Political Economics of Fiscal Consolidations and External Sovereign Accidents[⋆]

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Abstract

As the recent chain of EU sovereign crises has demonstrated, after an unexpected massive rise to the debt GDP ratio, several EU countries manage to proceed with fiscal consolidation quickly and effectively, while other countries, notably Greece, proceed slowly, fuelling "Graccident" and "Grexit" scenarios, even after generous rescue packages, involving debt haircuts and monitoring from official bodies. Here we recursively formulate a game among rent-seeking groups and propose that high debt-GDP ratios lead to predictable miscoordination among rent-seeking groups, unsustainable debt dynamics, and open the path to political accidents that foretell "Graccident" scenarios. Our analysis and application helps in understanding the politico-economic sustainability of sovereign rescues, emphasizing the need for fiscal targets and possible debt haircuts. We provide a calibrated example that quantifies the threshold debt-GDP ratio at 137%, remarkably close to the target set for private sector involvement in the case of Greece.

Keywords: sovereign debt, rent seeking, international lending, tragedy of the commons, EU crisis, Grexit, Graccident

JEL classification: H63, F34, F36, G01, E44, E43, D72

1 Introduction

The Maastricht treaty has been explicit about two fiscal requirements in order to justify participation in the Eurozone: (i) that the fiscal deficit-GDP ratio never exceeds 3%, and (ii) that the fiscal debt-GDP ratio never exceeds 60%. Here we investigate whether such fiscal rules go beyond narrow-minded economic accounting. Specifically, we examine whether quotas on fiscal debt-GDP ratios guarantee the political feasibility of fiscal prudence once a country is already member of a monetary union.

The European debt crisis brought to the forefront of policy the sustainability of debt-GDP ratios and fiscal consolidation programs. In this paper we argue that there is a strong political economy dimension to the crisis, and the political feasibility of fiscal consolidation programs is inherently linked to the political instability experienced by member countries in southern Europe. Southern European countries received several rounds of financial assistance from the "Troika" institutions (European Commission, European Central Bank and the IMF) in an effort to stabilise them, yet they were followed by more rather than less political instability, and fears about the future of these countries in the European Union have not subsided. Greece is perhaps the most vivid example of political instability. Since 2010, Greece has held five elections forming four (one coalition and three single party) short-lived governments and one interim technocrat government leading to the May 2012 election. The last double election held in January 2015 and September 2015 has again highlighted the deep political separatism and unwillingness of the major political parties to cooperate in a coalition government that would help in sharing the political cost of continued fiscal consolidation. Portugal is another example when just after the October 2015 election the socialist partner withdrew the support from the coalition government.

An important political economy aspect we emphasize is the degree of corruption –a form of rent seeking– and the political separatism that it generates. Figure 1 suggests corruption and fiscal profligacy correlate strongly across Eurozone countries, and corruption is particularly acute in the EU periphery.[1] The correlation displayed in Figure 1 admits two interrelated interpretations. On the one hand, the interplay between politics and corrup-

[1] The correlation coefficient between fiscal surplus/deficit-GDP ratios and the corruption perception index is 73%. Grechyna (2012) reports similar correlation results to this depicted by Figure 1, referring to OECD countries. Figure 1 partly reflects the sovereign "debt shocks" in EU countries, presented by Mendoza et al. (2014, Figure 1).

tion may be central to explaining the divergence of fiscal imbalances between the EU core and EU periphery countries. One the other hand, fiscal imbalances may reinforce channels through which corrupt politics lead to excessive government debt, i.e., corruption may lead to more corruption and eventually to an unsustainable level of government debt.

The channel we explore is whether outstanding debt-GDP ratios affect practices of well-organized groups within partisan politics that seek fiscal rents. In particular, we investigate whether debt-GDP ratios provide incentives to rent-seeking groups to cooperate (or not) in order to comply with fiscal-prudence practices. Our emphasis on such cooperation decisions is corroborated by excerpts of IMF country reports (see Appendix A), which refer to Eurozone countries that either received rescue packages or faced excessively high 10-year government bond spreads during the sovereign crisis and were forced out of the bond markets. IMF experts explicitly state the need for coalition governments or for partisan cooperation in order to implement programs of controlled fiscal spending. One goal of our analysis is to understand more about the policy prescription for sovereign-crisis problems that involve politics more heavily than usual. For example, Greece's commitment to the common currency gives a stronger role to politics, requiring from politicians of different parties to collaborate on strong reforms and on internal devaluation policies in order to avoid disorderly default (the so-called "Graccident") and sudden exit from the Eurozone (the so-called "Grexit", discussed extensively by Sinn, 2015) as well as to restore Greece's competitive edge (see Ioannides and Pissarides (2015)).

1.1 Illustrating the mechanics of the model

At the heart of our analysis is a dynamic game played by rent-seeking groups.[2]This game is embedded in an open economy with the following features: (i) rent-seeking groups jointly influence debt dynamics, government spending, and taxes through (non)cooperation decisions, while extracting rents from the fiscal budget and, (ii) interest rates are determined in international markets where foreign creditors buy government debt.

[2]Our setup extends the formulation suggested by Persson (1998), who studies political competition among rent-seeking groups which consume within-group club goods. This setup is related to the political economy of rent-seeking (special-interest) groups, pioneered by Schattschneider (1935), Tullock (1959), Olson (1965), Weingast, Shepsle, and Johnsen (1981), Becker (1983, 1985), and Taylor (1987).

		Rent seeker 2	
		C	NC
Rent	C	$\left(V_1^C, V_2^C\right)$	$\left(V_1^{NC}, V_2^{NC}\right)$
seeker 1	NC	$\left(V_1^{NC}, V_2^{NC}\right)$	$\left(V_1^{NC}, V_2^{NC}\right)$

Table 1

Consider the static snapshot (displayed in Table 1) of the game between two rent seeking groups. The game specifies payoff values V_i^C, V_i^{NC}, $i = 1, 2$, from the strategies cooperation "C" and noncooperation "NC"respectively. There are two possibilities for the equilibrium of the game. If $V_i^C < V_i^{NC}$, $i \in \{1, 2\}$, then there are three Nash equilibria, (NC, NC), (C, NC) and (NC, C), i.e., if noncooperation is more rewarding for both rent seekers, then noncooperation is a sure outcome. If, instead, $V_i^C > V_i^{NC}$, $i \in \{1, 2\}$, then there are two Nash equilibria, namely, (C, C) and (NC, NC), i.e., if co-operation is more rewarding for both rent seekers, then cooperation becomes a possible outcome.

A key role in shaping the inequality above is played by a *threshold value of the initial outstanding debt-GDP ratio.* Above that debt-GDP-ratio threshold, servicing the debt becomes too costly, and it leads to dominant noncooperation incentives among rent-seeking groups. Permanent non-cooperation in turn implies that no creditor is willing to lend money to the country in question, with the latter resorting to financial autarky forever after.

A tragedy of the commons problem, as explained in Persson and Tabellini (2000, pp. 163-164), is responsible for this market-isolation result. Without permanent cooperation of rent-seeking groups, there is excessive debt issuing, a type of endogenous fiscal impatience. This impatience causes a mismatch between creditors and a government, the former requiring excessively high interest rates that make debt servicing infeasible.

Nevertheless, such a market exclusion outcome can be avoided if creditors and the groups can both sign a binding commitment. Such a commitment exchanges debt relief for permanent cooperation, with the size of the debt relief given by the distance between the outstanding and threshold debt-to-GDP ratio. Fiscal consolidations can thus be more rewarding and hence politically feasible if they are accompanied by some form of debt relief. A key contribution of our study is the endogenous derivation of the threshold debt-GDP ratio that encourages cooperation and can thus support the political sustainability of fiscal consolidations.

Our recursive formulation contributes an analytically solved deterministic model which falls in Lagunoff's (2009, p. 577) specific class of politicoeconomic games. These games are a collection of, (i) economic primitives, (ii) political rules, and (iii) initial conditions. The political rules we study are Markovian decisions of rent-seeking groups to cooperate (or not) on fiscal prudence, while the key initial condition that matters in our analysis is the initial debt-GDP ratio.[3] Our analysis is able to shed light on issues related to the recent sovereign crisis in the Eurozone, specifically on the desirability and politically feasibility of bailouts and fiscal consolidations, which is the core application in this paper.[4]

1.2 Application

Perhaps unsurprisingly the Greek experience is the best example of all the model's mechanics at work. Hence the focus and motivation of the model application are the debt rescues that begun with the first Greek bailout in May 2010 (followed by Portugal, Ireland) and two further Greek bailout deals in 2012 and 2015. A quantitative exercise indicates that the threshold debt-GDP ratio that encourages cooperation and can thus be thought as the politically sustainable level is 137%. The model implies that, a "sunspot" one-off event that takes this ratio above the threshold, puts the country in question in a danger zone of a political accident, i.e. a disorderly default, where rent seeking groups foresee the cost of servicing the debt exceeding the

[3]In an influential paper, Battaglini and Coate (2008) introduce political competition over pork-barrel spending in a tax smoothing model and study the effect of debt on the composition of spending. While our model is similar in spirit to theirs (i.e. redistribution using debt and taxes as instruments) there are two differences. First, Battaglini and Coate (2008) adopt the legislative bargaining approach while we use a dynamic common pool resource approach. Second, a key difference is that we endogenize the interest rate on debt, which is assumed to be constant in Battaglini and Coate (2008). Consequently, the effect of interest rates on the dynamics of debt is a key channel, that affects the political decisions in our framework.

[4]Our model focuses on a setup in which there is a common currency between a domestic economy and foreign creditors, which is directly applied to the Eurozone case. Yet, our model could be modified to including a currency, in order to study the possibility of a currency crisis, potentially combined with a sovereign default as well.

benefits from extracting cooperative rents under a policy of fiscal prudence.[5] Greece flirted with a disorderly default (a "Graccident") twice. The first episode took place for much of the second half of 2011 and early 2012, leading eventually in March/April 2012 to a debt swap with the private sector (the so called "PSI"), writing off approximately 53% of bonds held by private creditors. The second event occurred in June-July 2015 when the newly elected left-wing Greek government missed scheduled payments to the IMF, while negotiating with EU partners the conditions of a new consolidation program. Even though we view 137% as an indicative threshold, the outstanding Greek debt-GDP ratio was substantially higher in both episodes, reaching 163% in 2012 and 177% by mid 2015.

Default in the model can be best thought of as accidental default, i.e., the outcome of a political separatism that results when the debt-GDP ratio is in a danger zone as explained above. The default concept is thus different from a strategic-default choice by a government in power as is most commonly encountered in the sovereign-debt literature.[6]Our model is best designed to study EU countries who are tightly connected through institutions, such as the ECB, the Euro-parliament, Eurogroup, European commission and even NATO agreements and where most of the EU debt is held by financial institutions within the union. A strategic default choice, implies an exit from the union and is thus incompatible with the institutional constraints adopted by member countries.[7]

Pappa et al. (2015) estimate, using a New Keynesian model, the fiscal multiplier in the presence of corruption and tax evasion in EU periphery countries and show that fiscal consolidations are more costly in terms of output losses and welfare. Their empirical results thus corroborate our analysis since they suggest that the presence of corruption makes the debt burden in

[5]Extrinsic, or in the language of King (2016), radical uncertainty implies, neither the creditors, nor rent seeking groups are able to see or expect one-off events (akin to "sunspots") that hit the debt-GDP ratio.

[6]This alternative literature of strategic default is vast, pioneered by Eaton and Gersovitz (1981), Bulow and Rogoff (1989), Cole and Kehoe (1995), Cole et al. (1995). Extensions of this literature include Beetsma and Uhlig (1999), Cole and Kehoe (2000), Arellano (2008), Cuadra and Sapriza (2008), Yue (2010), Roch and Uhlig (2011), Amador (2012), and Mendoza and Yue (2012) among others. For an extensive review on sovereign debt see Aguiar and Amador (2014).

[7]However we do not rule out that default threats may have played a role in the negotiations leading to the third bailout deal reached by EU partners and Greece in July 2015.

relation to GDP heavier for the economy undergoing the fiscal consolidation.

Insights on the determinants of such debt-GDP-ratio threshold levels help in understanding the design of bailout rescue packages.[8] A binding commitment for a debt haircut tries to exclude an equilibrium in which rent-seeking groups would want to swing to noncooperation even for one period. Securing that debt-GDP ratios stay below such threshold levels may contribute to the politicoeconomic sustainability of debt. We also find that international agreements (among foreign governments or by the IMF) to roll over fiscal debt using lower pre-agreed interest rates, increase the debt-GDP-ratio threshold levels that support cooperation. For instance, the 137% debt-GDP threshold discussed above rises to 160% if the interest rate falls from 2.5% to 2%. Indeed, one feature of bailout plans in the Eurozone is the tool of lowering interest rates. Our analysis thus suggests lower interest rates foster political cooperation among rent-seeking groups. They make rescue packages politically feasible (and socially desirable) even at high outstanding debt-GDP ratios since they imply lower taxes and higher public consumption increasing welfare for the general public. Our model's mechanics are compatible with these features, which perhaps explain the stated rationale behind bailouts: the need to make the servicing costs of debt socially and politically bearable.

2 Model

2.1 The domestic economy

The domestic economy is populated by a large number of identical infinitely-lived agents of total mass equal to 1.

2.1.1 Production

A single composite consumable good is produced under perfect competition, using labor as its only input through the linear technology,

$$y_t = z_t \cdot l_t \ , \tag{1}$$

[8] In our Online Appendix we provide evidence on observations motivating us to suggest that corruption and rent-seeking, as endemic problems in Eurozone periphery countries, play a central role as both causes and effects within the vicious circle of the Eurozone sovereign crisis.

in which y is units of output, l is labor hours, and z is productivity. Assume that there is no uncertainty and that productivity at time 0 is $z_0 > 0$, growing exogenously at rate γ, i.e.,

$$z_t = (1+\gamma)^t z_0 \ . \tag{2}$$

2.1.2 Non rent-seeking households

A representative non rent-seeking household (one among a large number of such households) draws utility from private consumption, c, leisure, $1-l$, and also from the consumption of a public good, G, maximizing the life-time utility function

$$\sum_{t=0}^{\infty} \beta^t \left[\ln(c_t) + \theta_l \ln(1-l_t) + \theta_G \ln(G_t)\right] \ , \tag{3}$$

in which $\beta \in (0,1)$ is the utility discount factor, while $\theta_l, \theta_G > 0$ are the weights on leisure and public consumption, G, in the utility function. Public consumption is financed via both income taxes and fiscal debt. Yet, for simplicity, we assume that agents in this economy cannot hold any government bonds, so fiscal debt is external in all periods. Finally, we assume that agents cannot have access to domestic government bonds in the future, and that there is no storage technology. Under these assumptions, the budget constraint of an individual household is,

$$c_t = (1-\tau_t)\, z_t l_t \ . \tag{4}$$

The representative non-rent-seeking household maximizes its lifetime utility given by (3), subject to equation (4), by choosing the optimal stream of consumption and labor supply, $(\{(c_t, l_t)\}_{t=0}^{\infty})$, subject to any given stream of tax rates and public-good quantities, $\{(G_t, \tau_t)\}_{t=0}^{\infty}$. Since the solution to this problem is based on intra-temporal conditions only, we obtain a simple formula, namely,

$$l_t = \frac{1}{1+\theta_l} = L \ , \quad t = 0, 1, \ldots \ , \tag{5}$$

with L being both the individual and the aggregate labor supply.[9]

[9] Under logarithmic utility the income and substitution effects of taxation on leisure cancel each other out, so labor supply does not respond to changes in marginal tax rates.

2.1.3 Rent-seeking groups and rent-seeking households

We introduce N rent-seeking groups in the domestic economy that may be heterogeneous in size. Total population in the economy has normalized size 1, and the population mass of each rent-seeking group is μ_j, $j \in \{1, ..., N\}$, with $\sum_{j=1}^{N} \mu_j \leq 1$. These groups have the power to expropriate resources from the fiscal budget. In each period $t \in \{0, 1, ...\}$, a rent-seeking group $j \in \{1, ..., N\}$ manages to extract a total rent of size $\bar{C}_{j,t}^{R}$. Changing slightly the formulation of Persson (1998), $\bar{C}_{j,t}^{R}$ is a composite club good subject to rivalness (public good within but with congestion). Examples of components of $\bar{C}_{j,t}^{R}$ are civil-servant jobs for which devoted group members can put less effort at work, tax evasion for which the group supports a network of non-transparency which is exclusive for group members, preferential legal treatment, privileges regarding the management of real estate, fiscal overinvoicing, or wasteful public infrastructure related to private benefits, etc. These goods, $\bar{C}_{j,t}^{R}$, are equally available to every member of rent-seeking group j (every member of the group is the same), but with each member taking advantage from a smaller club size.[10]In each rent-seeking group there is a large number of individuals, with each individual being unable to influence the group's aggregate actions.[11]*Denoting by* $C_{j,t}^{R}$ *the individual member's consumption of the club good* $\bar{C}_{j,t}^{R}$, the utility function of an individual rent seeker belonging to group j is,[12]

$$\sum_{t=0}^{\infty} \beta^t \left[\ln(c_{j,t}) + \theta_l \ln(1 - l_{j,t}) + \theta_G \ln(G_t) + \theta_R \ln\left(C_{j,t}^{R}\right) \right] , \tag{6}$$

with $\theta_R > 0$, and her economic problem is maximizing (6) subject to the budget constraint

$$c_{j,t} = (1 - \tau_t)\, z_t l_{j,t} \ . \tag{7}$$

Optimal choices for a rent seeker are given by,

$$l_{j,t} = l_t = \frac{1}{1 + \theta_l} = L \ , \quad t = 0, 1, ... \ . \tag{8}$$

[10]On club goods see Mueller (2003, Chapter 9), and especially Sandler and Tschirhart (1997), and Roberts (1999, Section 6), in which club goods with congestion are studied.

[11]Nevertheless, club strategies are fully compatible with individual-member incentives. We assume that even if rent-seeking groups have to lobby, this is a costless collective action: it requires no individual effort or any other sacrifice.

[12]For the formulation of the utility function see, for example, Sandler and Tschirhart (1997, eq. 1, p. 339).

Since labor supply is identical across rent seekers and non rent seekers, private consumption is also the same across rent seekers and non rent seekers, namely,

$$c_{j,t} = c_t = (1 - \tau_t)\, z_t L \ . \tag{9}$$

2.1.4 Aggregate production and fiscal budget

Combining L with (1) and (2) gives the competitive-equilibrium GDP level,

$$Y_t = (1 + \gamma)^t\, z_0 L \ . \tag{10}$$

For simplicity, we assume that the domestic government issues only one-period zero coupon bonds. So, in every period there is a need for full debt rollover to the next period.[13]The government's budget constraint is,

$$\frac{B_{t+1}}{1 + r_{t+1}} = B_t + G_t + \sum_{j=1}^{N} \omega_j C_{j,t}^R - \tau_t Y_t \ , \tag{11}$$

in which the weight $\omega_j = N\mu_j / \sum_{i=1}^N \mu_i$, B_{t+1} is the value of newly issued bonds in period t that mature in period $t+1$, evaluated in terms of the consumable good in period $t+1$, and r_{t+1} is the interest rate which reflects the intrinsic return of a bond maturing in period $t+1$. Assuming that the one-period zero-coupon bond delivers one unit of the consumable good at maturity, B_t reflects the quantity of bonds maturing in period t. The weights ω_j in equation (11) play the role of an efficiency factor, transforming and mapping each dollar extracted by the fiscal budget into goods enjoyed by each member of group j.[14]Specifically, given that $C_{j,t}^R$ *is an individual member's consumption of the total rents extracted by group* j, $\bar{C}_{j,t}^R$, the relationship between $\bar{C}_{j,t}^R$ and $C_{j,t}^R$ is given by,

$$\bar{C}_{j,t}^R = \omega_j C_{j,t}^R \ , \text{ for all } j \in \{1, ..., N\}\, , \ t \in \{0, 1, ...\} \ .$$

[13]This assumption of issuing exclusively one-year zero-coupon bonds rules out concerns about strategic supply of bonds with different maturity. The short maturity time of bonds does not affect our qualitative results.

[14]For the formulation of weights ω_j in the fiscal budget constraint (11), see, for example, Sandler and Tschirhart (1997, eq. 5, p. 341), which is based on the more general formulation of McGuire (1974), adapted for a continuum of agents within the group, and assuming a constant within-group congestion cost.

The smaller the size of group j, the smaller the weight ω_j, which means more special goods C_j^R for each member of j. If all groups have the same size ($\mu_i = \mu_j = \mu$ for all $i, j \in \{1, ...N\}$, the symmetric-equilibrium case), then $\omega_j = 1$ for all $j \in \{1, ..., N\}$. So, by convention, the price per unit of $C_{j,t}^R$ equals the consumer-basket price.[15]In the case of heterogeneity in group size, weights ω_j affect the rent-seeking-strategy incentives that each group member promotes, by taking into account that in larger groups there is a smaller portion of goods enjoyed per group member.

2.1.5 Impact of tax rates on GDP performance versus impact of tax rates on welfare

The absence of any marginal tax rates in equation (10) demonstrates that our logarithmic-utility setup neutralizes the impact of taxes on GDP performance and rules out dynamic Laffer curves. While taxes do not affect GDP performance, they directly reduce consumption and utility (see equation (4)). So, taxes have a profound impact on welfare. Also, despite that taxes do not have the classic distortionary effects on GDP performance, our analysis does not rule out considerations about an economy's ability to repay fiscal debt. As it will be clear later, international interest rates at which a country borrows externally, influence its ability to repay fiscal debt in the future. It is an analytical advantage that our model clearly distinguishes the impact of interest-rate pressure on the ability to repay from other factors affecting GDP performance.

2.1.6 Policy-setting mechanism: the biggest part of society influences policy all the time

The levels of fiscal spending, G_t, the tax rate, τ_t, and the level of debt one period ahead B_{t+1}, are the Nash equilibrium of a dynamic game among rent-seeking groups, which also determines $C_{j,t}^R$ in each period. We assume that

$$\underbrace{1 - \sum\nolimits_{j=1}^{N} \mu_j}_{\text{non rent-seekers}} < \underbrace{\min\{\mu_j\}_{j=1}^{N}}_{\text{smallest rent-seeking group}} \quad , \tag{12}$$

[15]We follow this convention as it is not straightforward to impose a market price on such special-interest club goods. Nevertheless, our equilibrium which emphasizes politicoeconomic inefficiencies, uncovers the effects and costs of providing such rents.

so non rent-seekers cannot beat any rent-seeking group in a majority-voting equilibrium on these policy variables. For simplicity, we assume that all existing rent-seeking groups actively and simultaneously influence policymaking in each period, while they determine their per-member rent allocation $\{C_j^R\}_{j=1}^N$. The allocation of rents, $\{C_j^R\}_{j=1}^N$, is determined in a competitive and decentralized way, through time-consistent Nash equilibrium. The tax rate and the debt level are determined *jointly through a simultaneous-move Nash equilibrium among rent-seeking groups,* as in legislative bargaining models or as in dynamic games in which different players jointly manage common-pool resources. Our Nash equilibrium concept synchronizes actions by rent-seeking groups, simplifying recursive formulations, implying that all tax/debt policies are time-consistent. The qualitative equivalence of asynchronous fiscal profligacy to a commons problem with simultaneous moves is demonstrated by Persson and Svensson (1989). Yet, such an extension should not alter our results.[16]

Persson and Tabellini (2000, Chapter 7), present a number of applications related to the political mechanism behind the provision of club goods as rents, such as legislative bargaining, lobbying, and electoral competition. Here we abstract from such an analysis since EU core/periphery countries do not differ with respect to institutional arrangements behind these political-economy extensions. As Figure 1 illustrates, the EU core/periphery countries differ mostly with respect to the intensity of rent-seeking/corruption.

2.2 The external creditors

We denote all external-creditor variables using a star. Creditors hold one-period zero-coupon bonds from M different countries. Creditors can be in-

[16] We do not model alternating political parties and associated rent-seeking groups in power, as this would complicate the derivation of equilibrium without adding insights to the model. Having all rent-seeking groups acting simultaneously conveys the mechanics of a commons problem adequately: a rent-seeking group tends to expropriate extra rents before being crowded out by extra rents of other groups. On the one hand, each group fully internalizes the benefits of its own per-member rent-seeking good, C_j^R. On the other hand, because financing is shared among groups, each group internalizes only one fraction of the social burden caused by higher taxes and debt. Extensions of our model employing numerical techniques may explore the role of alternating incumbent parties that are controled by rent-seeking groups. Such extensions are beyond the scope of our analysis here, which is based on closed-form solutions.

terpreted as managers of financial institutions who act in the best interest of the shareholders. Given an initial portfolio of bonds from different countries, $\left\{B^*_{i,0}\right\}_{i=1}^{M}$ they select $\left\{\left(c^*_t, \left\{B^*_{i,t}\right\}_{i=1}^{M}\right)\right\}_{t=0}^{\infty}$ in order to maximize the total life-time utility of (credit-institution) shareholders given by,

$$\sum_{t=0}^{\infty} \beta^t \ln\left(c^*_t\right) \tag{13}$$

subject to the budget constraint,

$$\sum_{i=1}^{M} P^B_{i,t} B^*_{i,t+1} = \sum_{i=1}^{M} B^*_{i,t} - c^*_t \ , \tag{14}$$

in which $P^B_{i,t} = 1/\left(1 + r_{i,t+1}\right)$ is the price of a bond that matures in period $t+1$. Notice also that the rate of time preference, $(1-\beta)/\beta$, in the utility function of creditors, (13), is equal to the rate of time preference of domestic households. For maximizing (13) subject to (14), a requirement for $B^*_{i,t} > 0$ for all $i \in \{1, ..., M\}$ is,

$$P^B_{i,t} = P^B_{j,t} = \frac{1}{1 + r_{t+1}} \ , \ \ t = 0, 1, ... \ . \tag{15}$$

The solution to the problem of maximizing (13) subject to (14) is,

$$c^*_t = (1-\beta)\,\bar{B}^*_t \ , \quad c^*_s = (1-\beta)\,\beta^{s-t} \prod_{j=t+1}^{s} \left(1 + r_j\right) \bar{B}^*_s \ , \ s = t+1, t+2, ... \ ,$$

which implies,

$$\bar{B}^*_{t+1} = \beta\left(1 + r_{t+1}\right) \bar{B}^*_t \ , \ \text{ with } \ \bar{B}^*_t \equiv \sum_{i=1}^{M} B^*_{i,t} \ , \ t = 0, 1, ... \ . \tag{16}$$

Logarithmic preferences are responsible for this compact algebraic solution given by (16), which implies that demand for external debt depends only on the return of bonds issued in period t and maturing in period $t+1$, r_{t+1}.[17]

[17]Without logarithmic utility, the typical decision rule determining the demand of bonds in period 1 is of the form $B^*_{t+1} = h\left(\left\{r_s\right\}_{s=t+1}^{\infty}, B^*_t\right)$, i.e., it depends on all future interest

2.3 Bond Demand by Creditors

Let a set of weights $\{m_{i,t}\}_{i=1}^{M}$, such that,

$$B_{i,t}^{*}=m_{i,t}\bar{B}_{t}^{*}\ ,\ \ i=1,...,M\ ,\ \ \text{with}\quad \sum_{i=1}^{M}m_{i,t}=1\ . \tag{17}$$

Combining (17) with (16) gives,

$$B_{i,t+1}^{*}=\beta\left(1+r_{t+1}\right)\frac{m_{i,t+1}}{m_{i,t}}B_{i,t}^{*} \tag{18}$$

Equation (18) determines the demand for bonds by external creditors for each country in period $t+1$, and $\{m_{i,t+1}\}_{i=1}^{M}$, is determined by market-clearing conditions which depend on bond supply by each country.

2.4 Bond Supply by the Domestic Economy Conditional Upon Cooperation Decisions

In Appendix B, Proposition 1.B, we derive political decisions according to a Markov-perfect non-cooperative equilibrium *for a given stream of interest rates,* $\{r_s\}_{s=t+1}^{\infty}$, the choices of club rents, $C_{j,t}^{R}$, and public policies B_{t+1}, G_t, and τ_t. These decisions are conditional upon (non-)cooperation decisions, distinguished in two categories: (i) a case of cooperation among rent-seeking groups, which is captured by setting $N=1$ in the formulas below, and (ii) a case of non-cooperation without partial coalitions among groups. The bond-supply equation from Proposition 1.B is,

$$B_{t+1}=\left(1+r_{t+1}\right)\left[\beta_N B_t+\left(1-\beta_N\right)\underbrace{z_t\mathbb{W}\left(\{r_s\}_{s=t+1}^{\infty}\right)}_{\text{Economy's worth}}-Y_t\right]\ , \tag{19}$$

rates, $\{r_s\}_{s=t+1}^{\infty}$. In the special case of logarithmic utility, h is of the more restricted form $h\left(\{r_s\}_{s=t+1}^{\infty},B_t^{*}\right)=\tilde{h}\left(r_{t+1},B_t^{*}\right)=\beta\left(1+r_{t+1}\right)B_t^{*}$. That $\tilde{h}\left(r_{t+1},B_t^{*}\right)$ is independent from any interest-rate changes in the continuation stream $\{r_s\}_{s=t+2}^{\infty}$ does not mean that creditors with logarithmic preferences are not forward-looking any more. It is that income- and substitution effects on consumption/savings cancel each other out one-to-one, for all future transition paths under logarithmic utility. So, under (13), the effects of any continuation stream $\{r_s\}_{s=t+2}^{\infty}$ only reflect the impact of the constant rate of time preference on current decisions, through the presence of the discount factor, β, in $\tilde{h}\left(r_{t+1},B_t^{*}\right)=\beta\left(1+r_{t+1}\right)B_t^{*}$.

in which,

$$\mathbb{W}\left(\{r_s\}_{s=t+1}^{\infty}\right) = \left[\prod_{s=t+1}^{\infty}\frac{1}{1+\tilde{r}_s} + 1 + \sum_{s=t+1}^{\infty}\frac{1}{\prod\limits_{j=t+1}^{s}(1+\tilde{r}_j)}\right]\cdot L \ , \qquad 1+\tilde{r}_t \equiv \frac{1+r_t}{1+\gamma} \ , \tag{20}$$

with,

$$\beta_N = \frac{1}{1+(N-1)\,\frac{(1-\beta)\theta_R}{1+\theta_G+\theta_R}}\beta \ . \tag{21}$$

2.5 Determining interest rates in international markets

Combining equation (19) with (18) in order to equate $B^*_{\hat{\imath},t} = B_t$ for all t (assume $\hat{\imath}$ is the domestic economy), leads to interest-rate determination in international equilibrium through the aid of equation (20). Equation (21) provides a crucial difference depending on whether rent-seeking groups cooperate or not. In case of cooparation, (21) implies that $\beta_N|_{N=1} = \beta$. In case of no cooperation, $\beta_N < \beta$, a case of collective impatience. This collective-impatience mechanism is crucial for understanding the tragedy-of-the-commons mechanism and this mechanism is a key element for understanding cooperation decisions.[18]The recursive-equilibrium concept for endoganizing these cooperation decisions follows in the next section.

2.6 Definition of Markov-perfect-cooperation-decision Nash equilibrium (MPCDNE)

Let the cooperation decision of rent-seeking group $j \in \{1, ..., N\}$ be denoted by the indicator function

$$\mathbb{I}_{j,t} = \begin{cases} 1 \ , & j \text{ plays "cooperate" in period } t \\ 0 \ , & j \text{ plays "do not cooperate" in period } t \end{cases} .$$

[18]With endogenous cooperation decisions among rent-seeking groups, formula (18) which governs the dynamics of B_t is still valid: in an equilibrium with some periods of cooperation and some periods without cooperation, β_N in equation (18) becomes a convex combination of β and β_N from equation (21).

Let the rent-consumption strategies in periods of no cooperation be denoted by $\mathbb{C}_j^{R,NC}$ for all $j \in \{1, ..., N\}$. Let

$$\mathbb{S} \equiv \left\{ \left(\mathbb{C}_i^{R,NC}, \mathbb{I}_i \right) \right\}_{i=1}^{N} ,$$

Define the Bellman equation related to determining the value of a cooperation decision in the current period,

$$V^{C,j}\left(B, z \mid \mathbb{S}\right) = \max_{(\tau, C^{R,C}, B')} \left\{ \ln\left(zL\right) + \ln\left(1-\tau\right) + \theta_l \ln\left(1-L\right) + \theta_R \ln\left(\frac{C^{R,C}}{N}\right) \right.$$
$$+ \theta_G \ln\left[\frac{B'}{1+R\left(B, z \mid \mathbb{S}\right)} - \left(B + C^{R,C} - \tau z L\right)\right]$$
$$+ \beta \left\{ \prod_{i=1}^{N} \mathbb{I}_i\left(B', (1+\gamma) z \mid \mathbb{S}\right) \underbrace{V^{C,j}\left(B', (1+\gamma) z \mid \mathbb{S}\right)}_{\text{future value from cooperation}} \right.$$
$$\left.\left. + \left[1 - \prod_{i=1}^{N} \mathbb{I}_i\left(B', (1+\gamma) z \mid \mathbb{S}\right)\right] \underbrace{V^{NC,j}\left(B', (1+\gamma) z \mid \mathbb{S}\right)}_{\text{future value from non-cooperation}} \right\} \right\} , \tag{22}$$

where, $C^{R,C}$ denotes cooperative rents that are shared equally among all rent-seeking groups, $R\left(B, z \mid \mathbb{S}\right)$ denotes the interest rate on debt, and a prime denotes the next period value of the corresponding variable. Further, the Bellman equation that determines the value of a noncooperation decision in the current period is,

$$V^{NC,j}\left(B, z \mid \mathbb{S}\right) = \max_{\left(\tau, c_j^{R,NC}, B'\right)} \left\{ \ln\left(zL\right) + \ln\left(1-\tau\right) + \theta_l \ln\left(1-L\right) + \theta_R \ln\left(c_j^{R,NC}\right) \right.$$
$$+ \theta_G \ln\left[\frac{B'}{1+R\left(B, z \mid \mathbb{S}\right)} - \left(B + c_j^{R,NC} + \sum_{\substack{i=1 \\ i \neq j}}^{N} \mathbb{C}_i^{R,NC}\left(B, z \mid \mathbb{S}\right) - \tau z L\right)\right]$$
$$+ \beta \left\{ \prod_{i=1}^{N} \mathbb{I}_i\left(B', (1+\gamma) z \mid \mathbb{S}\right) V^{C,j}\left(B', (1+\gamma) z \mid \mathbb{S}\right) \right.$$

$$+\left[1-\prod_{i=1}^{N}\mathbb{I}_i\left(B',(1+\gamma)z \mid \mathbb{S}\right)\right]V^{NC,j}\left(B',(1+\gamma)z \mid \mathbb{S}\right)\Bigg\}\Bigg\} \ . \tag{23}$$

where, $c_j^{R,NC}$ denotes non-cooperative rents shared among members of group j.

Definition 1 focuses on global cooperation among N rent-seeking groups, excluding cooperating subcoalitions. In the application of this paper we focus on a symmetric equilibrium of the case with $N = 2$, i.e., subcoalitions are ruled out.

Definition 1 *A Markov-Perfect-Cooperation-Decision Nash Equilibrium (MPCDNE) is a set of strategies,* $\mathbb{S} \equiv \left\{\left(\mathbb{C}_i^{R,NC}, \mathbb{I}_i\right)\right\}_{i=1}^{N}$ *of the form* $C_{i,t}^{R,NC} = \mathbb{C}_i^{R,NC}\left(B_t, z_t \mid \mathbb{S}\right)$ $\mathbb{I}_{i,t} = \mathbb{I}_i\left(B_t, z_t \mid \mathbb{S}\right)$ with

$$\mathbb{I}_i\left(B_t, z_t \mid \mathbb{S}\right) = \begin{cases} 1 \ , & \text{if } V^{C,j}\left(B, z \mid \mathbb{S}\right) \geq V^{NC,j}\left(B, z \mid \mathbb{S}\right) \text{ and } \prod\limits_{\substack{j=1 \\ j\neq i}}^{N}\mathbb{I}_j\left(B_t, z_t \mid \mathbb{S}\right) = 1 \\ 0 \ , & \text{if } V^{C,j}\left(B, z \mid \mathbb{S}\right) < V^{NC,j}\left(B, z \mid \mathbb{S}\right) \text{ and } \prod\limits_{\substack{j=1 \\ j\neq i}}^{N}\mathbb{I}_j\left(B_t, z_t \mid \mathbb{S}\right) = 1 \ , \\ & \text{or if } \prod\limits_{\substack{j=1 \\ j\neq i}}^{N}\mathbb{I}_j\left(B_t, z_t \mid \mathbb{S}\right) = 0 \end{cases}$$

and a set of policy decision rules $(\mathbb{T}, \mathbb{G}, \mathbb{B})$ *of the form,*

$$\tau_t = \mathbb{T}\left(B_t, z_t \mid \mathbb{S}\right) = \prod_{i=1}^{N}\mathbb{I}_i\left(B_t, z_t \mid \mathbb{S}\right)\mathbb{T}^C\left(B_t, z_t \mid \mathbb{S}\right) + \left[1-\prod_{i=1}^{N}\mathbb{I}_i\left(B_t, z_t \mid \mathbb{S}\right)\right]\mathbb{T}^{NC}\left(B_t, z_t \mid \mathbb{S}\right) \ ,$$

$$B_{t+1} = \mathbb{B}\left(B_t, z_t \mid \mathbb{S}\right) = \prod_{i=1}^{N}\mathbb{I}_i\left(B_t, z_t \mid \mathbb{S}\right)\mathbb{B}^C\left(B_t, z_t \mid \mathbb{S}\right) + \left[1-\prod_{i=1}^{N}\mathbb{I}_i\left(B_t, z_t \mid \mathbb{S}\right)\right]\mathbb{B}^{NC}\left(B_t, z_t \mid \mathbb{S}\right) \ ,$$

$$G_t = \mathbb{G}(B_t, z_t \mid \mathbb{S}) = \prod_{i=1}^{N} \mathbb{I}_i (B_t, z_t \mid \mathbb{S}) \, \mathbb{G}^C (B_t, z_t \mid \mathbb{S}) + \left[1 - \prod_{i=1}^{N} \mathbb{I}_i (B_t, z_t \mid \mathbb{S})\right] \mathbb{G}^{NC} (B_t, z_t \mid \mathbb{S}) \ ,$$

a bond-demand strategy of creditors, $B^*_{t+1} = \mathbb{B}^* (B_t, z_t \mid \mathbb{S})$*, such that* $\left(\mathbb{T}^{NC}, \mathbb{B}^{NC}, \mathbb{C}_j^{R,NC}, \mathbb{G}^{NC}\right)$ *guarantee that each and every rent seeking group* $j \in \{1, ..., N\}$ *solves the Bellman equation given by (23),* $\left(\mathbb{T}^{C}, \mathbb{B}^{C}, \mathbb{C}^{R,C}, \mathbb{G}^{C}\right)$ *solves the Bellman equation given by (22), creditors'* $\mathbb{B}^*$ *complies with equation (18), and with* $R(B_t, z_t \mid \mathbb{S}) = r_{t+1}$ *satisfying* $\mathbb{B}(B_t, z_t \mid \mathbb{S}) = \mathbb{B}^*(B_t, z_t \mid \mathbb{S})$*, for all* $t \in \{0, 1, ...\}$*.*

2.7 International Equilibrium Conditional Upon Cooperation Decisions

We study two international equilibria. A cooperation equilibrium with rent-seeking groups agreeing upon fiscal policy and sharing rents from the fiscal budget, and a non-cooperation equilibrium with rent-seeking groups fighting over fiscal rents and consequently over extract rents from that budget. The resulting fiscal policies (over debt, taxes and public goods) are very different in those two cases and so is the path of interest rates that clear the international debt market.

Cooperation. We examine the case in which $N \geq 2$ rent-seeking groups cooperate by forming a single government coalition comprised by all existing rent-seeking groups in the economy (universal coalition). Within this universal coalition, rent-seeking groups equally share a total amount of rents, $\bar{C}_t^R$, with each group member receiving $\bar{C}_t^R / \sum_{j=1}^{N} \omega_j = \bar{C}_t^R / N$ in each period.[19] We derive the supply of bonds decided by such a coalition and we equate it to the demand for bonds by external creditors in order to calculate international interest rates.

The Bellman equation of rent-seeking group $j \in \{1, ..., N\}$ under cooper-

[19] Notice that although rent-seeking groups may be heterogeneous in size ($\mu_i \neq \mu_j$ for some $i \neq j$), under cooperation each rent-seeking group member will end up consuming the same per-capita amount from the broad-coalition club good.

ation is given by,

$$V^{C,j}\left(B_t,z_t\right)=\max_{\left(\tau_t,\bar{C}_t^R,B_{t+1}\right)}\Bigg\{\theta_l\ln\left(1-L\right)+\ln\left(z_t\right)+\ln\left(1-\tau_t\right)$$

$$+\theta_G\ln\left[\frac{B_{t+1}}{1+R^C\left(B_t,z_t\right)}-\left(B_t+\bar{C}_t^R-\tau_tY_t\right)\right]+\theta_R\ln\left(\frac{\bar{C}_t^R}{N}\right)$$

$$+\beta V^{C,j}\left(B_{t+1},\left(1+\gamma\right)z_t\right)\Bigg\}\ , \quad (24)$$

in which the interest-rate rule, $r_{t+1}=R^C\left(B_t,z_t\right)$, is determined by equating supply and demand in the international market for bonds. Due to the symmetry of rent-seeking groups there is unanimity within the universal coalition. Definition 2, which is a special case of Definition 1, specifies international-market equilibrium under cooperation of rent-seeking groups.

Definition 2 *An International Equilibrium under Cooperation (IEC) is a set of strategies,* $\mathbb{C}^{R,C}$ *of the form* $\bar{C}_t^{R,C}=\mathbb{C}^{R,C}\left(B_t,z_t\right)$ *and a set of policy decision rules* $\left\{\mathbb{T}^C,\mathbb{G}^C,\mathbb{B}^C\right\}$ *of the form* $\tau_t=\mathbb{T}^C\left(B_t,z_t\right)$, $G_t=\mathbb{G}^C\left(B_t,z_t\right)$, *and* $B_{t+1}=\mathbb{B}^C\left(B_t,z_t\right)$, *a bond-demand strategy of creditors,* $B_{t+1}^*=\mathbb{B}^*\left(B_t,z_t\right)$, *and an interest-rate rule,* $R^C\left(B_t,z_t\right)$, *such that* $\left\{\mathbb{T}^C,\mathbb{B}^C,\mathbb{C}^{R,C},\mathbb{G}^C\right\}$ *guarantee that each and every rent seeking group* $j\in\{1,...,N\}$ *maximizes (24), subject to rule* $R^C\left(B_t,z_t\right)$, *creditors'* $\mathbb{B}^*$ *complies with equation (18), and with* $R^C\left(B_t,z_t\right)=r_{t+1}$ *satisfying* $\mathbb{B}^C\left(B_t,z_t\right)=\mathbb{B}^*\left(B_t,z_t\right)$, *for all* $t\in\{0,1,...\}$.

Proposition 1 characterizes the rent-seeking political equilibrium under cooperation among rent-seeking groups (IEC).

Proposition 1 *Assuming that all debtor countries follow an IEC path, for all* $t\in\{0,1,...\}$, *the IEC interest rates are constant, given by,*

$$R^C\left(B_t,z_t\right)=r^{ss}=\frac{1+\gamma}{\beta}-1\ ,\quad t=0,1,...\ , \qquad (25)$$

the debt-GDP ratio remains constant over time,

$$\frac{\mathbb{B}^C(B_t, z_t)}{Y_t} = \frac{B_t}{Y_t} \equiv b_t^C = b_0 \equiv \frac{B_0}{Y_0}, \quad t = 0, 1, \dots, \tag{26}$$

the public-consumption-to-GDP ratio, the rents-to-GDP ratio, and the tax rate, all remain constant over time, with,

$$\frac{\mathbb{G}^C(B_t, z_t)}{Y_t} \equiv g_t^C = \bar{g}^C = \frac{(1-\beta)\,\theta_G}{1+\theta_G+\theta_R}\left[\underbrace{\frac{1}{1-\beta}}_{\text{Economy's worth/GDP}} - \underbrace{b_0}_{\text{Fiscal debt/GDP}}\right], \quad t = 0, 1, \dots, \tag{27}$$

$$\frac{\mathbb{C}^{R,C}(B_t, z_t)}{Y_t} = \frac{\theta_R}{\theta_G}\bar{g}^C, \quad \text{and} \quad \mathbb{T}^C(B_t, z_t) = \tau_t^C = \bar{\tau}^C = 1 - \frac{1}{\theta_G}\bar{g}^C, \quad t = 0, 1, \dots. \tag{28}$$

Proof See Appendix B. □

Non-cooperation. In the case of no cooperation the Bellman equation of rent-seeking group $j \in \{1, \dots, N\}$ is given by,

$$V^{NC,j}\left(B_t, z_t \mid \left\{\mathbb{C}_i^{R,NC}\right\}_{\substack{i=1\\i\neq j}}^{N}\right) = \max_{\left(\tau_t, C_{j,t}^R, B_{t+1}\right)}\Bigg\{\theta_l \ln(1-L) + \ln(z_t) + \ln(1-\tau_t)$$

$$+\theta_G \ln\left[\frac{B_{t+1}}{1+R^{NC}(B_t, z_t)} - \left(B_t + \omega_j C_{j,t}^R + \sum_{\substack{i=1\\i\neq j}}^{N}\omega_i \mathbb{C}_i^{R,NC}(B_t, z_t) - \tau_t Y_t\right)\right]$$

$$+\theta_R \ln\left(C_{j,t}^R\right) + \beta V^{NC,j}\left(B_{t+1}, (1+\gamma) z_t \mid \left\{\mathbb{C}_i^{R,NC}\right\}_{\substack{i=1\\i\neq j}}^{N}\right)\Bigg\} \tag{29}$$

in which $r_{t+1} = R^{NC}(B_t, z_t)$ is the interest-rate rule. Definition 3 specifies international-market equilibrium under noncooperation of rent-seeking groups.

Definition 3 *An International Equilibrium under No Cooperation (IENC) is a set of strategies,* $\left\{\mathbb{C}_i^{R,NC}\right\}_{i=1}^{N}$ *of the form* $C_{i,t}^{R,NC} = \mathbb{C}_i^{R,NC}(B_t, z_t)$ *and a set of policy decision rules* $\left\{\mathbb{T}^{NC}, \mathbb{G}^{NC}, \mathbb{B}^{NC}\right\}$ *of the form* $\tau_t = \mathbb{T}^{NC}(B_t, z_t)$, $G_t = \mathbb{G}^{NC}(B_t, z_t)$, *and* $B_{t+1} = \mathbb{B}^{NC}(B_t, z_t)$, *a bond-demand strategy of creditors,* $B_{t+1}^{*} = \mathbb{B}^{*}(B_t, z_t)$, *and an interest-rate rule,* $R^{NC}(B_t, z_t)$, *such that* $\left\{\mathbb{T}^{NC}, \mathbb{B}^{NC}, \mathbb{C}^{R,NC}, \mathbb{G}^{NC}\right\}$ *guarantee that each and every rent seeking group* $j \in \{1, ..., N\}$ *maximizes (29), subject to rule* $R^{NC}(B_t, z_t)$ *and subject to strategies of other rent-seeking groups* $\left\{\mathbb{C}_i^{R,NC}\right\}_{\substack{i=1 \\ i\neq j}}^{N}$, *creditors'* $\mathbb{B}^{*}$ *complies with equation (18), and with* $R^{NC}(B_t, z_t) = r_{t+1}$ *satisfying* $\mathbb{B}^{NC}(B_t, z_t) = \mathbb{B}^{*}(B_t, z_t)$, *for all* $t \in \{0, 1, ...\}$.

Proposition 2 conveys a crucial feature of our model.

Proposition 2 *If* $N \geq 2$, *there is no IENC equilibrium with* $B_0 > 0$, *the only possibility for IENC existence is financial autarky, i.e.,*$B_0 = 0$. *If,* $N \geq 2$, *and* $B_0 > 0$, *are the initial conditions, then the only possible IENC as a market outcome, is immediate exclusion from international credit markets without the opportunity to return if debt renegotiation is not allowed.*

Proof See Appendix B. □

Proposition 2 says that financial autarky is the only Markov equilibrium without cooperation. While the proof of Proposition 2 is extensive, the key behind this result is an endogenous impatience mechanism that we explain in detail below. Specifically, the endogenous discount factor β_N, specified by equation (21) above, which implies $\partial\beta_N/\partial N < 0$, causes a mismatch in the market-clearing equation of external debt. External creditors foresee that multiple rent-seeking groups have the tendency to issue debt excessively in all periods. So, external creditors understand that the domestic economy will be unable to repay the debt asymptotically and demand a sequence of high interest rates that oblige the domestic economy to provide its total worth to creditors asymptotically. So, if debt renegotiation is not allowed, the domestic economy is excluded from international credit markets.

2.8 Inspecting the tragedy of the commons mechanism

2.8.1 The ability to repay debt and incentives for fiscal prudence

Equations (19)-(20) convey the fiscal-burden mechanism which is a key incentive for fiscal prudence in this model. Next period's optimal debt-GDP ratio decreases if future interest rates are foreseen to increase. Since $\partial \mathbb{W}\left(\{r_s\}_{s=t+1}^{\infty}\right)/\partial r_s < 0$ for all $s \geq t+1$, equation (19) implies that next period's debt-GDP ratio falls, because of the foreseen increase in rolling over debt issued in the future. This increase in interest rates imposes a debt-servicing burden that reduces the ability to repay.

2.8.2 Postponed fiscal prudence: fiscal impatience due to a commons problem

Policy setting by multiple noncooperating rent-seeking groups has a profound effect on postponing fiscal prudence. Since $\mathbb{W}\left(\{r_s\}_{s=t+1}^{\infty}\right)$ is multiplied by the factor $(1-\beta_N)$,in equation (19) and $\partial(1-\beta_N)/\partial N > 0$ (see equation (21)), an increase in the number of rent-seeking groups strengthens the fiscal-prudence-postponement characteristic. Postponement of fiscal prudence stems from two opposing forces. On the one hand, rent-seeking groups want to conserve the fiscal budget, in order to be able to extract more in the future. So, they exhibit fiscal prudence by having the optimal next period's debt-GDP ratio strategy depending positively on the term $\mathbb{W}\left(\{r_s\}_{s=t+1}^{\infty}\right)$. On the other hand, as the number of rent-seeking groups increases, fiscal debt is issued excessively today, a commons problem.

This commons problem is revealed by Proposition 1.B in Appendix B. For exogenous interest rates, $\{r_s\}_{s=t+1}^{\infty}$, with $\bar{C}_{j,t}^{R} = \mathbb{C}_i^R\left(B_t, z_t \mid \{r_s\}_{s=t+1}^{\infty}\right)$ being the per-capita level of club consumption by a member of rent-seeking group j, $\omega_j C_{j,t}^R$ is the total rents extracted by group j. So, aggregate economy-wide rents are,

$$\sum_{i=1}^{N}\omega_i \mathbb{C}_i^R\left(B_t, z_t \mid \{r_s\}_{s=t+1}^{\infty}\right) =$$

$$= \underbrace{\frac{N\cdot(1-\beta)\,\theta_R}{1+\theta_G+\theta_R+(N-1)(1-\beta)\,\theta_R}}_{\Phi(N)} \cdot \underbrace{\left[z_t \mathbb{W}\left(\{r_s\}_{s=t+1}^{\infty}\right) - B_t\right]}_{\text{Economy's net worth}}. \qquad (30)$$

The fraction of economy's net worth expropriated by all rent-seeking groups is increasing in the number of (symmetric) groups ($\Phi'(N) > 0$ in equation (30)). Aggregate rents increase in the number of rent-seeking groups because each noncooperating rent-seeking group expropriates additional rents before being crowded out by other groups. This effect, driven by $\Phi'(N) > 0$, leads to collective fiscal impatience across rent-seeking groups that do not cooperate, describing a classic commons problem, in a similar fashion to problems of resource conservation. This commons problem dominates, and leads to fiscal-prudence postponement.

3 The threshold debt-GDP ratio fostering cooperation and implications for sovereign rescue deals

The preceding analysis suggests that a positive debt level can be supported by an international equilibrium when rent-seeking groups cooperate forever. In this section we take the mechanics and intuition of the model and examine a bond renegotiation scheme that both creditors and rent-seeking groups may be willing to accept. According to that scheme, creditors are willing to offer a debt reduction in exchange for cooperation among rent seeking groups, leading to fiscal discipline. Our focus is inspired by the rescue packages received by Greece at the early stages of the sovereign crisis, emphasizing the goal to avoid a disorderly default, because of fears of "domino effects" and possible runs on financial institutions and governments of other troubled countries, such as Portugal and Spain.

In a monetary union the ability of each member state to issue and repay external fiscal debt is crucial for the sustainability of a banking system in which foreign banks may play the role of external creditors (EU banks are major buyers of sovereign debt issued by other EU countries).[20] While we do not model banks explicitly, we stress that an international agreement about either, (a) entrance into a monetary union, or (b) a rescue package for debt rollover of a member state, should guarantee that rent-seeking groups which tend to act separately, have incentives to cooperate forever. Here we focus on (b), a rescue package which aims at a particular agreement: that rent-

[20] Our formulation of external creditors reflects that banks maximize the utility of foreign bank-equity holders.

seeking groups will commit to a non-default and that they will be cooperating forever, sharing their rents.

Our analysis below can be executed for any $N \geq 2$. We set $N = 2$ by convention throughout the rest of this section, focusing on Greece, in which rent-seeking groups have been traditionally tied with two major political parties, the "center left-wing" versus "center right-wing". In addition, without loss of generality, we assume symmetry among groups, i.e., the two groups are of size.

3.1 Two rent-seeking groups and Markov-perfect-Nash-equilibrium selection

Even in the one-stage, normal-form game of cooperation decisions, presented by Table 1 in the Introduction, there are multiple Nash equilibria. If cooperation is less rewarding for both players ($V_i^C < V_i^{NC}$, $i \in \{1, 2\}$), then a cooperation outcome is impossible. The only way to make a cooperation outcome possible is to ensure that cooperation is more rewarding for both players ($V_i^C > V_i^{NC}$, $i \in \{1, 2\}$). A dynamic game with an infinite horizon and a free option to cooperate (or not) in each period can have multiple equilibria as well. In order to obtain clearer results whenever $V_i^C > V_i^{NC}$, $i \in \{1, 2\}$, we propose an equilibrium-selection assumption, which we call a "willingness refinement". In our model, $V_i^C > V_i^{NC}$, $i \in \{1, 2\}$, hinges on the debt-GDP ratio.

3.2 The willingness refinement mirroring international commitments within a monetary union

Following Lagunoff (2009), we restrict our attention to a self-selected dynamic politicoeconomic mechanism of cooperation as explained by Definition 1. In Definition 1 the implicit assumption is that whenever $V_i^C \geq V_i^{NC}$, $i \in \{1, 2\}$, then group i always chooses to cooperate. We impose this equilibrium selection since a monetary union implies powerful institutional commitments which we do not wish to model explicitly in this paper. Other member states, which are not explicitly modeled here, would dislike fiscal imbalances and would be inclined to punish countries that default due to lack of cooperation among rent-seeking groups. Yet, other member states respect the unwillingness of a polity to comply with a cooperative equilibrium, as long as this unwillingness is driven by fundamentals (even if this polity is dominated by rent-seeking groups).

For example, in the context of the Eurozone, a member state can exit the common currency after a mandate based on a referendum. For example, a left-wing Greek government, elected on January 2015, called such a referendum on June 26 2015, after a breakdown of negotiations on a new bailout deal with European partners. We believe that this rule, of allowing exit through a referendum, captures the idea that, in Definition 1, $V_i^C < V_i^{NC}$ for some $i \in \{1,2\}$, implies no cooperation (respecting unwillingness to cooperate), whereas $V_i^C \geq V_i^{NC}$, $i \in \{1,2\}$, always implies cooperation (respecting Euro-area obligations based on utility-based willingness to cooperate, which may be democratically expressed through a referendum). Finally, another refinement of having mutiple equilibria in the case of $V_i^C \geq V_i^{NC}$, $i \in \{1,2\}$, would be to assume i.i.d. randomizations, e.g. π times cooperation and $1-\pi$ times noncooperation. Such an analysis would still indicate a cutoff debt-GDP ratio level as a function of π.[21]

Table 1 illustrates that the strategies according to which two rent-seeking groups either, (i) cooperate forever, or (ii) never cooperate and default, in which case they keep not cooperating forever under a balanced fiscal budget, are both Markov-perfect cooperation-decision Nash equilibria.[22] As we explain in section 3.3. below, a default in our model should be interpreted as a political accident, that leads to the "accidental" default outcome and does not relate to the concept of strategic default used in the classic sovereign debt literature. We believe, this interpretation is more appropriate for countries that are members of a monetary union, in which countries commit to behave in a manner that does not threaten the financial stability of the union.

Let's start examining case (ii) above, i.e., default with no cooperation before and afterwards. Moving one period ahead after the full default, debt remains 0 forever (see Proposition 2), and the game is not a dynamic game anymore, but similar to the normal-form game of cooperation decisions, with the sole difference that GDP grows exogenously and sums of discounted util-

[21]We think that such a formulation would be ideal for studying an extension to our model without a currency peg to the currency of external creditors (implied or forced by participation to a monetary union). This extension could provide a tool for predicting long-term exchange-rate trends based on country corruption indicators and outstanding debt-GDP ratios.

[22]A formal proof of this claim, that strategies (i) and (ii) are both Markov-perfect cooperation-decision equilibriums, appears in the proof of Proposition 1 in Appendix B.

ities over an infinite horizon are computed. After some algebra, we find that

$$V^{C,j}\left(B_t=0,z_t\right)>V^{NC,j}\left(B_t=0,z_t \mid \left\{\mathbb{C}_i^{R,NC}\right\}_{\substack{i=1\\ i\neq j}}^{2}\right)\Leftrightarrow 1+\alpha>2^{\alpha}\ , \quad (31)$$

$j\in\{1,2\}$ in which,

$$\alpha\equiv\frac{\theta_R}{1+\theta_G+\theta_R}\ . \quad (32)$$

By its definition, $\alpha\in(0,1)$, and it is straightforward to verify that $1+\alpha>2^{\alpha}$ is a true statement for all $\alpha\in(0,1)$. So, $V^{C,j}(0,z_t)>V^{NC,j}(0,z_t)$ for $j\in\{1,2\}$ and all $t\in\{1,2,...\}$. As we have noticed above for the normal-form game, whenever cooperation is more rewarding for both players, there are two Nash equilibria, (C,C) and (NC,NC). So, by the unimprovability principle (cf. Kreps 1990, pp. 812-813), the strategies described by (ii) above, no cooperation in period 0, immediate default and no cooperation thereafter forever, is a Markov-perfect Nash equilibrium.

Having established that no cooperation and default is a Markov-perfect Nash equilibrium, allows us to study a sovereign-debt rescue initiative in a monetary union more formally. In the spirit of the willingness refinement discussed above, other member states may consider no cooperation among rent-seeking groups and sovereign default as being the worst possible outcome in a period of banking fragility. The reason is that default by a sovereign state may be a big shock for banks holding external debt, both due to direct balance sheet losses and, perhaps more importantly, contagion effects within the union. Moreover, convincing rent-seeking groups to follow a strategy of cooperation forever, in order to avoid the problems of fiscal impatience and fiscal profligacy is the most desirable outcome from the perspective of the union's sustainability. Proposition 3 establishes that this cooperation equilibrium is a Markov-perfect Nash equilibrium, and it identifies debt-to-GDP ratios that make its adoption and enforceability desirable by two rent-seeking groups.

Proposition 3 *If $N=2$, then the strategies according to which the two rent-seeking groups cooperate forever is a Markov-perfect cooperation-decision Nash equilibrium, which holds if,*

$$V^{C,j}\left(B_t,z_t\right)\geq V^{NC,j}\left(B_t=0,z_t \mid \left\{\mathbb{C}_i^{R,NC}\right\}_{\substack{i=1\\ i\neq j}}^{2}\right)\Leftrightarrow b_t\leq\frac{1}{1-\beta}\left(1-\frac{2^{\alpha}}{1+\alpha}\right)\equiv\underline{b}\ , \quad (33)$$

for all $t \in \{0, 1, ...\}$, in which α is given by (32).

Proof See Appendix B. □

In Proposition 3 notice the converse of (33): if the debt-GDP ratio is higher than a threshold level, $\underline{b}$, then rent-seeking groups have higher utility by defaulting and not cooperating ever after. This is reasonable, because paying back the debt and cooperating entails a tradeoff: on the one hand, rent-seeking groups can divide the coalition rents by two, which leads to rewards in each period, as (31) reveals; on the other hand, they have to bear the cost of servicing the debt. The higher the debt-GDP ratio the lower the cooperation benefits, so default strikes as a better option.

3.3 Model insights and extensions

Our model is deterministic and this simplifying aspect contributes to obtaining analytical results. A way to interpret our model's contribution is depicted by Figure 2. Figure 2 shows that the threshold debt-GDP ratio, $\underline{b}$, splits the space of initial conditions into two zones, a white one of cooperation and no default, and a black one, of noncooperation and *accidental* default (which is perhaps not far from the "Graccident" concept). The key simplifying assumption is that no shock is anticipated by creditors or any rent-seeking group. So, in a deterministic world, if initial conditions are in the white area of Figure 2, it is anticipated that $b_t = b_0$ for all t. However, an accidental default can occur if there is an unexpected shock (similar in spirit to the example employed by Kiyotaki and Moore (1997, p. 224)) to initial conditions, e.g. an unexpected jump in GDP, Y_0, which automatically makes $b_0 = B_0/Y_0$ to jump upwards.

In our model, default is a Nash-equilibrium in a deterministic framework after an unexpected shock, in the sense that the possibility of such a shock is not internalized by the creditors. For this reason, we do not include a default option in the action space of rent-seeking groups in the spirit of D'Erasmo and Mendoza (2015) in which a single player in a government may choose default strategically. Apparently this is a simplifying assumption that offers, however, useful insights for future extensions of our model. Such extensions would be accommodated in our recursive framework, by incorporating anticipated shocks and would also require to include default in the strategy space of rent-seeking groups. In that case, however, corner solutions and mixed-strategy equilibria would not allow for analytical results and would require solving through numerical approaches. Our conjecture is that stochastic versions of our model would give “grey zones” of default, as depicted in Figure 2. Specifically, such grey zones would correspond to confidence intervals of default riskiness, since all variables are random in a stochastic model. We believe that this is an exciting agenda for future research, especially if it is extended beyond rational expectations, to learning about disaster risk, as in Koulovatianos and Wieland (2011).

3.4 Rescue packages and sovereign-debt restructurings

Monitoring the ability of a government to satisfy the conditions of a rescue package involves preventing and eliminating excessive rent seeking by groups that influence policymaking. This focus on controlling the behavior of partisan corruption is evident in IMF-report excerpts outlined in Appendix A. EU rescue packages imply monitoring of the domestic economy's rent-seeking groups by other member states of the monetary union. However, as illustrated by Proposition 3, it is reasonable to try to make the rescue deal palatable to the rent-seeking groups in order to achieve political sustainability and robustness of the rescue-package deal. So, if b_t is larger than the threshold given by (33), $\underline{b} = [1 - 2^{\alpha}/\,(1+\alpha)]\,/\,(1-\beta)$, then the rescue-package deal may involve a sovereign-debt haircut of magnitude $100 \cdot (b_t - \underline{b})$ percentage points of the domestic economy's GDP.

Another crucial aspect of rescue-package effectiveness, is the welfare change for the general public (non rent seekers). In our model, political outcomes, $(G_t,\ \tau_t,\ B_{t+1})$, are determined solely by the Nash-equilibrium decisions of rent-seeking groups. Even after a default that eliminates the burden of servicing the fiscal debt, non-rent-seekers prefer that rent-seeking groups cooperate. This happens because noncooperation implies higher total rents extracted in the form of higher τ, and welfare reduction through lower $g \equiv G/Y$. Proposition 4 shows that gains from cooperation are substantial for non-rent-seekers. Specifically, even if $b_t > \underline{b}$, and an exogenous international agreement forces rent-seeking groups to cooperate without a haircut that reduces b_t to $\underline{b}$, then non-rent-seekers would benefit even if they had to service the high debt $b_t > \underline{b}$ thereafter.

Proposition 4 *There exists a cutoff debt-GDP ratio,*

$$\bar{b} = \frac{1}{1-\beta}\frac{\alpha}{1+\alpha} \ , \tag{34}$$

in which α *is given by (32), with* $\bar{b} > \underline{b}$*, such that, if* $g_{\hat{b}}^{C}$ *corresponds to cooperation among rent-seeking groups together with servicing* $\hat{b}$ *forever, and if* g_{default}^{NC} *corresponds to full default and noncooperation forever, then,*

$$(i) \quad \hat{b} \ \in \ \left(\underline{b}, \bar{b}\right) \Rightarrow g_{\hat{b}}^{C} > g_{\text{default}}^{NC} \ , \tag{35}$$

$$(ii) \quad \hat{b} \ > \ \bar{b} \Rightarrow g_{\hat{b}}^{C} < g_{\text{default}}^{NC} \ . \tag{36}$$

Proof See Appendix B. □

Proposition 4 states that attempts to convince rent-seeking groups to cooperate (see the relevant IMF-report excerpts in Appendix A) would be welcomed by the general non-rent-seeking public if the debt-GDP ratio is not too high. Non-rent-seeking households dislike excessive corruption that leads to fiscal profligacy, unless the outstanding debt GDP ratios is exceptionally high.

3.5 Calibration

Our goal in this section is to quantify the threshold debt-GDP ratio $\underline{b}$, that fosters cooperation. Our calibration focuses on matching data from the EU periphery countries, since they have been at the center of the EU crisis. First, we match the average total-government-to-GDP spending which is approximately 45%.[23] Second, we need to find the target value for the total-rents-GDP ratio at the threshold debt-GDP ratio $\underline{b}$ (denoted by $\underline{C}_R$). To do this we use estimates regarding the size of the shadow economy as a share of GDP reported by Elgin and Oztunali (2012). We make a simple projection of these shadow-economy estimates, assuming that these shares are uniform across the private and the public sector. In other words, the share of rents in total government spending match the size of the shadow economy as a share of GDP.

[23] Data for G/Y are from the European Central Bank (ECB), Statistical data Warehouse, Government Finance data (Revenue, Expenditure and deficit/surplus), September 2013. We take the average over the period 1995 to 2012.

$C^{R,C}$ as % of government spending	threshold debt-GDP ratio $\underline{b}$
28% (EU periphery)	137%

Table 2

In Table 2 we report the threshold debt-GDP ratio, $\underline{b}$, corresponding to the 28% rents-to-total-government spending ratio which is the average shadow economy share in EU-periphery countries.[24]The assumed rate of time preference, $(1-\beta)/\beta$, is 2.4%. The 137% cutoff level $\underline{b}$ provides higher utility to rent-seekers if they cooperate, compared to defaulting. Interestingly, a 137% debt-GDP ratio is in the ballpark of targets of the "private sector involvement (PSI)" haircut for Greece in the period 2011-2012.[25]A key factor shaping the target debt-GDP ratio of Greece during the PSI negotiations was the political sustainability of fiscal prudence. According to the model prudence could be achieved by a coalition government, at least by the two major political parties that used to alternate in power during the previous four decades, and in fact a broad based coalition government followed the PSI.

Figure 3 depicts a sensitivity analysis of our benchmark calibration. It shows the relationship between the rate of time preference, $\rho = (1-\beta)/\beta$ and the cutoff level $\underline{b}$. We emphasize that varying ρ means simultaneously changing the rate of time preference of both creditors and of all agents in the domestic economy. As Proposition 1 indicates, under cooperation, international interest rates remain constant, tracking closely the rate of time preference, ρ. Thus, a higher ρ implies higher cost of servicing outstanding debt, decreasing the tolerance to cooperation versus default. This is evident by Figure 3: at levels of ρ above 4%, the threshold debt-GDP ratio for cooperation versus default falls below 80%. On the contrary, more patient creditors and domestic agents (low ρ), increases the cooperation range, raising $\underline{b}$ above 160% of GDP for ρ less than 2%.

Figure 3 provides insights regarding the agreed interest rates of servicing debt under EU rescue packages (Ireland, Greece, Portugal). Since rescue

[24]So, the rents-GDP ratio is $28\% \times 45\% = 12.6\%$ in this calibration. In Appendix B we explain how calibration is achieved in this model. Specifically, we prove that calibrating θ_R and θ_G in order to match target values for the government-consumption-GDP ratio and the total-rents-GDP ratio is independent from the values of β at the cutoff level $\underline{b}$.

[25]For an extensive review of the Greek sovereign crisis and an outline of PSI see Ardagna and Caselli (2014). For a study reporting the average haircut values between years 1970-2010, see Cruces and Trebesch (2012).

packages involve long-term effective interest rates, lowering the cost of debt servicing may provide more political support in countries with corruption, by creating more incentives for rent-seeking groups to cooperate on fiscal prudence. The Greek PSI program, which involved both a reduction in interest rates and a haircut (see Ardagna and Caselli , 2014), has been followed by political consensus for at least some time (until the elections of January 2015), providing a good example of this insight. However, it appears that the effective debt reduction achieved by the PSI was not enough to break the non-cooperation culture in Greek politics and support a strong commitment to fiscal prudence. The fiscal position begun to deteriorate in the summer of 2014 after it became apparent that an election will be taking place in early 2015 and efforts to enforce the consolidation program were abandoned. The January 2015 election was won by a populist anti-austerity left wing party ("Syriza"). Negotiations for a new rescue deal commenced. The new government begun resisting and in cases reversing earlier fiscal commitments, thus regressing on fiscal prudence, while bargaining over the terms of fiscal discipline in the new deal and insisting on additional debt reduction from EU partners. Negotiations have stalled several times and a referendum was called to take place in June 26 2015, asking the public to vote yes/no to a financial deal offered by EU partners. Greece, around the June/July 2015 flirted with the "Graccident", after it became obvious that no financial assistance (with a promise for future debt reduction) would be extended by EU partners unless the deal on financial assistance was agreed and voted in favour by all political parties of the Greek parliament.

4 Conclusion

The EU sovereign debt crisis has painfully reminded that sustainability of debt-to-GDP ratios is of first order importance for the stability and future course of the monetary union. Rescue packages were introduced for EU periphery countries. One crucial element and a challenge behind these packages, stressed by official creditors, is the need for cooperation of political parties, in order to achieve fiscal prudence. But EU periphery politics are plagued with rent-seeking activities that overstretch fiscal budgets.

Our model studied the politics of coalition-making among rent-seeking groups, providing a key insight. Reaching a high level of external sovereign debt-GDP ratio takes an economy beyond the perils of mere economic accounting. Beyond some debt-GDP ratio threshold which depends on the influence of rent-seeking groups in policymaking, political resistance to cooperation among rent seekers and parties on prudent policies arises. International markets respond by charging high interest rates, worsening the debt dynamics and making default immediately preferable (and unavoidable) by rent seekers. Rent seekers do not want to service a high outstanding debt, yet their noncooperation triggers the vicious circle of rapidly worsening terms of borrowing. For economies which are prone to corruption and rent-seeking phenomena, the risk of political turmoil makes the requirement of staying within a safety zone of low debt-GDP ratio tighter.

Our framework has accommodated a number of modeling elements with explicit dynamic policy setting: debt, public consumption, tax rates, and importantly, the free decision of rent-seeking groups to cooperate or not, are all determined recursively, and as functions of outstanding sovereign debt. These modeling features help us to understand what determines cutoff debt-GDP ratios which lead to political turmoil and default. The mechanism triggering the vicious circle of default is a commons problem that leads to a discrepancy between the rate of time preference of creditors and the collective rate of time preference of governments that have multiple noncooperating rent-seeking groups. While commons problems are difficult to resolve, our model points at the importance of keeping debt-GDP ratios low. The role of debt-GDP ratios should prevail in future extensions of our model (e.g., with uncertainty and productive capital) which should be easy to accommodate, given the recursive structure of the dynamic game we have suggested. Such extensions would contribute to a project of developing sovereign-default-risk indicators for countries as a function of their corruption fundamentals and debt-GDP ratios. These indicators can arguably be a valuable core input for public institutions (IMF, World Bank, Eurogroup) and private institutions that interact in sovereign debt markets.

Our model suggests that rescue packages may use short-term tools, such as debt haircuts, or provision of low interest rates in order to convince rent-seeking groups to cooperate and to service a debt that costs less. Yet, the long-term goal of rescue packages should be to promote monitoring on reforms that are likely to eradicate rent-seeking groups.

5 Appendix B – Proofs and formal definitions

5.1 Definitions and proofs of Section 2.4

As explained in the text, fiscal policy is set (τ_t, G_t, B_{t+1}) residually by rent-seeking groups that co-determine $C^R_{j,t}$ for all $j \in \{1, ..., N\}$. In this section, $\left\{C^R_{j,t}\right\}_{j=1}^N$ is determined noncooperatively, with each group maximizing the group's utility, subject to the rent-seeking behavior of other rent-seeking groups (we will introduce the possibility of cooperation in a later section). We focus on time-consistent (Markovian) policies and rent-extraction strategies. For an exogenous stream of international-market interest rates, $\{r_s\}_{s=t+1}^\infty$, the Bellman equation of rent-seeking group $j \in \{1, ..., N\}$ is given by,

$$\hat{V}^j\left(B_t, z_t \mid \{\mathbb{C}^R_i\}_{\substack{i=1\\i\neq j}}^N, \{r_s\}_{s=t+1}^\infty\right) = \max_{\left(\tau_t, C^R_{j,t}, B_{t+1}\right)} \Bigg\{ \theta_l \ln(1-L) + \ln(z_t) + \ln(1-\tau_t)$$
$$+\theta_G \ln\left[\frac{B_{t+1}}{1+r_{t+1}} - \left(B_t + \omega_j C^R_{j,t} + \sum_{\substack{i=1\\i\neq j}}^N \omega_i \mathbb{C}^R_i\left(B_t, z_t \mid \{r_s\}_{s=t+1}^\infty\right) - \tau_t Y_t\right)\right]$$
$$+\theta_R \ln\left(C^R_{j,t}\right) + \beta \hat{V}^j\left(B_{t+1}, (1+\gamma) z_t \mid \{\mathbb{C}^R_i\}_{\substack{i=1\\i\neq j}}^N, \{r_s\}_{s=t+2}^\infty\right)\Bigg\}, \tag{37}$$

in which $\mathbb{C}^R_i\left(B_t, z_t \mid \{r_s\}_{s=t+1}^\infty\right)$ is the Markov-Perfect rent-extraction strategy of rent-seeking group $i \in \{1, ..., N\}$.

Definition B.1 *Given a stream of interest rates, $\{r_s\}_{s=t+1}^\infty$, a (Markov-Perfect) Domestic Equilibrium under No Cooperation (DENC) is a set of strategies, $\left\{\mathbb{C}^{i,R}\right\}_{i=1}^N$ of the form $C^R_{i,t} = \mathbb{C}^R_i\left(B_t, z_t \mid \{r_s\}_{s=t+1}^\infty\right)$ and a set of policy decision rules $\{\mathbb{T}, \mathbb{B}\}$ of the form $\tau_t = \mathbb{T}\left(B_t, z_t \mid \{r_s\}_{s=t+1}^\infty\right)$ and $B_{t+1} = \mathbb{B}\left(B_t, z_t \mid \{r_s\}_{s=t+1}^\infty\right)$, such that each and every rent seeking group $j \in \{1, ..., N\}$ maximizes (37) subject to $\{\mathbb{T}, \mathbb{B}\}$, and $\left\{\mathbb{C}^R_i\right\}_{i\neq j}$.*

Proposition B.1 *For all $t \in \{0, 1, ...\}$, given a stream of interest rates, $\{r_s\}_{s=t+1}^\infty$, there exists a symmetric DENC given* *by,*

$$\frac{G_t}{Y_t} = \frac{(1-\beta)\,\theta_G}{1+\theta_G+\theta_R+(N-1)(1-\beta)\,\theta_R}\left[\underbrace{\frac{z_t\mathbb{W}\left(\{r_s\}_{s=t+1}^{\infty}\right)}{Y_t}}_{\text{Economy's worth/GDP}} - \underbrace{\frac{B_t}{Y_t}}_{\text{Fiscal debt/GDP}}\right] , \tag{38}$$

while

$$\tau_t = \mathbb{T}\left(B_t, z_t \mid \{r_s\}_{s=t+1}^{\infty}\right) = 1 - \frac{1}{\theta_G}\frac{G_t}{Y_t} , \tag{39}$$

$$\begin{aligned}\mathbb{C}_i^R\left(B_t, z_t \mid \{r_s\}_{s=t+1}^{\infty}\right) &= \frac{1}{\omega_i}\mathbb{C}^R\left(B_t, z_t \mid \{r_s\}_{s=t+1}^{\infty}\right) = \\ &= \frac{1}{\omega_i}\cdot\frac{(1-\beta)\,\theta_R}{1+\theta_G+\theta_R+(N-1)(1-\beta)\,\theta_R}\cdot\underbrace{\left[z_t\mathbb{W}\left(\{r_s\}_{s=t+1}^{\infty}\right)-B_t\right]}_{\text{Economy's net worth}} ,\end{aligned} \tag{40}$$

for all $i \in \{1, ..., N\}$, *while,*

$$\begin{aligned}\frac{B_{t+1}}{Y_{t+1}} &= \frac{\mathbb{B}\left(B_t, z_t \mid \{r_s\}_{s=t+1}^{\infty}\right)}{Y_{t+1}} = \\ &= \frac{1+r_{t+1}}{1+\gamma}\left[\beta_N\frac{B_t}{Y_t} + (1-\beta_N)\frac{z_t\mathbb{W}\left(\{r_s\}_{s=t+1}^{\infty}\right)}{Y_t} - 1\right] .\end{aligned} \tag{41}$$

Proof The first-order conditions of the Bellman-equation problem given by (37) lead to,

$$G_t = \theta_G \cdot (1-\tau_t)\cdot z_t \cdot L , \tag{42}$$

$$C_{j,t}^R = \frac{\theta_R}{\theta_G\cdot\omega_j}G_t = \frac{\theta_R}{\omega_j}\cdot(1-\tau_t)\cdot z_t\cdot L , \tag{43}$$

and

$$\frac{\theta_R}{\omega_j\,(1+r_{t+1})\,C_{j,t}^R} = -\beta\frac{\partial\hat{V}^j\left(B_{t+1}, z_{t+1} \mid \left\{\mathbb{C}_i^R\right\}_{\substack{i=1\\i\neq j}}^{N}, \{r_s\}_{s=t+2}^{\infty}\right)}{\partial B_{t+1}} , \tag{44}$$

together with the fiscal-budget constraint (11).

In order to identify the value function of the Bellman equation given by (37), its associated rent-seeking strategies, and the model's decision rules, we make two guesses. We first take a guess on the functional form of the rent-seeking group consumption strategies, $C_{i,t}^{R} = \mathbb{C}^{R,i}\left(B_t, z_t \mid \{r_s\}_{s=t+1}^{\infty}\right)$. Specifically,

$$\mathbb{C}_i^R\left(B_t, z_t \mid \{r_s\}_{s=t+1}^{\infty}\right) = \xi_{R,i} \cdot \left(z_t W_{t+1} - B_t\right) \ \text{, for all } i \in \{1, ..., N\} \ , \quad (45)$$

in which $\xi_{R,i}$ is an undetermined coefficient, and,

$$W_{t+1} \equiv \mathbb{W}\left(\{r_s\}_{s=t+1}^{\infty}\right) \ ,$$

for notational simplicity, in which $\mathbb{W}\left(\{r_s\}_{s=t+1}^{\infty}\right)$ is given by the expression in (20). It can be verified that the expression in (20) is the solution to the difference equation

$$W_{t+1} = \frac{1+\gamma}{1+r_{t+1}} W_{t+2} + L \ , \quad t = 0, 1, ... \ , \quad (46)$$

which is a recursion fully characterizing W_{t+1} in the guess given by (45). The second guess is on the functional form of the value function of player $j \in \{1, ..., N\}$, in Bellman equation (37). Specifically,

$$\hat{V}^j\left(B_t, z_t \mid \left\{\mathbb{C}_i^R\right\}_{\substack{i=1 \\ i \neq j}}^{N}, \{r_s\}_{s=t+1}^{\infty}\right) = \zeta_j + \psi_j \cdot \sum_{s=t}^{\infty} \beta^{s-t} \ln\left(1 + r_{s+1}\right) + \nu_j \cdot \ln\left(z_t W_{t+1} - B_t\right) \ , \quad (47)$$

in which ζ_j, ψ_j, and ν_j, are undetermined coefficients, $j \in \{1, ..., N\}$.

We substitute our guesses (45) and (47) into the Bellman equation given by (37), in order to verify whether the functional forms given by (45) and (47) are indeed correct, and also in order to calculate the undetermined coefficients ζ_j, ψ_j, ν_j, and $\xi_{R,j}$. Before making this substitution, a simplifying step is to use a state-variable transformation, namely,

$$x_t \equiv z_t W_{t+1} - B_t \ ,$$

and to calculate the law of motion of x_t, a function $x_{t+1} = X\left(x_t\right)$, that is based on (11), the first-order conditions (42) through (47), and our guesses (45) and (47).

In order to find the law of motion $x_{t+1} = X(x_t)$, we first combine (47) with (44) to obtain $C^R_{j,t} = \theta_R x_{t+1}/[\omega_j \nu_j \beta(1+r_{t+1})]$, and then we combine this result with (43), which leads to,

$$(1-\tau_t)\cdot \underbrace{z_t \cdot L}_{\substack{\shortparallel \\ Y_t}} = \frac{1}{\nu_j \beta(1+r_{t+1})} x_{t+1} \ . \tag{48}$$

Since (48) holds for all $j \in \{1, ..., N\}$, we conclude that

$$\nu_j = \nu, \text{ for all } j \in \{1, ..., N\} \ . \tag{49}$$

From the fiscal-budget constraint (11) and the recursion given by (46) we obtain,

$$\underbrace{z_{t+1}W_{t+2} - B_{t+1}}_{\substack{\shortparallel \\ x_{t+1}}} = (1+r_{t+1}) \left[\underbrace{z_t W_{t+1} - B_t}_{\substack{\shortparallel \\ x_t}} - (1-\tau_t) Y_t - G_t - \omega_j C^R_{j,t} - \sum_{\substack{i=1 \\ i \neq j}}^{N} \omega_i C^R_{i,t} \right] ,$$

which we combine with (42), (43), and (45), in order to get,

$$x_{t+1} = (1+r_{t+1}) \left[\left(1 - \sum_{\substack{i=1 \\ i \neq j}}^{N} \omega_i \xi_{R,i} \right) x_t - (1+\theta_R+\theta_G)(1-\tau_t) Y_t \right] \ . \tag{50}$$

Since the choice of $j \in \{1, ..., N\}$ is arbitrary, equation (50) implies,

$$\sum_{\substack{i=1 \\ i \neq j}}^{N} \omega_i \xi_{R,i} = \sum_{\substack{i=1 \\ i \neq k}}^{N} \omega_i \xi_{R,i} \ , \text{ for all } j, k \in \{1, ..., N\} \ . \tag{51}$$

The linear system implied by (51) has a unique solution according to which,

$$\omega_i \xi_{R,i} = \xi_R \ , \text{ for all } i \in \{1, ..., N\} \ . \tag{52}$$

Combining (50) with (52) gives,

$$x_{t+1} = (1+r_{t+1}) \left\{ [1-(N-1)\xi_R] x_t - (1+\theta_R+\theta_G)(1-\tau_t) Y_t \right\} \ . \tag{53}$$

After combining (53) with (48) and (49), we obtain the law of motion $x_{t+1} = X(x_t)$, namely,

$$x_{t+1} = \frac{1 + r_{t+1}}{1 + \frac{1+\theta_R+\theta_G}{\nu\beta}} \left[1 - (N-1)\,\xi_R\right] x_t \ . \tag{54}$$

With (54) at hand we return to calculating the undetermined coefficients ζ_j, ψ_j, ν, and ξ_R. We substitute (47) into the Bellman equation given by (37) and get,

$$\zeta_j + \psi_j \cdot \sum_{s=t}^{\infty} \beta^{s-t} \ln(1 + r_{s+1}) + \nu \cdot \ln(x_t) = \theta_l \ln(1-L) + \ln(L)$$
$$+ \ln(1-\tau_t) + \ln(z_t) + \theta_G \ln(G_t) + \theta_R \ln\left(C^R_{j,t}\right)$$
$$+ \beta\zeta_j + \beta\psi_j \cdot \sum_{s=t+1}^{\infty} \beta^{s-t-1} \ln(1 + r_{s+1}) + \beta\nu \ln(x_{t+1}) \ . \tag{55}$$

After combining (42), (43), and (48) with (54), we obtain,

$$\theta_l \ln(1-L) + \ln(L) + \ln(1-\tau_t) + \ln(z_t) + \theta_G \ln(G_t) + \theta_R \ln\left(C^R_{j,t}\right)$$
$$= \theta_l \ln(1-L) - \theta_R \ln(\omega_j) + \theta_G \ln(\theta_G) + \theta_R \ln(\theta_R) - (1 + \theta_G + \theta_R) \Bigg[\ln(\beta) + \ln(\nu)$$
$$+ \ln\left(1 + \frac{1 + \theta_G + \theta_R}{\nu\beta}\right)\Bigg] + (1 + \theta_G + \theta_R)\left\{\ln\left[1 - (N-1)\,\xi_R\right] + \ln(x_t)\right\} \ . \tag{56}$$

In addition, equation (54) implies,

$$\beta\nu \ln(x_{t+1}) = \beta\nu \ln(1 + r_{t+1}) + \beta\nu \left\{\ln\left[1 - (N-1)\,\xi_R\right] + \ln(x_t) - \ln\left(1 + \frac{1 + \theta_G + \theta_R}{\nu\beta}\right)\right\} \ . \tag{57}$$

Substituting (57), (43), and (56) into (55), leads to,

$$(1-\beta)\,\zeta_j = \theta_l \ln(1-L) + \theta_G \ln(\theta_G) + \theta_R \ln(\theta_R) - (1 + \theta_G + \theta_R) \ln(\beta\nu)$$
$$+ (1 + \theta_G + \theta_R + \beta\nu)\left\{\ln\left[1 - (N-1)\,\xi_R\right] - \ln\left(1 + \frac{1 + \theta_G + \theta_R}{\nu\beta}\right)\right\} - \theta_R \ln(\omega_j)$$
$$+ (\beta\nu - \psi_j) \ln(1 + r_{t+1}) + \left[1 + \theta_G + \theta_R - \nu(1-\beta)\right] \ln(x_t) \ . \tag{58}$$

In order that the guessed functional forms given by (45) and (47) be indeed correct, equation (58) should not depend on its two variables, x_t and r_{t+1}. Due to this requirement of non-dependence of equation (58) on x_t and r_{t+1}, two immediate implications of (58) are,

$$\nu = \frac{1+\theta_G+\theta_R}{1-\beta} \ , \tag{59}$$

and $\psi_j = \beta\nu$, so, based on (59), we obtain,

$$\psi_j = \psi = \frac{\beta \cdot (1+\theta_G+\theta_R)}{1-\beta} \ , \text{ for all } j \in \{1, ..., N\} \ . \tag{60}$$

Combining (48), (54), (42), and (59), we obtain,

$$G_t = \frac{(1-\beta)\,\theta_G\,[1-(N-1)\,\xi_R]}{1+\theta_G+\theta_R} x_t \ . \tag{61}$$

Equations (61) and (43) imply,

$$\omega_j C^R_{j,t} = \frac{(1-\beta)\,\theta_R\,[1-(N-1)\,\xi_R]}{1+\theta_G+\theta_R} x_t \ . \tag{62}$$

Our guess (45) concerning the exploitation strategy of group $j \in \{1, ..., N\}$ is $C^R_{j,t} = \xi_{R,j} x_t$. So, combining (45) with (62) and (52) identifies the undetermined coefficient ξ_R,

$$\xi_R = \frac{(1-\beta)\,\theta_R}{1+\theta_G+\theta_R+(N-1)\,(1-\beta)\,\theta_R} \ , \tag{63}$$

which proves equation (40). Based on (63),

$$1-(N-1)\,\xi_R = \frac{1+\theta_G+\theta_R}{1+\theta_G+\theta_R+(N-1)\,(1-\beta)\,\theta_R} \ . \tag{64}$$

Combining (61) and (63) proves equation (38). In addition, the budget-constraint equation (41) is reconfirmed by substituting (61) and (62) into (11), and after noticing that,

$$\beta_N \equiv \beta\,[1-(N-1)\,\xi_R] \ ,$$

which proves formula (21). Equation (39) is proved directly from (42). Finally, after combining (58) with (59), (60), (63), and (64), we can identify the last undetermined coefficient, ζ_j, which is given by,

$$\zeta_j = \frac{1}{1-\beta}\left\{ -\theta_R \ln(\omega_j) + \theta_l \ln(1-L) + \theta_G \ln(\theta_G) + \theta_R \ln(\theta_R) \right.$$
$$+ (1+\theta_G+\theta_R)\left[\frac{\beta}{1-\beta}\ln(\beta) + \ln(1-\beta) + \frac{\beta}{1-\beta}\ln(1+\theta_G+\theta_R)\right]$$
$$\left. -\frac{1+\theta_G+\theta_R}{1-\beta}\ln\left[1+\theta_G+\theta_R+(N-1)(1-\beta)\theta_R\right]\right\} , \tag{65}$$

completing the proof. □

5.2 Proof of Proposition 1

Since all other debtor countries are on an IEC path, the statement of this proposition states that all debt-GDP ratios will be constant, which we will reconfirm by proving the proposition. Equations (17) implies that $m_{t+1} = m_t$ for all t, so (18) becomes,

$$B^*_{i,t+1} = \beta(1+r_{t+1}) B^*_{i,t} \ . \tag{66}$$

Interest-rate levels are determined by equating demand and supply of government bonds in international markets. In particular, the demand for bonds one period ahead, B^*_{t+1}, is given by equation (66). Bond supply is obtained by combining the optimal level of government spending with the fiscal-budget constraint. From equations (41) and (21) for $N = 1$ we know that the supply of bonds in period $t+1$ is given by,

$$B_{t+1} = \beta(1+r_{t+1}) B_t + (1+r_{t+1})\left[(1-\beta) z_t \mathbb{W}\left(\{r_s\}_{s=t+1}^{\infty}\right) - Y_t\right] \ . \tag{67}$$

After applying the equilibrium condition $B_{t+1} = B^*_{t+1}$, and assuming also that $B_t = B^*_t$ (no default in any period), equations (67) and (66) imply,

$$\mathbb{W}\left(\{r_s\}_{s=t+1}^{\infty}\right) = \frac{L}{1-\beta} \ , \quad t = 0, 1, \ldots \ . \tag{68}$$

Previously we have mentioned an easily verifiable result, that the sequence $\{W_{t+1}\}_{t=0}^{\infty}$ corresponding to equation (20) satisfies the recursion given by (46). Specifically, the formula given by (20) is the solution to (46). After substituting (68) into (46), we obtain the level of interest rate r^{ss} given by (25), and the implication that $r_{t+1} = r^{ss}$ for all $t \in \{0, 1, ...\}$.

Equations (26), (27), and (28) are derived immediately after substituting $r_{t+1} = r^{ss}$ for all $t \in \{0, 1, ...\}$ into (41), (38), (39), and (40). In all cases we take into account that, under cooperation, $\beta_N = \beta$. Under cooperation, all formulas are considered as if $N = 1$ with the sole exception that the aggregate rents of the coalition are equally shared among rent-seeking groups, with each rent-seeking group member receiving $\mathbb{C}^{R,C}(B_t, z_t)/N$. □

5.3 Proof of Proposition 2

Equating demand for bonds (equation (66)) and supply of bonds (equation (41)), together with (10), leads to,

$$(\beta - \beta_N) b_t = (1 - \beta_N) \left[\frac{W_{t+1}}{L} - \frac{1}{1 - \beta_N} \right] . \tag{69}$$

From (46) it is,

$$\frac{W_{t+2}}{L} = \frac{1 + r_{t+1}}{1 + \gamma} \left(\frac{W_{t+1}}{L} - 1 \right) . \tag{70}$$

After considering equation (69) one period ahead and after substituting (70) into it, we obtain,

$$(\beta - \beta_N) b_{t+1} = (1 - \beta_N) \frac{1 + r_{t+1}}{1 + \gamma} \left(\frac{W_{t+1}}{L} - 1 \right) - 1 . \tag{71}$$

After some algebra, equation (69) gives,

$$\frac{W_{t+1}}{L} - 1 = \frac{1}{1 - \beta_N} \left[(\beta - \beta_N) b_t + \beta_N \right] . \tag{72}$$

Substituting (72) into (71) gives,

$$(\beta - \beta_N) b_{t+1} = \frac{1 + r_{t+1}}{1 + \gamma} \left[(\beta - \beta_N) b_t + \beta_N \right] - 1 . \tag{73}$$

Equation (41) can be expressed as,

$$b_{t+1} = \frac{\beta\left(1 + r_{t+1}\right)}{1+\gamma} b_t \ , \quad \text{for all } t \in \{0, 1, ...\} \ . \tag{74}$$

Substituting (74) into (73) gives two useful equations, a linear first-order difference equation in variable $1/b_t$,

$$\frac{1}{b_{t+1}} = \frac{\beta_N}{\beta} \cdot \frac{1}{b_t} + (1-\beta)\left(1 - \frac{\beta_N}{\beta}\right) \ , \tag{75}$$

and an equilibrium condition that links up b_t directly with r_t,

$$\left[(1-\beta)\left(\beta - \beta_N\right) b_t + \beta_N\right] \frac{1 + r_{t+1}}{1+\gamma} = 1 \ . \tag{76}$$

The solution to (75) is,

$$\frac{1}{b_t} - (1-\beta) = \left(\frac{\beta_N}{\beta}\right)^t \left[\frac{1}{b_0} - (1-\beta)\right] \ . \tag{77}$$

Combining (76) and (77) leads to,

$$\frac{1}{1+\tilde{r}^*_{t+1}} = \frac{\beta - \beta_N}{1 + \left(\frac{\beta_N}{\beta}\right)^t \left(\frac{1}{1-\beta} \cdot \frac{1}{b_0} - 1\right)} + \beta_N \ , \quad t = 0, 1, ... \ , \tag{78}$$

in which $\{\tilde{r}^*_s\}_{s=1}^{\infty}$ is the sequence of international-equilibrium interest rates.

With equation (78) at hand we can identify which b_0 is possible or admissible, through equating supply and demand for bonds in period 0. Recall from equation (20) that,

$$\frac{W_1}{L} = \frac{W\left(\{\tilde{r}_s\}_{s=1}^{\infty}\right)}{L} = \prod_{s=1}^{\infty} \frac{1}{1+\tilde{r}_s} + 1 + \sum_{s=1}^{\infty} \frac{1}{\prod_{j=1}^{s}\left(1 + \tilde{r}_j\right)} \ . \tag{79}$$

A direct implication of equation (78) is that $\lim_{t\to\infty} \tilde{r}^*_t = (1-\beta)/\beta$, and consequently,

$$\prod_{s=1}^{\infty} \frac{1}{1+\tilde{r}^*_s} = 0 \ , \tag{80}$$

which is the first term of the right-hand side of (79). In particular, after incorporating (80) and (78) into (79) we obtain,

$$\frac{W\left(\{\tilde{r}_s^*\}_{s=1}^{\infty}\right)}{L} = \frac{1}{1-\beta_N} + \sum_{s=1}^{\infty}\prod_{j=1}^{s} \frac{\beta - \beta_N}{1 + \left(\frac{\beta_N}{\beta}\right)^{j-1}\left(\frac{1}{1-\beta}\cdot\frac{1}{b_0} - 1\right)} \equiv F\left(b_0\right) \ . \quad (81)$$

In order to understand whether an equilibrium with default is possible in the case of $N \geq 2$, we examine which values of b_0 are possible after equating supply with demand for bonds in period 0. This market-clearing condition is obtained by substituting (81) into equation (69), after setting $t = 0$ for the latter, which gives, $(\beta - \beta_N)\, b_0 = (1 - \beta_N)\, F(b_0) - 1$, or,

$$H\left(b_0\right) \equiv \frac{\beta - \beta_N}{1-\beta_N} b_0 + \frac{1}{1-\beta_N} = F\left(b_0\right) \ . \quad (82)$$

In order to find solutions of (82) that reflect bond-market clearing in period 0, it is helpful to understand some properties of function $F(b_0)$. Let

$$f\left(b_0, j\right) \equiv \frac{\beta - \beta_N}{1 + \left(\frac{\beta_N}{\beta}\right)^{j-1}\left(\frac{1}{1-\beta}\cdot\frac{1}{b_0} - 1\right)} \ . \quad (83)$$

From (83) and (81),

$$F\left(b_0\right) = \frac{1}{1-\beta_N} + \sum_{s=1}^{\infty}\prod_{j=1}^{s} f\left(b_0, j\right) > 0 \ , \text{ for all } b_0 \in \left[0, \frac{1}{1-\beta}\right] \ . \quad (84)$$

Since, for all $b_0 \in [0, 1/(1-\beta)]$,

$$f_{b_0}\left(b_0, j\right) = \frac{\frac{\beta-\beta_N}{1-\beta}\left(\frac{\beta_N}{\beta}\right)^{j-1}}{\left\{\left[1 - \left(\frac{\beta_N}{\beta}\right)^{j-1}\right] b_0 + \frac{1}{1-\beta}\left(\frac{\beta_N}{\beta}\right)^{j-1}\right\}^2} > 0 \ , \quad (85)$$

an implication of (84) and (85) is,

$$F'\left(b_0\right) = f_{b_0}\left(b_0, 1\right) + \sum_{s=2}^{\infty}\sum_{j=1}^{s} f_{b_0}\left(b_0, j\right) \prod_{\substack{l=1 \\ l\neq j}}^{s} f\left(b_0, l\right) > 0 \ . \quad (86)$$

In addition,

$$F(0) = \frac{1}{1-\beta_N} = H(0) \ , \tag{87}$$

since $f(0,j) = 0$ for all $j \in \{1, 2, ...\}$,

$$F'(0) = (1-\beta)(\beta-\beta_N) < \frac{\beta-\beta_N}{1-\beta_N} = H'(0) \ , \tag{88}$$

and

$$F\left(\frac{1}{1-\beta}\right) = \frac{1}{1-\beta_N} + \frac{\beta-\beta_N}{1-(\beta-\beta_N)} < \frac{1}{1-\beta} = H\left(\frac{1}{1-\beta}\right) \ . \tag{89}$$

Equations (86), (87), (88), and (89) show that, as b_0 spans the interval $[0, 1/(1-\beta)]$, (i) function $F(b_0)$ starts from taking the value $1/(1-\beta_N)$, and satisfying the market-clearing condition at $b_0 = 0$, (ii) it continues in the neighborhood of $b_0 = 0$ with slope which is lower than the constant slope of $H(b_0)$, ($F'(0) < H'(0)$), meaning that $F(b_0)$ goes below function $H(b_0)$ in the neighborhood of $b_0 = 0$, (iii) $F(b_0)$ continues as a strictly increasing function all the way up to $1/(1-\beta)$, and (iv) then at $1/(1-\beta)$, $F(1/(1-\beta)) < H(1/(1-\beta))$. Investigating concavity/convexity properties of $F(b_0)$ is a cumbersome task with, perhaps ambiguous results. Properties (i)-(iv) regarding the behavior of $F(b_0)$, reveal that, if $F(b_0)$ was either globally concave or globally convex on the interval $[0, 1/(1-\beta)]$, then it would be immediately proved that $b_0 = 0$ (full default) would be the only value satisfying the market-clearing condition $F(b_0) = H(b_0)$. Since we do not have such a result at hand, we prove that no solutions other than default are possible, proceeding by contradiction.

Suppose that there exists some $\tilde{b}_0 \in (0, 1/(1-\beta))$, such that,

$$F\left(\tilde{b}_0\right) = H\left(\tilde{b}_0\right) \ . \tag{90}$$

From (75) we know that,

$$\tilde{b}_1 = \frac{1}{\frac{\beta_N}{\beta}\frac{1}{\tilde{b}_0} + \xi} = \frac{\tilde{b}_0}{\alpha} \ , \tag{91}$$

in which $\xi \equiv (\beta-\beta_N)(1-\beta)/\beta$ and $\alpha \equiv \beta_N/\beta + \xi\tilde{b}_0$. Since $\tilde{b}_1$ is on the equilibrium path, it should also satisfy,

$$F\left(\tilde{b}_1\right) = H\left(\tilde{b}_1\right) \ . \tag{92}$$

From (82) and (91) it is,

$$H\left(\tilde{b}_1\right) = \frac{1}{\alpha}\frac{\beta-\beta_N}{1-\beta_N}\tilde{b}_0 + \frac{1}{1-\beta_N} \ ,$$

and by substituting (91) into this last expression again, we obtain

$$H\left(\tilde{b}_1\right) - \frac{1}{1-\beta_N} = \frac{1}{\alpha}\left[H\left(\tilde{b}_0\right) - \frac{1}{1-\beta_N}\right] = \frac{1}{\alpha}\left[F\left(\tilde{b}_0\right) - \frac{1}{1-\beta_N}\right] = F\left(\tilde{b}_1\right) - \frac{1}{1-\beta_N} \ , \tag{93}$$

an implication of (90) and (92). From (81) it is,

$$F\left(\tilde{b}_1\right) - \frac{1}{1-\beta_N} = \sum_{s=1}^{\infty}\prod_{j=1}^{s}\frac{\beta-\beta_N}{1+\left(\frac{\beta_N}{\beta}\right)^{j-1}\left(\alpha\frac{1}{1-\beta}\cdot\frac{1}{\tilde{b}_0}-1\right)} \ ,$$

and (93) implies,

$$\sum_{s=1}^{\infty}\prod_{j=1}^{s}\frac{\beta-\beta_N}{1+\left(\frac{\beta_N}{\beta}\right)^{j-1}\left(\alpha\frac{1}{1-\beta}\cdot\frac{1}{\tilde{b}_0}-1\right)} = \frac{1}{\alpha}\sum_{s=1}^{\infty}\prod_{j=1}^{s}\frac{\beta-\beta_N}{1+\left(\frac{\beta_N}{\beta}\right)^{j-1}\left(\frac{1}{1-\beta}\cdot\frac{1}{\tilde{b}_0}-1\right)} \ . \tag{94}$$

Subtracting the right-hand-side of (94) from the left-hand side and rearranging terms,

$$\sum_{s=1}^{\infty}\left(\beta-\beta_N\right)^s\frac{\alpha-1}{\alpha}\prod_{j=1}^{s}\left[\frac{1}{1+\left(\frac{\beta_N}{\beta}\right)^{j-1}\left(\alpha\frac{1}{1-\beta}\cdot\frac{1}{\tilde{b}_0}-1\right)} - \frac{1}{1+\left(\frac{\beta_N}{\beta}\right)^{j-1}\left(\frac{1}{1-\beta}\cdot\frac{1}{\tilde{b}_0}-1\right)}\right] = 0 \ ,$$

or,

$$\frac{\alpha-1}{\alpha}\sum_{s=1}^{\infty}\left(\beta-\beta_N\right)^s\left(1-\alpha\right)^s\times$$

$$\times\prod_{j=1}^{s}\frac{\left(\frac{\beta_N}{\beta}\right)^{j-1}\frac{1}{1-\beta}\frac{1}{\tilde{b}_0}}{\left[1+\left(\frac{\beta_N}{\beta}\right)^{j-1}\left(\alpha\frac{1}{1-\beta}\cdot\frac{1}{\tilde{b}_0}-1\right)\right]\left[1+\left(\frac{\beta_N}{\beta}\right)^{j-1}\left(\frac{1}{1-\beta}\cdot\frac{1}{\tilde{b}_0}-1\right)\right]} = 0 \ . \tag{95}$$

From (91) we know that

$$\alpha = \frac{\tilde{b}_0}{\tilde{b}_1} \ , \tag{96}$$

and from (74) it is,

$$\frac{\tilde{b}_0}{\tilde{b}_1} = \frac{1}{\beta} \frac{1}{1 + \tilde{r}_1} \ . \tag{97}$$

Yet, it is verifiable from (78) that for all $\tilde{b}_0 < 1/ (1 - \beta)$,

$$\tilde{r}_1 > \tilde{r}^{ss} \Leftrightarrow \frac{1}{\beta} \frac{1}{1 + \tilde{r}_1} < \frac{1}{\beta} \frac{1}{1 + \tilde{r}^{ss}} = 1 \ . \tag{98}$$

Combining (98) with (97) and (96) implies,

$$0 < \alpha < 1 \ . \tag{99}$$

Inequality (99) implies that the left-hand side of (95) is the product of a negative term, $(\alpha - 1) / \alpha$, and an infinite summation of strictly positive terms, contradicting (95). Since the choice of $\tilde{b}_0 \in (0, 1/ (1 - \beta))$ was arbitrary, the possibility that $N \geq 2$ and positive outstanding fiscal debt is ruled out.

Therefore, $b_0 = 0$ is the only admissible solution. To see that $b_0 = 0$ is admissible, notice that (74) implies $b_t = 0$ for all $t \in \{0, 1, ...\}$, so $F (b_t = 0) = H (b_t = 0)$ is always satisfied.

To sum up, if $N \geq 2$, domestic governments will default. After the default, all future governments will optimally cease the issuing of public deficit. This optimal behavior in our model is demonstrated by equation (74). □

5.4 Proof of Proposition 3

In order to calculate $V^{C,j} (B_t, z_t)$ we substitute the results stated previously into the Bellman equation given by (24), after taking into account that the total rents of the coalition are divided by 2, which implies that we must subtract $\theta_R \ln (2) / (1 - \beta)$. We have already achieved most of this calculation as we have obtained the expressions for ζ, ψ, and ν (c.f. equations (65), (60), and (59), which correspond to the value function given by (47)). From equation (25) in Proposition 1 we know that $W_t/L = 1/ (1 - \beta)$ for all $t \in$

$\{0,1,...\}$, so $V^{C,j}(B_t, z_t)$ becomes,

$$V^{C,j}(B_t, z_t) = \frac{1}{1-\beta}\Bigg\{-\theta_R \ln(2) + \theta_l \ln(1-L) + \theta_G \ln(\theta_G) + \theta_R \ln(\theta_R) + (1+\theta_G+\theta_R)\left[\frac{\beta \ln(1+\gamma)}{1-\beta} + \ln(1-\beta) - \ln(1+\theta_G+\theta_R)\right] + (1+\theta_G+\theta_R)\ln\left(\frac{z_t L}{1-\beta} - B_t\right)\Bigg\}. \tag{100}$$

In order to calculate $V^{NC,j}\left(B_t = 0, z_t \mid \left\{\mathbb{C}_i^{R,NC}\right\}_{\substack{i=1\\ i\neq j}}^{2}\right)$ we find the static-equilibrium noncooperative solution for $N = 2$, and calculate the discounted sum of lifetime utility of each group. So,

$$V^{NC,j}\left(B_t = 0, z_t \mid \left\{\mathbb{C}_i^{R,NC}\right\}_{\substack{i=1\\ i\neq j}}^{2}\right) = \frac{1}{1-\beta}\Bigg\{\theta_l \ln(1-L) + \theta_G \ln(\theta_G) + \theta_R \ln(\theta_R) + (1+\theta_G+\theta_R)\left[\ln(L) - \ln(1+\theta_G+2\theta_R)\right] + (1+\theta_G+\theta_R)\left[\frac{\beta \ln(1+\gamma)}{1-\beta} + \ln(z_t)\right]\Bigg\}. \tag{101}$$

Comparing (100) with (101) leads to the cutoff debt-GDP ratio in (33).

In order to verify that the cases in which (i) the two rent-seeking groups never cooperate, (ii) the two rent-seeking groups cooperate forever, are both *Markov-Perfect-Cooperation-Decision Nash Equilibrium (MPCDNE)*, notice that, by definition 1, (i) can be a MPCDNE, no matter what b_t might be. From Proposition 2 we know that if rent-seeking groups never cooperate, then $b_t = 0$ for all $t \in \{0,1,...\}$, which still allows (i) to be an MPCDNE. To see that (ii) is also an MPCDNE, notice that, as long as (33) holds in period 0, then Proposition 3 (c.f. eq. 26) implies $b_t = b_0$, so (33) holds for all $t \in \{0,1,...\}$. So, rent-seeking groups cooperating forever is an MPCDNE, as a direct consequence of Definition 1. □

5.5 Proof of Proposition 5

In order to derive $\bar{b}$, notice that

$$g^{NC}_{\text{default}} = \frac{\theta_G}{1+\theta_G+2\theta_R} = \frac{\alpha}{1+\alpha}\frac{\theta_G}{\theta_R} \ , \tag{102}$$

and that (27) implies,

$$g^C_{\hat{b}} = \frac{\theta_G}{\theta_R}\alpha\left[1-(1-\beta)\,\hat{b}\right] \ . \tag{103}$$

Comparing (102) with (103) gives,

$$g^C_{\hat{b}} \geq g^{NC}_{\text{default}} \Leftrightarrow \hat{b} \leq \frac{1}{1-\beta}\frac{\alpha}{1+\alpha} \ ,$$

proving (34), (35), and (36). To show that $\bar{b} > \underline{b}$, use (34) and (33),

$$\bar{b} > \underline{b} \Leftrightarrow 2^\alpha > 1 \ ,$$

which is a true statement, proving the proposition. □

5.6 Analytical results about calibration

Here we prove that calibrating θ_R and θ_G in order to match target values for the government-consumption-GDP ratio and the total-rents-GDP ratio is independent from the values of β at the cutoff level $\underline{b}$. Let $\underline{g}$ denote the government-consumption-GDP ratio G/Y at the cutoff debt-GDP $\underline{b}$, and let $\underline{c}_R$ denote the total-rents-GDP ratio at the cutoff debt-GDP $\underline{b}$. Substituting the formula given by (33) for $\underline{b}$ into (27), we obtain,

$$\underline{g} = \frac{\theta_G}{\theta_R}\alpha\left[1-(1-\beta)\,\underline{b}\right] = \frac{\theta_G}{\theta_R}\frac{\alpha 2^\alpha}{1+\alpha} \ , \tag{104}$$

in which α is given by (32). Equation (28) implies,

$$\frac{\underline{c}_R}{\underline{g}} = \frac{\theta_R}{\theta_G} \Rightarrow \theta_G = \theta_R\frac{\underline{g}}{\underline{c}_R} \ . \tag{105}$$

Using (105), we can express (104) as a function of parameter θ_R alone, obtaining,

$$\underline{g} = \frac{\theta_R \frac{\underline{g}}{\underline{c}_R}}{1+\theta_R(1+\frac{\underline{g}}{\underline{c}_R})} \frac{2^{\frac{\theta_R}{1+\theta_R(1+\frac{\underline{g}}{\underline{c}_R})}}}{1+\frac{\theta_R}{1+\theta_R(1+\frac{\underline{g}}{\underline{c}_R})}} \ . \tag{106}$$

Using (106) together with target calibration values for $\underline{g}$ and $\underline{c}_R$, we can find the specific value of parameter θ_R^* by solving the nonlinear equation

$$f\left(\theta_R\right) = 0 \ ,$$

in which

$$f\left(\theta_R\right) \equiv \frac{\theta_R \frac{\underline{g}}{\underline{c}_R}}{1+\theta_R(1+\frac{\underline{g}}{\underline{c}_R})} \frac{2^{\frac{\theta_R}{1+\theta_R(1+\frac{\underline{g}}{\underline{c}_R})}}}{1+\frac{\theta_R}{1+\theta_R(1+\frac{\underline{g}}{\underline{c}_R})}} - \underline{g} \ . \tag{107}$$

From (107) we can see that matching target calibration values for $\underline{g}$ and $\underline{c}_R$ is independent from values of β. Finally, from (105), $\theta_G^* = \theta_R^* \underline{g}/\underline{c}_R$. □

References

[1] Aguiar, M. and Amador, M. (2014): "Sovereign Debt ," Handbook of International Economics, 4, Elsevier.

[2] Amador, M. (2012): "Sovereign Debt and the Tradegy of the Commons," mimeo, Federal Reserve bank of Minneapolis.

[3] Ardagna, S. and F. Caselli (2014): "The Political Economy of the Greek Debt Crisis: A Tale of Two Bailouts", American Economic Journal: Macroeconomics, 6, 291-323.

[4] Arellano,C. (2008): "Default Risk and Income Fluctuations in Emerging Economies," American Economic Review, 98, 690-712.

Battaglini, M. and Coate, S. (2008): "A Dynamic Theory of Public Spending, Taxation, and Debt," American Economic Review, 98, 201-36.

[5] Becker, G. S. (1983): "A theory of competition among pressure groups for political influence," Quarterly Journal of Economics, 98, 371–400.

[6] Becker, G. S. (1985): "Public policies, pressure groups and deadweight costs," Journal of Public Economics, 28, 330–47.

[7] Beetsma and Uhlig (1999): "An Analysis of the Stability and Growth Pact," Economic Journal, 109, 546-571.

[8] Bulow, J. and K. Rogoff (1989): "Sovereign Debt: Is to Forgive to Forget?", American Economic Review, 79, 43-50.

[9] Cole, H. L, J. Dow and W. English (1995): "Default, Settlement, and Signalling: Lending Resumption in a Reputational Model of Sovereign Debt," International Economic Review, 36, 365-85.

[10] Cole, H. L. and P.J. Kehoe (1995): "The role of institutions in reputation models of sovereign debt," Journal of Monetary Economics, 35, 45-64.

[11] Cole, H. L. and P.J. Kehoe (1998): "Models of Sovereign Debt: Partial versus General Reputations," International Economic Review, 39, 55-70.

[12] Cole, H. L., and T. Kehoe (2000): "Self Fulfilling Debt Crises," Review of Economic Studies, 60, 91-116.

[13] Conesa, J.C., and T.J. Kehoe (2012): "Gambling for Redemption and Self-Fulfilling Debt Crises," Federal Reserve Bank of Minneapolis, Research Department Staff Report 465.

[14] Conesa, J.C., and T.J. Kehoe (2014): "Is it too Late to Bail out the Troubled Countries in the Eurozone?, " American Economic Review: Papers and Proceedings 104, 88-93.

[15] Cruces, J. J. and C. Trebesch (2012): "Sovereign Defaults: The Price of haircuts", American Economic Journal: Macroeconomics, 5, 85-117.

[16] D'Erasmo , P. and E. Mendoza (2015): "Distributional Incentives in an Equilibrium Model of Domestic Sovereign Default", forthcoming, Journal of European Economic Association.

[17] Denzau, A. T, and R. J. Mackay (1981): "Structure-Induced Equilibria and Perfect-Foresight Expectations," American Journal of Political Science, Vol. 25(4), pp. 762-779.

[18] Eaton, J. and M.Gersovitz, (1981): "Debt with Potential Repudiation: Theoretical and Empirical Analysis," Review of Economic Studies, 48, 289-309.

[19] Elgin, C. and O. Oztunali (2012): "Shadow Economies around the World: Model Based Estimates", mimeo, Bogazici University.

[20] Grechyna (2012): "Public Debt Levels and Corruption in High-Income Economies", Mimeo, University of Auckland.

[21] Haag, M. and R. Lagunoff (2007): "On the size and structure of group cooperation, "Journal of Economic Theory, 135, 68-89.

[22] International Monetary Fund (2010a): "Portugal: Staff Report; Public Information Notice on the Executive Board Discussion; and Statement by the Executive Director for Portugal." IMF Country Report No. 10/18, downloadable from: http://www.imf.org/external/pubs/ft/scr/2010/cr1018.pdf

[23] International Monetary Fund (2010b): "Greece: Staff Report on Request for Stand-By Arrangement." IMF Country Report No. 10/110, downloadable from: http://www.imf.org/external/pubs/ft/scr/2010/cr10110.pdf

[24] International Monetary Fund (2010c): "Spain: 2010 Article IV Consultation—Staff Statement; Staff Supplement; Staff Report; Statement by the Executive Director for Spain; and Public Information Notice on the Executive Board Discussion" IMF Country Report No. 10/254, downloadable from: http://www.imf.org/external/pubs/ft/scr/2010/cr10254.pdf

[25] International Monetary Fund (2010d): "Ireland: Request for an Extended Arrangement—Staff Report; Staff Supplement; Staff Statement; and Press Release on the Executive Board Discussion." IMF Country Report No. 10/366, downloadable from: http://www.imf.org/external/pubs/ft/scr/2010/cr10366.pdf

[26] International Monetary Fund (2011a): "Ireland: Extended Arrangement—Interim Review Under the Emergency Financing Mechanism."? IMF Country Report No. 11/47, downloadable from: http://www.imf.org/external/pubs/ft/scr/2011/cr1147.pdf

[27] International Monetary Fund (2011b): "Ireland: First and Second Reviews Under the Extended Arrangement and Request for Rephasing of the Arrangement—Staff Report; Letter of Intent; Memorandum of Economic and Financial Policies; Technical Memorandum of Understanding; Letter of Intent and Memorandum of Understanding on Specific Economic Policy Conditionality (College of Commissioners); Staff Supplement; and Press Release on the Executive Board Discussion."? IMF Country Report No. 11/109, downloadable from: http://www.imf.org/external/pubs/ft/scr/2011/cr11109.pdf

[28] International Monetary Fund (2011c): "Italy—-Staff Report for the 2011 Article IV Consultation; Informational Annex; Public Information Notice; Statement by the Staff Representative; and Statement by the Executive Director for Italy."? IMF Country Report No. 11/173, downloadable from: http://www.imf.org/external/pubs/ft/scr/2011/cr11173.pdf

[29] International Monetary Fund (2011d): "Spain—-Staff Report for the 2011 Article IV Consultation; Public Information Notice; Statement by the Staff Representative; and Statement by the Executive Director for Spain."? IMF Country Report No. 11/215, downloadable from: http://www.imf.org/external/pubs/ft/scr/2011/cr11215.pdf

[30] International Monetary Fund (2011e): "Portugal: First Review Under the Extended Arrangement."? IMF Country Report No. 11/279, downloadable from: http://www.imf.org/external/pubs/ft/scr/2011/cr11279.pdf

[31] International Monetary Fund (2011f): "Greece: Fifth Review Under the Stand-By Arrangement, Rephasing and Request for Waivers of Nonobservance of Performance Criteria; Press Release on the Executive Board Discussion; and Statement by the Executive Director for Greece."? IMF Country Report No. 11/351, downloadable from: http://www.imf.org/external/pubs/ft/scr/2011/cr11351.pdf

[32] International Monetary Fund (2012a): "Greece: Request for Extended Arrangement Under the Extended Fund Facility—Staff Report; Staff Supplement; Press Release on the Executive Board Discussion; and Statement by the Executive Director for Greece."? IMF Country Report No. 12/57, downloadable from: http://www.imf.org/external/pubs/ft/scr/2012/cr1257.pdf

[33] International Monetary Fund (2012b): "Portugal: Third Review Under the Extended Arrangement and Request for Waiver of Applicability of End-March Performance Criteria—Staff Report; Staff Statement; Press Release on the Executive Board Discussion; and Statement by the Executive Director for Portugal." IMF Country Report No. 12/77, downloadable from: http://www.imf.org/external/pubs/ft/scr/2012/cr1277.pdf

[34] International Monetary Fund (2012c): "Portugal: Fourth Review Under the Extended Arrangement and Request for a Waiver of Applicability of End-June Performance Criteria—Staff Report; Press Release on the Executive Board Discussion; and Statement by the Executive Director for Portugal." IMF Country Report No. 12/179, downloadable from: http://www.imf.org/external/pubs/ft/scr/2012/cr12179.pdf

[35] International Monetary Fund (2012d): "Ireland: 2012 Article IV and Seventh Review Under the Extended Arrangement—Staff Report; Informational Annex, Staff Supplement; and Public Information Notice" IMF Country Report No. 12/264, downloadable from: http://www.imf.org/external/pubs/ft/scr/2012/cr12264.pdf

[36] International Monetary Fund (2012e): "2012 Article IV Consultation with Italy- Concluding Statement of the IMF Mission." downloadable from: http://www.dt.tesoro.it/export/sites/sitodt/modules/documenti_en/news/news/CLEAN_VERSION_FINAL_WEDNESDAY_Italy_-_2012_-_Article_IV_Concluding_Statement_x2x.pdf

[37] International Monetary Fund (2012f): "Transcript of the Updates to the World Economic Outlook/Global Stability Report/Fiscal Monitor Press Briefing 01.2012" downloadable from: http://www.imf.org/external/np/tr/2012/tr012412.htm

[38] Ioannides, Y. and C. Pissarides (2015): "Is the Greek Debt Crisis one of Supply or Demand? ", Brookings Paper on Economic Activity.

[39] King, M. (2016): "The End of Alchemy: Money, banking and the Future of the Global Economy ", W.W. Norton and Company Inc. (Editors).

[40] Kiyotaki, N. and J. Moore (1997): "Credit Cycles", Journal of Political Economy, 105, 211-248.

[41] Koulovatianos, C., C. Schröder, and U. Schmidt (2015), "Do Demographics Prevent Consumer Aggregates from Reflecting Micro-Level Preferences?," Center for Financial Studies (CFS) working paper No. 484.

[42] Koulovatianos, C. and Wieland (2011): "Asset Pricing Under Rational Learning About Rare Disasters", CEPR Discussion Paper No. 8514.

[43] Kreps D.M. (1990) "A course in Microeconomic Theory", FT/Prentice Hall.

[44] Krusell, P., Quadrini V., and Rios-Rull, J. V. (1996): "Politico-economic equilibrium and economic growth," Journal of Economic Dynamics and Control, 21, 243-272.

[45] Krusell, P. and Rios-Rull, J. V. (1996): "Vested Interests in a Theory of Growth and Stagnation," Review of Economic Studies, 63, 301-329.

[46] Krusell, P. and Rios-Rull, J. V. (1999): "On the Size of U.S. Government: Political Economy in the Neoclassical Growth Model," American Economic Review, 89, 1156-1181.

[47] Lagunoff R. (2008): "Markov Equilibrium in Models of Dynamic Endogenous Political Institutions," mimeo, Georgetown University.

[48] Lagunoff R. (2009): "Dynamic Stability and Reform of Political Institutions ", Games and Economic Behavior, 67, 569-583.

[49] McGuire, M. (1974), "Group Segregation and Optimal Jurisdictions", Journal of Political Economy, 82, 112-132.

[50] Mendoza, E.G. and V. Z. Yue (2012) "A General Equilibrium Model of Sovereign Default and Business Cycles," Quarterly Journal of Economics, 127, 889-946.

[51] Mendoza, E.G., L. L. Tesar and J. Zhang, 2014. "Saving Europe?: The Unpleasant Arithmetic of Fiscal Austerity in Integrated Economies," NBER Working Papers 20200, National Bureau of Economic Research.

[52] Mueller, D. C. (2003): "Public Choice III," Cambridge University Press.

[53] Olson, M. (1965): "The Logic of Collective Action: Public Goods and the Theory of Groups," Cambridge: Harvard University Press.

[54] Pappa, E. and Sajedi, R. and Valla, E. (2015): "Fiscal Consolidation with tax evasion and corruption," Journal of International Economics, 96, 556–575.

[55] Persson, T. (1998): "Economic policy and special interest politics," Economic Journal, 108, 310–27.

[56] Persson, T. and Svensson, L. E. O. (1989): "Why a Stubborn Conservative would Run a Deficit: Policy with Time-Inconsistent Preferences", Quarterly Journal of Economics, 104, 325-345.

[57] Persson, T. and G. Tabellini (2000): "Political Economics: Explaining Economic Policy," The MIT Press.

[58] Roberts, K. (1999): "Dynamic Voting in Clubs," mimeo, University of Oxford.

[59] Roch, F. and H. Uhlig, (2011): "The Dynamics of Sovereign Debt Crisis in a Monetary Union," mimeo, University of Chicago.

[60] Sandler, T. and J. Tschirhart (1997), "Club theory: Thirty years later", Public Choice 93, 335–355.

[61] Schattschneider, E. E. (1935): "Politics, Pressures and the Tariff", Englewood Cliffs, N.J.: Prentice Hall.

[62] Sinn, H.-W. (2015): "The Greek Tragedy", CESifo Forum, Special Issue, June 2015.

[63] Taylor, M. (1987): ""The Possibility of Cooperation", Studies in Rationality and Social Change, Cambridge University Press.

[64] Tornell, A. and P. R. Lane (1999): "The Voracity Effect," American Economic Review, 89, pp. 22-46.

[65] Tullock, G. (1959): "Some problems of majority voting," Journal of Political Economy, 67, 571–79.

[66] Weingast, B. R., K. Shepsle, and C. Johnsen, (1981): "The political economy of benefits and costs: A neoclassical approach to distributive politics." Journal of Political Economy, 89, 642–64.

[67] Yue, V. (2010): "Sovereign default and debt renegotiation," Journal of International Economics, 80, 176-187.