\Pi) = \quad & \max_{\{\tau, g, s, b'\}} U(c^*, l^*, g) + B(\tau, g, b'; \Pi) - (m-1)s + \beta \mathbb{E}_{z',m'} J_0(\Pi') \\ \text{s.t.} \quad & U(c^*, l^*, g) + s + \beta \mathbb{E}_{z',m'} J_0(\Pi') \geqslant J_0^T(\Pi) \\ & B(\tau, l^*, g) \geqslant (m-1)s \\ & s \geqslant 0 \end{aligned} \tag{A.6}$$

The main difference between round T and round $T-1$ is the expected value of the coalition member in case the round $T-1$ negotiations fail. Notice that the value J_0^{T+1} is determined by maximizing the unanimous joint utility of the legislators. We need to show that if $\{\tau_{T-1}, g_{T-1}, b'_{T-1}, s_{T-1}\}$ solve the proposer's problem in round $T-1$, then $\{\tau_{T-1}, g_{T-1}, b'_{T-1}\}$ solves the equivalent problem and $s_{T-1} = J_0^T - U(c^*, l^*, g) - \beta E_{z'} J_0(\Pi')$.

If we can show that $s_{T-1} = J_0^T - U(c^*, l^*, g) - \beta E_{z'} J_0(\Pi')$, then the proof for the rest of the rounds $\{1, 2, \ldots, T-1\}$ follows easily from the previous argument. To prove by contradiction, let us assume that $s_{T-1} > J_0^T - U(c^*, l^*, g) - \beta E_{z'} J_0(\Pi')$. Therefore, it must be the case that $s_{T-1} = 0$. Otherwise, if $s_{T-1} \geqslant 0$, the proposer can obtain a better allocation by reducing the transfer of local public goods s_{T-1}. This implies

$$J_0^T(\Pi) < U(c_{T-1}^*, l_{T-1}^*, g_{T-1}) + \beta \mathbb{E}_{z',m'} J_0(\Pi') \tag{A.7}$$

where $c_{T-1}^* = c^*(\tau_{T-1}, z)$ and $l_{T-1}^* = l^*(\tau_{T-1}, z)$. Thus, we can rewrite the proposer's original problem to include $s_{T-1} = 0$. $\{\tau_{T-1}, g_{T-1}, b'_{T-1}\}$ must solve

$$\begin{aligned} & \max_{\{\tau, g, b'\}} U(c^*, l^*, g) + B(\tau, g, b'; \Pi) + \beta \mathbb{E}_{z',m'} J_0(\Pi') \\ & B(\tau, g, b'; \Pi) \geqslant 0 \end{aligned} \tag{A.8}$$

Consider a proposal $\left\{\tau_T, g_T, b'_T, \frac{B(\tau_T, g_T, b'_T; \Pi)}{n}\right\}$. This proposal satisfies all the constraints of the proposer's problem in round $T-1$. The incentive compatibility constraint holds with equality. The payoff of the proposer with these policies is

$$m\left[U(c_T^*, l_T^*, g_T) + \beta \mathbb{E}_{z',m'} J_0(\Pi')\right] + B(\tau_T, g_T, b'_T; \Pi) - (m-1)J_0^T(\Pi) \tag{A.9}$$

where $c_T^* = c^*(\tau_T, z)$ and $l_T^* = l^*(\tau_T, z)$. Following A.7, this is strictly larger than

$$m\left[U(c_T^*, l_T^*, g_T) + \beta \mathbb{E}_{z',m'} J_0(\Pi')\right] + B(\tau_T, g_T, b'_T; \Pi) - (m-1)\left[U(c_{T-1}^*, l_{T-1}^*, g_{T-1}) + \beta \mathbb{E}_{z',m'} J_0(\Pi')\right] \tag{A.10}$$

On the other hand, the optimal payoff of the proposer in proposal round $T-1$ is

$$U(c_{T-1}^*, l_{T-1}^*, g_{T-1}) + B(\tau_{T-1}, g_{T-1}, b'_{T-1}; \Pi) + \beta \mathbb{E}_{z',m'} J_0(\Pi') \tag{A.11}$$

Therefore, the following inequality must hold.

$$\begin{aligned} & U(c_{T-1}^*, l_{T-1}^*, g_{T-1}) + B(\tau_{T-1}, g_{T-1}, b'_{T-1}; \Pi) + \beta \mathbb{E}_{z',m'} J_0(\Pi') \\ & \quad > m\left[U(c_T, l_T^*, g_T) + \beta \mathbb{E}_{z',m'} J_0(\Pi')\right] + B(\tau_T, g_T, b'_T; \Pi) - (m-1)\left[U(c_{T-1}^*, l_{T-1}^*, g_{T-1}) + \beta \mathbb{E}_{z',m'} J_0(\Pi')\right] \end{aligned} \tag{A.12}$$

This further implies that

$$\begin{aligned} & m\left[U(c_{T-1}^*, l_{T-1}^*, g_{T-1}) + \beta \mathbb{E}_{z',m'} J_0(\Pi')\right] + B(\tau_{T-1}, g_{T-1}, b'_{T-1}; \Pi) > \\ & \qquad m\left[U(c_T^*, l_T^*, g_T) + \beta \mathbb{E}_{z',m'} J_0(\Pi')\right] + B(\tau_T, g_T, b'_T; \Pi) \end{aligned}$$

[16] Also, s is not the main focus in this paper.

But this is impossible since $\{\tau_T, g_T, b'_T\}$ maximizes the equivalent problem given the value expected by the coalition members in the following period. The same logic can be applied for the other proposal rounds as well as for the proposer's problem in default.

Appendix B. Proof of Lemma 1

Lemma 1 characterizes the behavior of the one-period model when the government decides to default or enters the period already in default. According to the timing of events in the model, in both these situations, b=b'=0.

Proof. Incorporating the equilibrium form of labor supply into the objective function, the period utility function can be simplified in the following way[17].

$$U(\tau, g) = \frac{1}{1-\sigma}\left[\frac{\gamma}{1-\gamma}(1-\tau)z^{\frac{1+\gamma}{\gamma}}\right]^{1-\sigma} + \frac{1}{1-\sigma}g^{1-\sigma} \tag{B.1}$$

In default, the government maximizes the above period indirect utility function. Since this is a one-period problem, there is no continuation value for the government. Therefore, the government solves the following problem.

$$\begin{aligned} &\max_{\{\tau,g\}} U(\tau, g) + \tfrac{B(\tau,g;\Pi)}{m} \\ \text{s.t.} \quad & B(\tau, g; \Pi) \geqslant 0 \end{aligned} \tag{B.2}$$

$B(.) \geqslant 0$ is the government's resource constraint. If the constraint is slack, first-order conditions with respect to g yields

$$g^{-\sigma} = \frac{1}{m} \tag{B.3}$$

The left-hand side is the marginal benefit from an additional unit of pure public good spending. The corresponding cost is one less unit of local public goods spent out of the budget surplus. Notice that we use the equivalent problem proved in Proposition 1 as the government's problem. Clearly, when the resource constraint is slack, the government provides $g^* = m^{-\frac{1}{\sigma}}$ pure public goods. Any additional unit provided after g^* is costlier for the government (yields lower marginal benefit than $\frac{1}{m}$). Additional surplus is transferred to the regions as local public goods. When the government budget constraint binds, then the proposer's problem can be written as

$$\max_{\{\tau,g\}} \frac{1}{1-\sigma}\left[\frac{\gamma}{1-\gamma}[(1-\tau)z]^{\frac{1+\gamma}{\gamma}}\right]^{1-\sigma} + \frac{1}{1-\sigma}\left[n\tau z[(1-\tau)z]^{\frac{1}{\gamma}}\right]^{1-\sigma} \tag{B.4}$$

This is the same period utility function as before, except g is replaced by $n\tau z[(1-\tau)z]^{\frac{1}{\gamma}}$, indicating total tax revenues and $B(.)$ is set to 0. First-order conditions with respect to τ yields

$$\left[\frac{\gamma}{1+\gamma}[(1-\tau)z]^{\frac{1+\gamma}{\gamma}}\right]^{-\sigma}[(1-\tau)z]^{\frac{1}{\gamma}}(-z) + \left[n\tau z[(1-\tau)]^{\frac{1}{\gamma}}\right]^{-\sigma}\left(nz[(1-\tau)z]^{\frac{1}{\gamma}} + \frac{n\tau z}{\gamma}[(1-\tau)z]^{\frac{1}{\gamma}-1}(-z)\right) = 0 \tag{B.5}$$

The first term of the above expression is the cost of increasing labor income taxes by 1 unit, assuming that the resource constraint binds. The second and third terms are the benefit of providing pure public goods. At the margin, the cost and benefit of raising taxes must be equal. Also, note that the entire additional tax revenue is used to provide pure public goods in this case. The benefit from providing pure public goods g is bigger than $\frac{1}{m}$, the benefit from providing local public goods.

Collecting z's from the above expression we obtain

$$z^{-\sigma\left[\frac{1+\gamma}{\gamma}\right]}z^{\frac{1+\gamma}{\gamma}}[\ldots] + z^{-\sigma\left[\frac{1+\gamma}{\gamma}\right]}[\ldots]\left[z^{\frac{1}{\gamma}+1}[\ldots] + z^{\frac{1}{\gamma}+1}[\ldots]\right] = 0 \tag{B.6}$$

The z's cancel out. This proves that $\tau = \tau^*$ if the resource constraint binds. Intuitively, when the government is in default and the constraint binds, a higher z impacts the cost and benefit of taxation equally. More specifically, a higher z implies a lower cost of taxation and a lower benefit from using the entire tax revenue as pure public goods. Thus, when the government's budget is constrained,

$$\begin{aligned} g &= n\tau^* z[(1-\tau^*)z]^{\frac{1}{\gamma}} \\ &= n\tau^* z^{\frac{1+\gamma}{\gamma}}[(1-\tau^*)] \end{aligned} \tag{B.7}$$

Clearly, $\frac{\partial g}{\partial z} > 0$. g continues to rise with z until $g = g^*$.

The first-order condition for the proposer's problem with respect to τ, assuming that the resource constraint does not bind is given by the following equation.

[17] Here we assume that π=1.

$$\left[\frac{\gamma}{1+\gamma}\right]^{-\sigma}(1-\tau)^{-\sigma\left(\frac{1+\gamma}{\gamma}\right)}z^{-\frac{1+\gamma}{\gamma}\sigma}=\frac{1}{m}\left[n-\frac{1}{1-\tau}\right] \tag{B.8}$$

Totally differentiating the above expression with respect to z, we get

$$\frac{\partial\tau}{\partial z}=\frac{\left[\frac{\gamma}{1+\gamma}\right]^{-\sigma}(1-\tau)^{-\sigma\left(\frac{1+\gamma}{\gamma}\right)}\left[\frac{1+\gamma}{\gamma}\sigma\right]z^{-\left(\frac{1+\gamma}{\gamma}\right)\sigma-1}}{\frac{1}{m(1-\tau)^2}+\left[\frac{\gamma}{1+\gamma}\right]^{-\sigma}\left[\sigma\left(\frac{1+\gamma}{\gamma}\right)\right](1-\tau)^{-\sigma\left(\frac{1+\gamma}{\gamma}\right)-1}z^{-\frac{1+\gamma}{\gamma}\sigma}} \tag{B.9}$$

It can be easily verified that the above expression has a positive sign.

For the behavior of the government surplus, $B(.)$, in default if the government's budget is unconstrained, pure public good provision $g=g^*$. However, tax rates and tax revenues are both increasing in z, as $\frac{\partial\tau}{\partial z}\geqslant 0$ and the government operates on the positively sloped part of the Laffer curve. Therefore, in this situation, the surplus is used to provide local public goods, and the provision is increasing in z. This implies that

$$\frac{\partial B}{\partial z}>0 \tag{B.10}$$

However, if the government's budget constraint binds, the marginal benefit from providing pure public goods, g is higher than $\frac{1}{m}$. Hence local public good provision is 0. This far, we have characterized the behavior of the fiscal policies in two situations, if the government's budget constraint is slack or when it binds. This is an endogenous outcome. Now we find the condition which determines when the constraint binds.

Define $z^*(m)$ such that

$$n\tau^*z^*(m)^{\frac{1+\gamma}{\gamma}}[(1-\tau^*)]=g^*(m) \tag{B.11}$$

If follows from above that if $z<z^*(m)$, the constraint binds, else it is slack. Furthermore, since $g^*(m)=m^{-\frac{1}{\sigma}}, g^*(m)$ is increasing in m. This implies that $z^*(m)$ is also increasing in m.

Appendix C. Proof of Lemma 2

Lemma 2 summarizes the behavior of the one-period model when the government decides to repay its existing debt, $-b$. Since this is a one-period model, the government cannot borrow or save. Hence, $b'=0$.

Proof. Similar to the proof of Lemma 1, we incorporate the equilibrium labor supply into the objective function. The simplified period utility function is:

$$U(\tau,g)=\frac{1}{1-\sigma}\left[\frac{\gamma}{1+\gamma}[(1-\tau)z]^{\frac{1+\gamma}{\gamma}}\right]^{1-\sigma}+\frac{1}{1-\sigma}g^{1-\sigma} \tag{C.1}$$

The government maximizes

$$\max_{\{\tau,g\}}U(\tau,g)+\frac{B(\tau,g;\Pi)}{m} \tag{C.2}$$

subject to the constraint $B(\tau,g;\Pi)\geqslant 0$, where $B(\tau,g;\Pi)=n\tau z[(1-\tau)z]^{\frac{1}{\gamma}}-g+b$.

Start with pure public good spending. If the government's resource constraint is slack, then the first order condition yields $g^{-\sigma}=\frac{1}{m}$. The amount of pure public good provision is $g^*=m^{-\frac{1}{\sigma}}$. Beyond this point, it is optimal for the government to provide local public goods instead of pure public goods. Hence, higher assets (b) keep g^* unchanged.

When the government's resource constraint is slack, then first order conditions with respect to taxes, τ is the same as that in Lemma 1. This equation is independent of b. Therefore, $\frac{\partial\tau}{\partial b}=0$ and, $\tau=\tau^{**}$.

When the government's resource constraint binds, then we can write pure public good spending as $g=n\tau z[(1-\tau)z]^{\frac{1}{\gamma}}+b$, that is, the entire tax revenue net of debt payment is used to provide for pure public good spending. In this case, the government's maximization problem is

$$\max_{\tau}\frac{1}{1-\sigma}\left[\frac{\gamma}{1+\gamma}[(1-\tau)z]^{\frac{1+\gamma}{\gamma}}\right]^{1-\sigma}+\frac{1}{1-\sigma}\left[n\tau z[(1-\tau)z]^{\frac{1}{\gamma}}+b\right]^{1-\sigma} \tag{C.3}$$

First-order conditions with respect to τ yields

$$\underbrace{\left[\frac{\gamma}{1+\gamma}\right]^{-\sigma}[(1-\tau)z]^{\frac{-\sigma(1+\gamma)}{\gamma}}}_{\text{MarginalCostofTaxation}}-\underbrace{\left[n\tau z[(1-\tau)z]^{\frac{1}{\gamma}}+b\right]^{-\sigma}}_{\text{MarginalUtilityofPurePublicGoods}}\underbrace{n\left[1-\frac{\tau}{\gamma(1-\tau)}\right]}_{\text{MarginalRevenuefromTaxation}}=0 \tag{C.4}$$

The first term on the left-hand side is the cost of raising the tax rate by 1 unit while the second term is the benefit. In this case, the entire tax revenue is used to pay for the maturing debt stock and pure public goods. Totally differentiating the above expression with respect to b, and using the first order condition of taxation (positive marginal revenue from taxation), we can show that $\frac{\partial\tau}{\partial b} \leqslant 0$. Intuitively, higher assets reduce the marginal value of pure public good provision. It is then optimal for the government to reduce distortionary taxes in the margin.

When the government's budget is constrained, the provision of pure public goods equals $g = n\tau z[(1-\tau)z]^{\frac{1}{\gamma}} + b$. Re-writing the objective function above at the optimum, for a given z, and taxes τ expressed as a function of b, we have

$$\frac{1}{1-\sigma}\left[\frac{\gamma}{1+\gamma}[(1-\tau(b))z]^{\frac{1+\gamma}{\gamma}}\right]^{1-\sigma} + \frac{1}{1-\sigma}\left[n\tau(b)z[(1-\tau(b))z]^{\frac{1}{\gamma}} + b\right]^{1-\sigma} \tag{C.5}$$

Using the envelope theorem, it must be the case that

$$\frac{\partial\tau}{\partial b}[\text{MarginalGainfromReducingTaxes} - \text{MarginalGainfromPurePublicGoods}] = 0 \tag{C.6}$$

We already know that $\frac{\partial\tau}{\partial b} \leq 0$. Using the envelope theorem, it must be the case that the gain from reducing taxes equals the gain from pure public goods provision at the new level of taxes and public goods. At lower taxes, the marginal gain from lowering taxes further is also low because of the concavity of the utility function. This further implies that the gain from increasing pure public goods provision must be lower. This is only possible at a higher g. It follows from this argument that $\frac{\partial g}{\partial b} \geqslant 0$.

Finally, when the government's budget constraint binds, $B(.) = 0$, by definition. In this situation, when b increases for a given z, the tax rate is reduced, and pure public good provision increases (as already proved). The marginal gain from providing pure public goods is higher than local public goods ($\frac{1}{m}$). Thus, $\frac{\partial B}{\partial b} = 0$. However, if the government's budget constraint is slack, then taxes and pure public good provisions are fixed (as already proved). The entire increase in assets is used to provide local public goods. Thus, $\frac{\partial B}{\partial b} \geqslant 0$.

Define $b^*(z,m)$ such that $n\tau^{**}z[(1-\tau^{**})z]^{\frac{1}{\gamma}} + b^*(z,m) = g^*(m)$, where $b^*(z,m)$ is the threshold value of government assets for which the government's budget constraint binds. Since $g^*(m)$ is increasing in m, it is easy to follow that for a given value of z, $b^*(z,m)$ is also increasing in m. Keeping m constant, if z increases, tax revenue increases. For the above equation to hold, $b^*(z,m)$ must fall. Therefore, the asset threshold $b^*(z,m)$ is decreasing in z. Finally, note that m only matters for fiscal policies if the Samuelson level of pure public goods is provided. Otherwise, all the fiscal policies are independent of m.

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