NBER WORKING PAPER SERIES

THE POLITICAL ECONOMY OF DEBT AND ENTITLEMENTS

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Working Paper 22570
http://www.nber.org/papers/w22570

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
August 2016, Revised September 2019

We thank the editor Nicola Gennaioli, three anonymous referees, Marina Azzimonti, Micael Castanheira, Pedro Gete, and Stefanie Stantcheva. The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bureau of Economic Research.

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JEL No. D72,E62,H60

ABSTRACT

This paper presents a dynamic political-economic model of total government obligations. Its focus is on the interplay between debt and entitlements. In our model, both are tools by which temporarily powerful groups can extract resources from groups that will be powerful in the future: debt transfers resources across periods; entitlements directly target the future allocation of resources. We prove the following results. First, the presence of endogenous entitlements dampens the incentives of politically powerful groups to accumulate debt, but it leads to an increase in total government obligations. Second, fiscal rules can have perverse effects: if entitlements are unconstrained, and there are capital market frictions, debt limits lead to an increase in total government obligations and to worse outcomes for all groups. Analogous results hold for entitlement limits. Third, our model sheds some lights on the influence of capital market frictions on the incentives of governments to adopt fiscal rules, and implement entitlement programs. Finally, we identify preference polarization as a possible explanation for the joint growth of debt and entitlements.

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1 Introduction

Increasingly, governments struggle to meet their fiscal obligations. Fiscal stress is usually blamed on government debt and, indeed, debt has ballooned in the U.S. and other OECD countries in recent decades. To tame this trend, more and more countries (as of 2015, over 90: see Figure 3 below) have put in place fiscal rules that limit government debt and/or deficit. Similar rules also exist in many U.S. states (see Figure 4 below).

However, fiscal rules often do not target other spending obligations (most notably pensions and health care) that are major determinants of fiscal sustainability: the so-called entitlement programs. Entitlements are a major determinant of fiscal sustainability in many jurisdictions because they are large (on a flow basis, larger than interest payments on debt) and because by definition they cannot be compressed easily. In the United States, entitlements have grown rapidly since the 1960s and have long overtaken discretionary spending.[1] A similar pattern in the growth of entitlements holds across OECD countries.[2] This growth is viewed as a threat to fiscal stability in many countries (see, e.g., Evans, Kotlikoff, and Phillips 2012, and Steuerle 2014). Sometimes entitlements are practically the *sole determinant* of fiscal sustainability: this is the case for some US states where debt is strictly capped by state constitutions.

Fiscal rules that target debt but not entitlements generates perverse incentives for governments to reduce debt but increase future entitlements, with an uncertain effect on total obligations. In fact, recent research argues that the European Union Stability Pact has caused de-funding of pensions (Carey 2014), and that U.S. states with stricter fiscal rules have less-funded pensions (Wang 2017). And yet, while leading academics have long pointed out that debt and entitlements should be recognized as a combined fiscal burden for the government (see Kotlikoff and Burns, 2004), there is no academic work that studies the political forces that jointly shape debt and entitlements.

In this paper we provide a politico-economic model in which debt and entitlement levels are *jointly determined* in equilibrium. Our aim is to study the interplay between debt and entitlements and thus to investigate the *political economy of total government obligations* (i.e., debt plus entitlements). To maximize comparability with the literature that builds on Alesina and Tabellini (1990), we adhere closely to their basic framework. Our main departure from the canonical framework is to allow for the coexistence of debt

[1] See, e.g., Steuerle (2014) and David Crane: "New California Taxes Pay for Pensions, Not Students." Bloomberg, April 23 2012. Steuerle and Roeper developed an index of Fiscal Democracy that measures the percentage of (projected) revenues **not** claimed by permanent programs currently in place. In the US, this index dropped from 65% in 1962 to a range between 0 and 20 percent in the period 1998-2012; it is forecast to stay in this range through 2022, and there is no expectation of improvement in the more distant future. Evans, Kotlikoff, and Phillips (2012) provide another measure of fiscal sustainability –the so-called *duration to game over*. In the case of the US, this measure also points to the high (or even unsustainable) fiscal burden of entitlement programs.

[2] Defined as: public social expenditure as a percent of GDP in 1960-2014. Source: OECD (2014).

and entitlements.

The key ingredients of our model are the following. In each of two periods, a political process determines spending on a public good as well as private goods for two groups. Political power changes over time, as for instance in an intergenerational setting. The group that is powerful in period 1 (we call it "young generation A") can use debt to leverage future resources to finance higher current consumption. In addition, young generation A can set entitlements, which we model as "pre-committing" some fraction of future resources to a desired allocation. Thus, both debt and entitlements are tools for the temporarily powerful group to extract resources from groups that will be more powerful in the future. Note the assumption that entitlements *for generation A* cannot be changed once generation A is old. Albeit stark, this assumption is not counterfactual[3] and it has the advantage of being symmetric to the assumption, which is standard in this literature, that there is no default on government debt.

We first characterize the equilibrium allocation when there are no limits to debt and entitlements. We first show that, in the presence of endogenous entitlements, young generation A may choose to *run a surplus*, because future resources may be more effectively extracted via entitlements. Nevertheless, we also show that *total government obligations increase* compared to the model without entitlements. Furthermore, while entitlements allow generation A to smooth its private consumption over time, they crowd out period-2 public goods.[4] These results highlight that abstracting from the presence of entitlements, as is generally done in the political economy literature on debt, leads one not only to risk over-estimating the power of the model to account for debt accumulation, but also to under-estimate its ability to account for total obligations.

We then present our main results, which concern whether fiscal rules protect future generations. In a world with frictionless capital markets, debt limits have no real effects. For example, forcing a reduction in debt by ϵ will cause young generation A to increase both its entitlements and private borrowing by exactly ϵ, such that young generation A's private and public consumption levels, and indeed all agent's consumption levels in both periods, are unchanged in equilibrium. Thus, tightening a debt limit results is neutralized by a combination of less government debt, more entitlements, and more private borrowing. The same neutrality property holds for limits on entitlements. (This is not to say that debt and entitlement limits *together* are neutral: constraints on total obligations do impact

[3] The entitlements of current beneficiaries have proved difficult to change without the current beneficiaries' consent. In the vast majority of US states, for example, changing future benefits for current employees is extremely difficult; see Munnell and Quinby (2012). And across the world, even when pension laws have been revised, the benefits of current retirees have generally been protected. Typically, what is reformed are the benefits of future beneficiaries. We discuss the mechanisms that protect entitlements in Section 10, but in our model we simply assume that the entitlements of current beneficiaries cannot be changed without the current beneficiaries' consent.

[4] As we discuss below, this crowding out is in line with the evolution of government spending in the U.S. and other OECD countries since the 1960s.

inter-generational resource allocation.)

When, instead, frictions are so large that agents do not participate in private capital markets, fiscal rules are partially effective in protecting the future generation: they reduce total government obligations, but less than one-for-one because group A partially substitutes debt with entitlements.

Strikingly, however, when capital market frictions are in an intermediate range such that agents actively participate in capital markets, fiscal rules have perverse effects. In such a setting, if entitlements are unconstrained, tightening a debt limit leads to an increase in total government obligations and to worse outcomes for all groups. Suppose for example that, to borrow privately, a household has to pay a premium ϕ, which we interpret as a deadweight loss, above the government rate. Then, forcing a reduction in debt would lead young generation A to react as before (more entitlements and more private borrowing), except now increasing one's private borrowing by ϵ requires repaying $\epsilon\phi > \epsilon$ tomorrow. Thus, our model predicts that: tightening a debt limit causes entitlements to grow; and in the presence of capital-market frictions, Pareto-harmful effects arise. Analogous results hold for entitlement limits if debt is unconstrained.

The Pareto-harmful effect of limits on debt seems particularly relevant nowadays given how prevalent fiscal rules are across the world and within states, that international institutions such as the International Monetary Fund encourage an even broader use of fiscal rules, and that most of these fiscal rules do not address entitlements.[5]

As we discuss in Section 8, the main theoretical results of the model shed a new light on some real-world phenomena and policy ideas. First, the prediction that entitlements increase following the tightening of a debt limit is in line with the evidence that fiscal rules are met by increasing future unfunded obligations.

Second, our model also sheds some lights on the influence of capital market frictions on the incentives of governments to: (1) adopt fiscal rules; and (2) implement entitlement programs. These incentives grow stronger when market frictions increase. The historical evolution of pensions systems in the US and the UK is consistent with these results.

Last but not least, despite debt and entitlements being *substitute* tools of intergenerational redistribution, we show that an increase in preference polarization may lead to an increase in both debt and entitlements. This is in line with the joint growth of debt, entitlements and polarization that has taken place since the 1960s. Our model is also consistent with the decrease in public good provision and savings (or increase in borrowing) during that time period.

[5] See Eyraud et al (2018).

2 Related Literature

Some papers explain debt as the outcome of a struggle between different groups in the population who want to gain more control over resources. The reason debt is accumulated is that the group that is in power today may not be in power tomorrow, and debt is a way to take advantage of this temporary power. For instance, Cukierman and Meltzer (1989) and Song, Storesletten, and Zilibotti (2012) argue that debt is a tool used to redistribute resources across generations. Persson and Svensson (1989), Alesina and Tabellini (1990), and Tabellini and Alesina (1990) argue that debt represents a way to tie the hands of future governments that will have different preferences from the current one. In Tabellini and Alesina (1990), voters choose the composition of public spending in an environment where the median voter theorem applies. If the median voter remains the same in both periods, the equilibrium involves budget balance. If the median voter tomorrow has different preferences, the current median voter may choose to run a budget deficit to take advantage of his temporary power and tie the hands of the future government. The equilibrium may also involve a budget surplus because there is an "insurance" component that links the two periods as well: a surplus tends to equalize the median voter's utility in the two periods. Tabellini and Alesina (1990) detail conditions such that deficits will be incurred and show that increased polarization leads to larger deficits.

Browning (1975) and Boadway and Wildasin (1989) have studied voting models of pensions in which age is the only dimension of heterogeneity. Conde-Ruiz and Galasso (2005) study a two-dimensional voting model in which pensions coexist with a welfare state. Thus they allow for voting on both intragenerational and intergenerational redistribution. They argue that pensions are particularly stable because the elderly are a relatively homogeneous voting group, and the pension system is supported by a broad coalition including the low-income young.

Tabellini (1991) also illustrates how debt and social security differ as distributional instruments in an overlapping generations environment. In contrast with our model, the main force concerns the difference in default between the two instruments.

Battaglini and Coate (2008) present a dynamic model of taxation and debt where a rich policy space is considered within a legislative bargaining environment. Velasco (1996) discusses a model where government resources are "common property" with which interest groups can finance their own consumption. Deficits arise in his model because of a dynamic "common pools" problem. Lizzeri (1999) presents a model of debt as a tool of redistributive politics.

There are several papers that discuss the impact of fiscal rules, such as budget procedures and budgetary institutions.[6] Recent work has focused on understanding political

[6] See for instance, Von Hagen (1991, 1992) and Alesina and Perotti (2000).

economic consequences of debt limits. For instance, Azzimonti et al. (2015) study the effects of a "no deficit" constraint in the Battaglini and Coate (2008) model. They show that the effect is a gradual reduction in debt, and the characterize the circumstances that lead to improvement (or reduction) in voters' welfare. Piguillem and Riboni (2018) consider an extension of the Alesina and Tabellini (1990) model in which a fiscal rule can be overcome if there is sufficient consensus. Thus, fiscal rules can be viewed as bargaining chips for the groups out of power. They show that under some assumptions fiscal rules are partially effective in reducing debt, and they also lead to more "equitable" distribution of spending. Amador et al. (2006) study optimal fiscal rules in an environment in which an individual (or a government) faces a bias toward present spending. Halac and Yared (2014) extend this model to an environment with persistent shocks, and Halac and Yared (2019) study the case in which the enforcement of these rules is imperfect. In contrast to this literature, our focus is on the consequence of tightening a debt rule for total government obligations when currently powerful groups can substitute toward entitlement programs.

The dynamic public finance literature (e.g., Golosov, Tsyvinski and Werning 2006) provides a setup that is suited to the normative study of debt and entitlements, although this question has not been a main substantive focus of this literature so far.[7]

This paper is also related to work on legislative bargaining with endogenous status quo. Kalandrakis (2004) studies a classic divide-the-dollar problem where the division agreed to in one period is the status quo for the next period. Bowen, Chen and Eraslan (2014) study a model in which two parties decide unanimously how to allocate a given budget to spending on a public good and private transfers. The focus is on the comparison between two political institutions: discretionary vs. mandatory public good spending (private transfers are discretionary in both cases).[8] When the public good is discretionary (mandatory), the status quo level of the public good is zero (the one from the previous period). By contrast, we focus on the interplay between debt and entitlements.

A very different approach to understanding public debt is explored by Azzimonti et al. (2014). They propose a multi-country model with incomplete markets, and they show that governments may choose higher public debt when financial systems are more integrated. They thus offer an explanation of the rise in debt as driven by an increase in financial integration.

[7] See also Stantchveva (2014) and (2016). Regarding the latter, one could think of entitlements as promised spending on education and health.

[8] In a modified version of this model–with two periods and no private transfers–Bowen et al. (2015) allow the party making the take-it-or-leave-it offer to choose whether the public good is discretionary or mandatory. The focus is on the efficiency of the public good provision under various budgetary institutions.

3 Model

In this section we present the model. We provide a detailed discussion of the key assumptions of the model in the Online Appendix.

There are two periods.[9] There are three equal-size groups: group A, which represents a single generation that works in period 1 and is retired in period 2; group B1, the retired in period 1; and group B2, the workers in period 2. In each period, workers hold political power.

3.1 Demography and economy

In each period t, workers inelastically supply labor that produces 1 unit of output. Government spending consists of group-targeted transfers of private consumption y_i^t as well as spending on public goods g_t. This spending is financed via a lump-sum tax τ^t on the workers, and via government debt d^t (which can be negative). After taxes and transfers, the retired group in period t has an endowment of y_i^t. Workers have an endowment of $1-\tau_i^t+y_i^t$. Since after period 2 the world ends, workers in period 2 do not face an intertemporal decision. In contrast, in period 1, workers can choose to borrow or save. We assume that these workers face imperfect capital markets. Specifically, we assume that private agents face more unfavorable terms than the government. We break this assumption into two parts depending on whether we talk about borrowing or savings. Let R be the interest rate faced by the government.[10]

Assumption 1 ***Borrowing Frictions.*** *Private agents borrow at rate $R\bar{\phi}$, with $\bar{\phi} > 1$.*

Assumption 2 ***Savings Frictions.*** *Private agents returns to savings are given by $R\underline{\phi}$, with $\underline{\phi} < 1$.*

We believe that Assumption 1 is uncontroversial, that is, if agents borrow they pay higher rates than the government does.[11] This case is the primary focus of our analysis. We are more ambivalent about Assumption 2 and our main result does not rely on this assumption. However, we believe that it is still worth exploring the role of frictions on both sides of the capital market. One possible interpretation of the friction is a tax on returns to savings.[12] If both assumptions 1 and 2 hold, and in addition, $\underline{\phi}$ is low and $\bar{\phi}$ is

[9] The two-period (finite-horizon) model facilitates comparison with some of the prior work done in the literature on debt and outlines how some basic forces are changed by the presence of entitlements. In ongoing work, we study an infinite horizon extension of this model where we focus on different forces that do not arise in the two-period environment. We elaborate on this issue briefly below in our section on fiscal rules.

[10] We assume a small open economy so that this interest is exogenous to the choices of the government.

[11] It is certainly true in the data. We discuss this in Section 8 below.

[12] We discuss this issue in more detail in Section 8.

high, then agents cannot borrow or save. If, on the other hand, $\bar{\phi} = 1 = \underline{\phi}$, then agents have access to perfect capital markets. These are useful benchmark cases that we discuss in detail later.

In period 1, group A's private consumption is given by

$$x_A^1 = 1 - \tau^1 + y_A^1 - s.$$

In period 2, group A's private consumption is given by

$$x_A^2 = y_A^2 + R\phi(s)$$

where $\phi(s) = \underline{\phi}s$ if $s > 0$ and $\phi(s) = \bar{\phi}s$ if $s < 0$). From now on, whenever there is no ambiguity, we abuse notation by just writing ϕs for $\phi(s)$.

The government's budget constraint in period t is

$$g^t + y_A^t + y_B^t + Rd^{t-1} = Rd^t + \tau^t.$$

We assume that the government and individual agents borrow on the world capital market. From now on, we set $R = 1$,[13] and $d^0 = 0$. Therefore, $d^2 = -d^1 \equiv d$. We also assume no default on debt, but we revisit this assumption in Section 9.

The aggregate resource constraint in period 1:

$$x_A^1 + x_B^1 + g^1 = 1 + d - s \tag{1}$$

and in period 2:

$$x_A^2 + x_B^2 + g^2 = 1 - d + \phi s. \tag{2}$$

Finally, preferences in each period are given by:

$$u_i\left(x_i^t, x_j^t, g^t\right) = h\left(x_i^t\right) + v\left(g^t\right),$$

where $h(\cdot)$ and $v(\cdot)$ are concave, and twice continuously differentiable. We also assume that both the private and the public goods are sufficiently valuable that $h'(0) = \infty = v'(0)$, implying that it is not optimal for one group to spend all the resources on its own private good or on the public good. Utility is additive across periods and there is no discounting.

[13] This is the natural specification given that we assume no discounting. Allowing for an interest rates above the discounting factor and discounting has no qualitative effects on our results.

3.2 Political structure and entitlements

The political structure is such that group A decides the public allocation in period 1 $g^1, y_A^1, y_B^1, d, E, \tau^1$, group B2 decides the public allocation in period 2 $g^2, y_A^2, y_B^2, \tau^2$ subject to debt and entitlements, as specified below.[14]

Because taxes are non distortionary, and because the members of the group are homogeneous, although savings and consumption are private, group A's overall problem reduces to choosing the following quintuple:[15]

$$\left(x_A^1, x_B^1, g^1, d, E, s\right), \tag{3}$$

subject to the resource constraint (1). E is a nonnegative number that represents group A's entitlements in the future.[16] In period 2, group B2 chooses the triple:

$$\left(x_A^2, x_B^2, g^2\right),$$

subject to the resource constraint (2) and to the following additional constraint:

$$x_A^2 \geq E + \phi s.$$

This constraint requires group B2 to transfer to group A at least the level of entitlements (E) so that group A's private consumption is a least E plus group A's private savings. Given that group B2 does not benefit from resources transferred to group A, this constraint is always binding in equilibrium.

4 Benchmarks and Preliminary Discussion

In this section we highlight some features of the setup that are conceptually important to frame the results in this paper.

[14] In the Online Appendix we consider the consequences of allowing for some persistence in power.

[15] To be precise, the government, which is controlled by group A, chooses τ^1, g^1, d, and E under the constraint that each member of group A will allocate his endowment $1-\tau_i^1+y_i^1$ optimally between private consumption, x_i^1, and savings, s. Given that all members of group A are identical, this problem is equivalent to one representative agent of group A choosing the quintuple in (3).

[16] This assumption is discussed extensively in the Online Appendix. In the Online Appendix we also discuss a specification where group A can choose between entitlements on private or public goods. We show that there is a strong preference for entitlements on private goods, essentially because group B already has an incentive to provide some public goods. The Online Appendix also discusses the possibility of costly reneging of entitlements.

4.1 Private Savings Frictions and Ricardian Equivalence

If capital market frictions are so large that it is impractical for group A to save or borrow privately; if furthermore entitlements are absent (or restricted to equal zero): then the only way for group A to save (borrow) is by running a government surplus (debt). In this scenario our model becomes essentially equivalent to early political economy models of debt such as Alesina and Tabellini (1990) and Tabellini and Alesina (1990): it can be shown that group A runs up debt in period 1 and that public good provision decreases between periods 1 and 2.

If there are no capital market frictions ($\bar{\phi} = 1 = \underline{\phi}$), then a Ricardian-equivalence-type result arises, in the following sense. Suppose that group A selects a triple d, E, and s in order to generate a certain allocation $\left(x_A^1, g^1, x_A^2, g^2\right)$ for itself. If subsequently d was exogenously shifted to $d' \neq d$, then group A would still be able to achieve $\left(x_A^1, g^1, x_A^2, g^2\right)$ by opportunely adapting E and s. A direct implication of this observation is that debt limits are neutral in the frictionless case. Clearly, analogous considerations apply to entitlement limits if there are no frictions and debt is unconstrained.

4.2 Absent entitlements, debt limits redistribute across generations

The above Ricardian equivalence property of irrelevance of debt limits requires flexibility in choosing entitlements (and no borrowing frictions). If, for instance, entitlements are constrained to be zero, then restricting group A's ability to create debt redistributes utility from the first-period groups (A and B1) to group B2. In this sense, tightening or relaxing a debt limit can transfer utility across groups, but it cannot lead to either a Pareto-improvement or worsening. This feature is shared with early models of sovereign debt such as Alesina and Tabellini (1990) and Tabellini and Alesina (1990). In those models debt accumulation is viewed negatively from a utilitarian perspective since they allow the current group to extract resources from a group that will have power in the future. This view needs to be revisited in the presence of entitlements, as we will see below.

5 Equilibrium Analysis Without Fiscal Rules

Absent fiscal rules it is without loss of generality to set $s^* = 0$ because it is optimal for group A to neither save nor borrow (strictly optimal if there are even small saving/borrowing frictions). This is because private savings/borrowings are redundant for group A; a manifestation of the Ricardian equivalence property highlighted in Section 4.1.

We start with some definitions and preliminary analysis. We denote by c the portion of the second period budget that has already been committed (either in debt or entitlements) in period 1.

Definition 1 ***(second-period policies)*** *Define second-period policy choices conditional on a budget commitment of c as the set $X(c), G(c)$ that solves:*

$$\max_{(x,g)} h(x) + v(g) \;\; s.t. \;\; x + g \leq 1 - c.$$

$X(c)$ represents the amount of private good that the group in charge in period 2 would allocate itself, subject to the constraint that a fraction c of period 2's endowment has been reserved for other purposes. $G(c)$ represents the corresponding amount of public good.

Lemma 1 ***(well-behaved second-period policies)*** *Second period policy choices $X(c)$ and $G(c)$ are single-valued differentiable functions that are decreasing in c. Thus, increasing the fraction of the second period budget which is committed lowers private and public consumption in the second period.*

Proof. See Appendix A. ■

In period 2, group B is in power. We can use Definition 1 to describe group B's allocation choice.

Corollary 1 ***(second period equilibrium allocation)*** *Assume the second period starts with pre-defined commitments d of debt and E of entitlements. Then in period 2 group B allocates exactly E to group A's private good, allocates $X(d+E)$ in private good to itself, and allocates $G(d+E)$ to the public good.*

Given period-2 policy choices, we can move to consideration of optimal policies in the first period.

Definition 2 ***(first-period policies)*** *Define first-period policy choices as the set (x^*, g^*, d^*, E^*) that solves:*

$$\max_{(x,g,d,E)} h(x) + v(g) + h(E) + v(G(d+E)) \;\; s.t. \;\; x + g \leq 1 + d. \tag{4}$$

The four-tuple (x^*, g^*, d^*, E^*) maximizes group A's lifetime payoff. This payoff is partly accrued in period 1 (the first two addends in equation (4)) and partly in period 2 (the last two addends in equation (4)). However, in period 2 group A does not directly control the allocation; therefore, its private consumption in period 2 is given by the amount E it chose in entitlements in the first period, and its amount of public consumption is determined by whatever amount group B chooses to provide given the (uncommitted) resources available in the second period.

In what follows, we assume that $v(G(\cdot))$ is concave. This is a technical assumption that guarantees concavity of the problem faced by group A. Because $G(\cdot)$ is endogenous, it is helpful to provide sufficient conditions on the primitives that ensure the desired property. Lemma 2 in Appendix A provides these conditions.

It is easy to see that the optimal allocation is interior: group A does not fully commit period 2's budget: $d^* + E^* < 1$. The reason is that when government obligations are too high, second period public good provision becomes very small, and the high marginal utility of public consumption requires that this provision stay bounded away from zero.

The next Proposition and the discussion that follows highlight some key properties of the equilibrium of the model when entitlements are allowed.

Proposition 1 *In equilibrium, total government obligations are always positive and larger than in the case without entitlements; however, equilibrium debt is lower than in the case without entitlements:* $d^* + E^* > d^*_{E=0} > d^*$.

Proof. See Appendix A. ■

Consider the proposition in light of the important literature that has highlighted the role of debt as an instrument to leverage temporary power (e.g., Alesina and Tabellini 1990, Tabellini and Alesina 1990, Persson and Svensson 1989).[17] If, consistent with this literature, entitlements were left out of our model (i.e., implicitly set to zero), Proposition 1 indicates that the equilibrium level of debt would be larger than if entitlements were accounted for by the model. That is, by abstracting from the presence of entitlements, there is a risk of over-estimating the amount of debt that is created in an effort to take advantage of temporary power.

Furthermore, in a model with both debt and entitlements, debt can even be negative, i.e., group A may choose to run a surplus; for example, if $h(x)$ and $v(g)$ have a CRRA form, with $h(x) = (x)^{1-\rho}/(1-\rho)$, and $v(g) = \alpha(x)^{1-\rho}/(1-\rho)$ then group A runs a surplus if and only if $\rho > 1$.[18]

Proposition 1 also highlights that a model that abstracts from entitlements would underestimate the total level of government obligations (i.e., the sum of debt and entitlements). In our model, both types of government obligations arise because group A anticipates its lack of political control in period 2 and understands that a fraction of any uncommitted dollar will be diverted from public consumption to group B's private consumption. Absent entitlements, the only way to pre-commit period 2 dollars is to consume

[17] This determinant of debt is a major component of recent developments in the political economy theory of public debt (see, e.g., Battaglini and Coate 2008, Battaglini 2011, and Azzimonti et al. 2015).

[18] We show this result formally in the Online Appendix (see Proposition 7 part 3). We also wish to emphasize that the possibility of surplus is not of interest in itself. We view it as a useful contrast with the no entitlement benchmark. Of course, surplus is also a possibility in other political economy models of debt (e.g., Persson and Svensson 1989). However, this is due to differences in the utility functions between groups.

them today (by issuing debt). But, due to the concavity of the utility function, group A would prefer to allocate (at least some of) these period 2 dollars to its private consumption in period 2. This is exactly what entitlements allow group A to do. This additional commitment channel raises the value of committing period 2 dollars and therefore leads to larger government obligations.

To understand the intuition of these results, it is useful to consider the two key first-order conditions that determine debt and entitlements. They are obtained by differentiating the objective function (4) with respect to E and d respectively:

$$h'(E) = -v'(G(d+E))\,G'(d+E), \tag{5}$$

$$h'(x) = -v'(G(d+E))\,G'(d+E). \tag{6}$$

These equations illustrate the different roles of debt and entitlements. Group A uses debt to smooth consumption over time and entitlements to smooth consumption over types of goods in period 2. If group A were in charge in both periods, then the term $G'(d)$ would not appear. This term captures the fact that an extra dollar left uncommitted to period 2 only increases public consumption by $|G'(d)| < 1$, the marginal amount chosen by group B, with the remainder going to group B's private consumption. We call the presence of this term the *crowdout effect*. As in the model without entitlements, the crowdout effect gives an incentive to increase government obligations. There is also a *smoothing effect* that works as follows: because of concavity in the utility function, group A wants to smooth consumption over time. Because public consumption is smaller in period 2, then, in a model without entitlements, the smoothing effect gives an incentive to decrease debt. The presence of entitlements increases the importance of the smoothing effect in determining total obligations, but it has a more complicated effect on how it affects the distribution of these obligations between debt and entitlements. The balance of the crowdout effect and the smoothing effect determines the equilibrium level of debt and entitlements.

To illustrate more explicitly how the crowdout effect and the smoothing effect balance to produce equilibrium debt and entitlements, we discuss two examples with CRRA preferences (that is, $h(x) = (x)^{1-\rho}/(1-\rho)$ and $v(x) = \alpha h(x)$). First, let us consider a low value of $\alpha = .5$, which represents an environment with relatively high distributive conflict since the value of public consumption is relatively low. Figure 1 shows how equilibrium magnitudes vary with ρ, and contrasts them with the case in which entitlements are exogenously set to zero.

Consider first the case without entitlements. The dashed red line depicts equilibrium debt when entitlements are not allowed. In this case, debt is always positive. When $\rho \to 0$ (to the limiting case of linear preferences), the conflict among the two groups becomes extreme because group B would spend the entire budget on its private consumption,

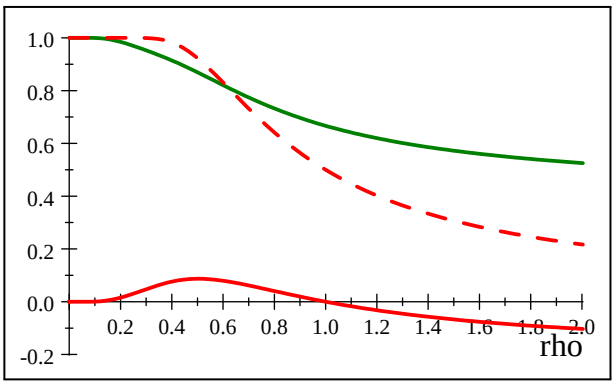

Figure 1: Entitlements (Green); Debt with entitlement (Plain Red); Debt without entitlements (Dashed Red).

leaving nothing for the public good. The crowdout effect is thus maximal, and group A chooses maximal debt. As ρ increases, the smoothing effect starts to matter more and more and it become more important to devote resources to second period public consumption, so debt falls.

Suppose now that entitlements are allowed (represented by the solid lines). Just as in the case with no entitlements, when $\rho \to 0$ there is an extreme conflict of views in period 2 and the crowdout effect is maximal. However, the consequence is very different: in the limit there is no debt and full entitlements. Entitlements are a superior way to capture the second period resources as long as $\rho > 0$. Just as before, when ρ increases the smoothing effect implies that it becomes more desirable to devote part of the budget to the public good, so entitlements drop. Debt responds non-monotonically to an increase in ρ. While resources become available for the public good over both periods, the amount invested in the public good is different in the two periods; for low values of ρ, the crowdout effect dominates, and for high values of ρ the smoothing effect dominates.

Second, let us consider a case with relatively low conflict, i.e., $\alpha = 1.5$, which is shown in Figure 2. When $\rho \to 0$, there is essentially no conflict between groups because group B spends the entire budget on the public good. Thus, in this case, the optimal debt (entitlements) level goes to zero as ρ goes to zero. When ρ increases, conflict starts mattering, but the effect differs for debt and entitlements. For debt, the crowdout effect first dominates so debt rises until it is overtaken by the smoothing effect and debt drops. For entitlements, both effects pull in the same direction. Because group B starts allocating resources to its private consumption, the crowdout effect pulls entitlements up. Because of the change in the concavity of the utility function, group A wants to balance private and public consumption more in period 2. Given that we start from zero private consumption (and full public consumption), this requires an increase in entitlements.

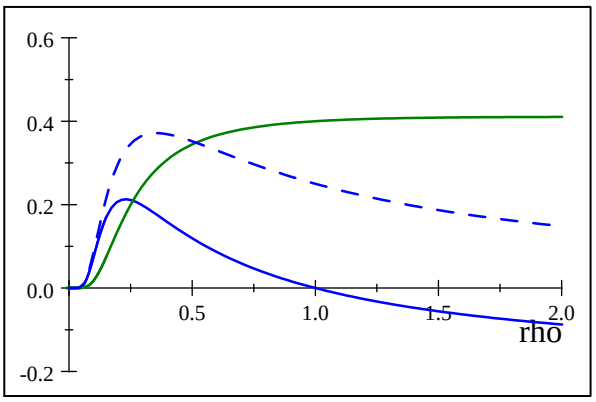

Figure 2: Entitlements (Green); Debt with entitlement (Plain Blue); Debt without entitlements (Dashed Blue).

6 Fiscal Rules

We now discuss the consequences of fiscal rules for equilibrium allocations and for the welfare of the three groups in our economy. We begin by discussing debt limits, then we consider limits to entitlements. Finally, we discuss limits to the overall level of government obligations.

Debt limits restrict group A's policy space in period 1. Therefore, tightening a binding debt limits cannot improve, and will generally reduce group A's period-1's payoff, and also its overall utility. Moreover, group B1's utility must also decrease as a debt limit is tightened because group A, being "poorer" chooses to provide a lower level of public good in period 1. Regarding group B2, a naive intuition suggests that this group should benefit from the protection provided by debt limits. We show in this section that this is not necessarily the case and that the welfare of group B2 depends on the existence of capital market frictions.

Group B2's utility is a decreasing function of total obligations $\overline{d} + E\left(\overline{d}\right)$, where $\overline{d}$ is a binding debt limit. Tightening $\overline{d}$ reduces the marginal cost of entitlements because it frees up resources in period 2, so group A optimally responds by increasing entitlements. Since debt is strategically replaced by entitlements, the combined effect of a debt limit on total obligations can be ambiguous.

To appreciate this ambiguity, consider the extreme but important benchmark of no financial frictions ($\bar{\phi} = 1 = \underline{\phi}$). In this case, forcing a reduction in debt by ϵ will cause young generation A to increase both its entitlements and private borrowing by exactly ϵ, such that young generation A's private and public consumption levels, and indeed all agent's consumption levels in both periods, are unchanged in equilibrium. Thus, tightening a debt limit results in a combination of less government debt, more entitlements, and more

private borrowing.[19]

Consider next the other extreme case in which credit market frictions are sufficiently high that group A is at a corner in its borrowing decisions, choosing not to borrow at all. Then it can be shown that debt ceilings are partially effective, i.e., tightening a binding debt ceiling $\overline{d}$ reduces $\overline{d} + E\left(\overline{d}\right)$. The intuition for this result is the following. Suppose that, in response to the tighter debt ceiling, group A increased entitlements to keep total obligations $\overline{d} + E\left(\overline{d}\right)$ constant. Then, the marginal cost of obligations, given by the reduction in public consumption in period 2, is unchanged. However, the marginal benefit of these obligations is now lower: since the debt limit was already binding, group A's preferred composition of obligations favored transferring resources toward first period consumption. Thus, increasing private consumption in the second period, which is the effect of increased entitlements, has lower marginal benefit for group A. Restoring second period optimality requires reducing total obligations.

We now consider the case in which capital market distortions are at an intermediate level, so that, given a binding debt limit, group A chooses to borrow in equilibrium. We show that, in fact, government obligations *increase* as a consequence of a tightening of the debt limit. A direct consequence of this result is that, in this case, all groups suffer when debt limits are tightened.

Proposition 2 *Assume assumption 1 and a binding debt limit $\overline{d}$ tight enough that group A chooses to borrow in equilibrium.*[20] *Then, total government obligations inherited by group B2 are decreasing in $\overline{d}$, and so tightening the debt limit harms group B2 as well as harming groups A and B1.*

Proposition 2 identifies a Pareto-harmful effect of debt limits. This is a novel effect relative to the existing literature, which views debt limits as constraints on the ability of temporarily-powerful group to expropriate future generations. This novel effect arises due to the presence of entitlements.

[19] There is one caveat to this irrelevance result on debt limits. In an infinite horizon economy, even when there are no capital market frictions, if debt accummulation motives are very strong, there can be an effect on debt limits. We explore these effects in ongoing work.

[20] The proposition requires that group A finds it optimal to borrow a positive amount privately in period 1, in addition to issuing government debt. This condition can be expressed in closed form in the Constant Relative Risk Aversion (CRRA) case where $h(x) = (x)^{1-\rho}/(1-\rho)$ and $v(x) = \alpha h(x)$. (The parameter $\alpha > 0$ captures the value that all groups place on public consumption.) With these preferences, the condition can be shown to be:

$$\overline{d} < \frac{\left(1+\alpha^{\frac{1}{\rho}}\right)\left(\left(\frac{1}{\phi}\right)^{\frac{1}{\rho}} - \left(\frac{\alpha^{\frac{1}{\rho}}}{\alpha^{\frac{1}{\rho}}+1}\right)^{\frac{1}{\rho}}\right) - 1}{\left(1+\alpha^{\frac{1}{\rho}}\right)\left(\left(\frac{1}{\phi}\right)^{\frac{1}{\rho}} + \left(\frac{\alpha^{\frac{1}{\rho}}}{\alpha^{\frac{1}{\rho}}+1}\right)^{\frac{1}{\rho}}\right) + 1}.$$

The intuition for why total government obligations increase in response to a tightening of debt limits is as follows. Suppose that, in response to a tightening of the debt ceiling by ϵ, group A responded by borrowing ϵ more and increasing entitlements by ϵ. This operation keeps generation A's period-1 private consumption unchanged, but its period-2 private consumption would decrease because they would have to repay $\overline{\phi}\epsilon > \epsilon$. Thus, group A has an incentive to raise entitlements by more than ϵ to partially offset this reduction. Such an increase in future entitlements more than offsets the debt reduction.

Another way to develop an intuition for the logic of Proposition 2 is to consider a really stripped down problem in which entitlements and savings are kept constant, so that group A only chooses debt. However, we assume that the debt ceiling is soft. Specifically, assume that generation A can choose to borrow more than the debt ceiling, but in such a scenario, it needs to pay an extra interest, $r > 0$. Thus, if group A issues a level of debt d which is $d - d_\ell$ units above the debt ceiling d_ℓ, the reimbursement in period 2 is $d_\ell + (1 + r)(d - d_\ell)$. These resources do not benefit anybody in the economy.

This simpler problem allows us to highlight the key feature underlying our main result: a tightening of the debt limit leads to a Pareto deterioration when it increases the marginal cost of intertemporal consumption smoothing.

Remark 1 *Fix a binding (but soft) debt limit d_ℓ. Then the equilibrium debt level, $d(d_\ell)$, is increasing in d_ℓ, but total government obligations inherited by group B2, $d_\ell + (1 + r)(d - d_\ell)$, are decreasing in d_ℓ. Hence, tightening the debt limit harms all groups.*

We prove this remark in Appendix B (see Proposition 5).

The intuition for this result is as follows. Suppose that the equilibrium debt level prior to the tightening of the soft debt limit is d^*. A debt limit $d_l < d^*$ increases the marginal cost of debt d in the range $[d_l, d^*]$. This leads group A to reduce the debt level. This reduction, of course, reduces the total cost of obligations in period 2. However, this reduction cannot be so large that $d_\ell + (1 + r)(d - d_\ell) < d^*$, i.e., below the original debt level. Otherwise group A would wish to increase debt because the marginal benefit of debt in period 1 is unchanged by the debt limit.

We now consider the possibility of entitlement limits $\overline{E}$ and discuss the consequences for total government obligations $d\left(\overline{E}\right) + \overline{E}$. As for the case of debt limits, there are three cases depending on the severity of credit market frictions. Absent financial frictions, entitlement limits have no effect on total obligations because debt and savings adjust to restore the pre-existing allocation. If frictions are very severe, then entitlement limits are partially effective: total obligations fall when entitlement limits are tightened. However, in this case, the consequence of an entitlement limit is a reduction of private consumption for group A in period 2 and an increase in private and public consumption in period 1. Therefore, in contrast to the case of debt limits with severe credit market frictions, both

groups B1 and B2 can benefit from a tighter entitlement limit. The next result presents the mirror image of Proposition 2 for the case of entitlement limits when capital market frictions are intermediate, and group A actively saves in equilibrium.

Proposition 3 *Assume assumption 2 and a binding entitlement limit $\overline{E}$ tight enough that group A chooses to save in equilibrium.*[21] *Then, total government obligations inherited by group B2 decrease in $\overline{E}$, and first period spending on the public good increases in $\overline{E}$ so tightening the entitlement limit harms group B1 and B2 as well as harming group A.*

The logic for the perverse effect of tightening entitlement limits on the total level of government obligations is almost the same as for Proposition 2.

Most of the discussion of fiscal rules so far has relied on the substitution between entitlements and debt when the use of one of these tools is restricted. This suggests that the most effective way to limit the fiscal burden on group $B2$ is to restrict the overall level of government obligations directly. Leaving aside potential concerns of enforceability of such limits, it is correct that these limits would be effective in our model. Such limits would have a straightforward intergenerational redistributive effect along the lines of debt limits in the Tabellini and Alesina model, as discussed in Section 4.2.

7 Preference polarization

Tabellini and Alesina (1990) provide conditions under which polarization of preferences for public policy leads to an increase in debt. In our context, this same polarization can be modeled as a decreased valuation for the public good compared to private goods. The idea is that, as preference polarization increases, there are fewer goods whose enjoyment society as a whole shares.[22] To model polarization we introduce a parameter α that governs how much, within each cohort, everyone likes the public good relative to the private goods.

We focus on the case of CRRA preferences where preferences for private consumption are given by $h(x) = (x)^{1-\rho}/(1-\rho)$ and $v(x) = \alpha h(x)$. The parameter α captures the value that all groups place on public consumption, and lower values of α imply more disagreement over the distribution of resources since both groups wish to shift consumption toward their private good.

[21] In the CRRA case, the condition that guarantees positive savings can be shown to be:

$$\overline{E} < \frac{2\underline{\phi}^{\frac{1}{\rho}}}{\left(1+\alpha^{\frac{1}{\rho}}\right)\left(1+\left(\frac{\alpha^{\frac{1}{\rho}}}{\alpha^{\frac{1}{\rho}}+1}\right)^{\frac{1}{\rho}}\right)+\underline{\phi}^{\frac{1}{\rho}}}.$$

[22] For example, an increase in income inequality might cause the young rich and the young poor to diverge in the type of goods that they prefer.

For the purposes of this discussion we assume that there are no fiscal rules, and hence, as in Section 5, savings and borrowings are optimally zero.

Proposition 4 ***(growth in debt and entitlements)*** *Suppose* $h(x) = (x)^{1-\rho}/(1-\rho)$ *and* $v(x) = \alpha h(x)$, *where* $\alpha > 0$ *is a parameter that captures the degree of redistributive conflict. Then, as* α *decreases: for* $\rho < 1$ *(respectively:* $\rho > 1$*), debt and entitlements increase jointly if and only if* α *is smaller (respectively: larger) than* $\left[\frac{\rho^{\frac{\rho}{1-\rho}}}{\left(1-\rho^{\frac{\rho}{1-\rho}}\right)}\right]^{\rho}$.

Proof. See Appendix C. ■

A reduction in α has the following effects on debt and entitlements. As α falls, there is a direct effect of a reduction in the value that group A places on public consumption. This is a force in favor of increasing debt and entitlements because both can lead to increases in private consumption for group A. Of course, the reduction in α also reduces group B's value for public consumption, implying that group B contributes less to the public good in the second period both in total and at the margin, changing both the crowdout and the smoothing effects. A larger crowdout effect also pushes toward an increase in debt and entitlements. However, the smoothing effect can become larger pushing in the opposite direction. Figure 8 in Appendix C illustrates the region of parameters for which debt and entitlements increase with conflict.[23]

This proposition can be contrasted with Alesina and Tabellini (1990). In their model, an increase in disagreement always leads to an increase in debt. Absent entitlements, our model delivers the same result. When entitlements are endogenous, the results are more subtle: entitlements always increase with conflict, but this is not always the case for debt.

8 Empirical Relevance

This section aims to demonstrate that the main forces featured in our model have a significant counterpart in the real world.

[23] We have also considered two other ways to define increasing intergenerational conflict. First, we have considered a case in which α decreases over time in the same way for both groups. In this case we have shown that debt and entitlements increase with conflict for all values of ρ. Second, we have considered a case in which α is smaller for the new generation: group B has lower α than group A. In this case there is always comovement between debt and entitlements, but debt and entitlements increase in conflict if and only if $\rho < 1$. Interestingly, the latter version of the model is close to the model used by Persson and Svensson (1989) to study debt. For the case without entitlements we can replicate their results in our version of the model.

8.1 Fiscal rules increasingly prevalent

Our main results concern the (sometimes counterintuitive) effect of fiscal rules. This subsection documents that fiscal rules are increasingly prevalent, in the U.S and round the world. Figure 3 reports the number of countries with a fiscal rule. Figure 4 provides a summary of the features of fiscal rules in U.S. states. Typically, these fiscal rules do not explicitly constrain entitlements.

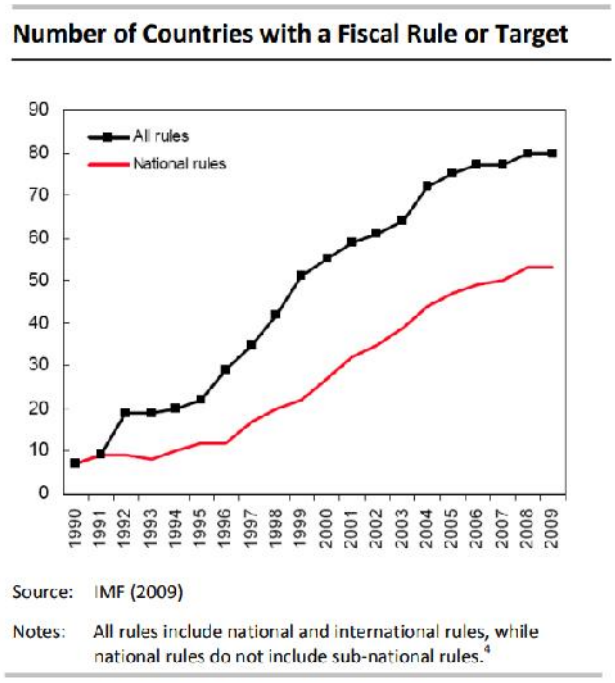

Figure 3: After 1990: number of countries with a fiscal rule is increasing. Reproduced from Tapp (2010, Figure 2.1).

One could of course question whether these fiscal rules are effective in reducing deficits. No doubt, some are not. For instance, the U.S. congress routinely raises its self-imposed debt limit. However, several studies document the effectiveness of some fiscal rules, and the IMF places a lot of importance on these rules. Regarding Europe's Stability and Growth Pact (SGP), Koehler and Konig (2015, p. 20) find that "the aggregated level of debt for the euro 11 countries is significantly lower than the level we would have observed without the introduction of the euro and the working of the SGP." Further evidence of the fact that the SGP affected member countries' behavior, Caselli and Wingender (2018) show evidence of "bunching" around the 3% threshold after its introduction.

Smith and Hou (2013) study over 50 years of US states expenditure, and find that certain balance budget requirement provisions are effective in reducing deficits. This finding agrees with Bohn and Inman's (1996) seminal study.

While we do not explicitly model the adoption of fiscal rules, our welfare analysis

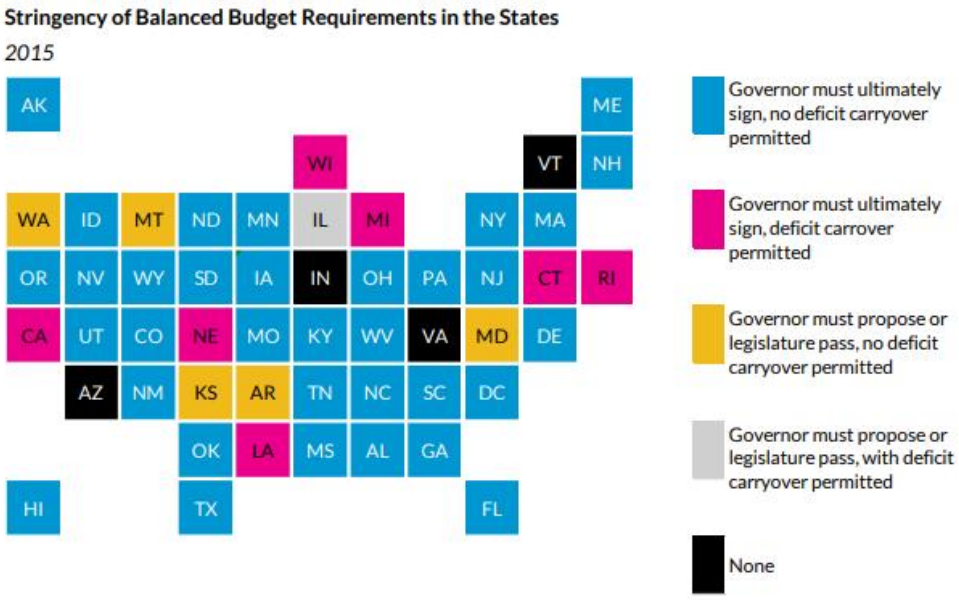

Figure 4: Most US states have balanced-budget requirements (in blue). Reproduced from Randall and Rueben (2017, Figure 11).

nonetheless speaks to the issue of endogenous adoption. In particular, we find that, for some values of the parameters, citizens' opposition to debt limits increases when capital market frictions increases. This in line with the findings of Altunbas and Thornton (2015) and Elbadawi et al. (2015): there is a positive correlation between the financial market developments and the adoption of debt limits.

8.2 Fiscal rules met by increasing future unfunded obligations

In our model, if fiscal rules are tightened, it is optimal for today's government to increase entitlements (future unfunded government obligations). In this section we provide support for this theoretical prediction.

Casey (2014) documents that when the European SGP became more binding for member states (during the financial crisis), it caused them to de-fund pensions (in our language, to increase entitlements). This phenomenon was prophesized by Schick (2005, p.109), who wrote that "fiscal rules [...] are not attuned to long-term issues [... and] may spur some stressed governments to engage in budgetary legerdemain which improves the medium-term outlook at the expense of the country's long-term fiscal health." Beetsma and Oksanen (2007) and Banyár (2017) link this effect on pension systems to a specific feature of the SGP: "[...] it only deals with explicit government debt and ignores implicit debt." (Banyár 2017, p.45); in our language: the SGP ignores entitlements to solely focus on debt. This is so even if the 2005 reform of the SGP has increased the importance of

the long-term sustainability of a country (and thus pension systems) in the terms of the Pact.[24] The increased awareness of these long-term sustainability issues has also led the European Commission, in 2009, to develop a forward-looking measure of fiscal sustainability, the "intertemporal net worth," that captures government obligations much more broadly than simple measures of debt.[25]

A related point can be made by looking at the United States, where states with more-stringent fiscal rules have a lower funded-ratio of pensions and a higher level of pensions liability per state resident (in our language, a higher level of entitlements). Chaney et al. (2002, p. 287) study the relation between the stringency of balanced budget rules (BBR) and the extent of underfunding problem for state pensions.[26] The conclusion of their empirical analysis is that "fiscally stressed states that are required to balance their budgets both underfund their pensions and select discount rates which obscure the underfunding." Similarly, Wang (2017) finds that "states with stricter balanced budget requirements and debt limits had a lower pension funded ratio." As Chaney et al. (2002) discuss, a key issue is that fiscal rules do not address entitlements.[27] Even worse, "Governmental accounting practices contribute to states' ability to use pension funds in this manner [i.e., to balance their budget]." (Chaney et al. (2002, p. 307).

8.3 Relevance of capital market frictions

Our analysis of the effect of a fiscal rule relies on the assumption of capital market frictions. This type of assumption underlies a vast literature in finance and macroeconomics (see e.g., the survey by Brunnermeier et al. 2013 and Kaplan and Violante 2014). Various forms of these frictions have been amply documented. In our setting, we can break down this assumption into two parts depending on whether we consider borrowing frictions or savings frictions.

For the analysis of debt limits, the relevant market frictions concern private borrowing: there is an unfavorable wedge between the interest rate on private debt and the one on public debt. We view this assumption, which is common in the literature (see, e.g., Cocco et al. 2005, Davis et al. 2006, Livshits et al. 2007, Huo and Rios-Rull 2016, Chatterjee et al. 2016), as uncontroversial in the sense that it is clearly satisfied for the vast major-

[24] This issue about PAYG pension systems and their reform was recognised by the European Council and was one of the drivers of the 2005 reform of the SGP (see, e.g., Daniele et al. 2017 for more details).

[25] Intertemporal Net Worth is based on the total discounted sum of future primary balances under current policies and current net worth. This measure suggests that assessing the fiscal burden via debt only and ignoring entitlements not only severely understates the problem but can also bring about misleading inferences about the relative burden across countries. For instance, according to some of these measures the EU country in the best state of fiscal health is Italy, despite its extremely high level of government debt. See also the discussion in Velculescu (2010).

[26] The correlation between these variables is -0.249.

[27] This is also understood by journalists: "Governmental accounting, you see, simply counts formal government debt, it ignores *unfunded* governmental promises" (The Wall Street Journal, 1997, p. A18).

ity of individuals and governments. In the US, there is a clear positive spread between the interest rate on government bonds and various type of private credit instruments: credit cards (Stango and Zinman 2016, Galenianos and Gavazza 2019), automobile loans (Grunewald et al. 2019), and mortgages (Justiniano et al. 2017). For other countries, see, e.g., Alesina et al. (1992) and the "risk premium on lending" measure from the International Monetary Fund.[28] As stated by Cuadra et al. (2010, p. 453): "The empirical literature also documents that the cost of public debt generally represents a floor for the cost of private borrowing." One potential explanation is that in most countries, sovereign default is much less frequent than private default. The government can indeed handle risk more efficiently than the private sector by pooling many projects and spreading the risk over many taxpayers (see, e.g., Arrow and Lindt 1970). It can also avoid default by taxing citizens; a recourse which is not available to private citizens.

For the analysis of entitlements limits, the relevant market frictions concern private savings. One possible reason is that most governments tax returns on private savings (see, e.g., OECD 2018). Moreover, in some countries with weaker institutions, private investments face risks of theft and/or expropriation by either the government or, sometimes through the government by powerful groups.[29] Regarding savings for retirement, capital markets do not always offer the financial products pension funds require: long-term fixed income assets and annuities (see the discussion in OECD 2005).

8.4 Entitlements, savings, and frictions

In our model, there are two key predictions related to savings: 1. The promise of an increases in entitlement leads consumers to save less. This is a Ricardian equivalence-type result. When there are financial frictions, our model predicts that the offset is only partial. 2. Entitlements grow larger in equilibrium if private savings are subject to higher frictions. In this Subsection we discuss evidence pertaining to these two predictions of the model.

Regarding the first prediction, there is a large literature seeking to estimate the offset between public and private savings, and the estimated offset varies depending on the time frame. Based on aggregate US time-series data, Feldstein (1974) concluded that "social security substantially depresses personal savings." Cutler and Gruber (1996) report similar crowding out for health insurance. Roehn (2010) reviews the literature and says that

[28] https://data.worldbank.org/indicator/FR.INR.RISK

[29] There are many cases of expropriation of savings by the governemnt. It could be of general savings (as in the case of Cyprus in 2013, https://www.investors.com/politics/editorials/expropriating-cyprus-private-insured-deposits-is-eu-overreach/), or directly targeted at pension savings (as in the case of Argentina in 2008 https://www.nytimes.com/2008/10/22/business/worldbusiness/22argentina.html). For data about the risks of expropriation see, e.g., the Property Right componen of the Heritage Foundation Economic Freedom Index or the Expropriation Risk Index from the Credendo Group. For a theoretical discussion of of the incentives of governments, see, e.g., Chassang and Padro-i-Miquel (2010). In developing countries land reform is an example of expropriation by politically powerful groups. See for instance, Ntsebeza, L. and R. Hall (2007) on South Africa, Guo (2001) on China, and Alston et al. (2000) on Brazil.

"Estimates of the offset for OECD countries range from 0.1 to 0.5 in the short run to about 0.3 to as much as 0.9 in the long run." Overall, the literature supports a partial offset.

The second prediction suggests that exogenous variation in financial development should impact the development of the welfare state. Cutler and Johnson (2004, p. 88) point to this effect as a possible explanation for their findings: "In our study of the creation of social insurance, we find the most evidence for a negative effect of the level of per capita GDP, that is, the opposite of Wagner's Law. This reflects the fact that some of the richer countries in our sample were particularly late in adopting social-insurance institutions, such as the United States. Our interpretation is that in richer countries, where private capital markets are more developed, there is less need for and greater private opposition to the introduction of state insurance systems."

The creation of state pensions in Great Britain is a historical case study that illustrates how increasing savings frictions contribute to the creation of entitlements. The landmark Old Age Pensions Act of 1908 created state pensions financed by general taxation.[30] Before 1908, retirement savings were channeled through working-class provident institutions and "Friendly Societies:" private cooperatives that collected contributions and provided sickness insurance, death benefits, usually medical care, and occasionally a small pension, to their members. These institutions numbered almost 24,000 in 1898, with 4.2 million members (Gilbert 1965, p. 552). According to Boyer and Schmidle (2009, p. 255) "probably somewhere between 33 and 40 per cent of adult males were eligible to receive a small 'pension' from a friendly society or trade union when they were no longer able to work." But, "by the end of the nineteenth century, many of these societies were in a precarious financial condition," (Gilbert 1965, p. 551) due to increasing longevity and to competition for members among provident institutions. At the same time, young men grew reluctant to join the societies at all (Gilbert, p. 554). Despite being seriously troubled, the leadership of provident societies opposed the creation of state pensions out of fear of unfair government competition. But finally their resistance was overcome in 1908 and, by 1911, the majority of provident societies were folded into the state pension system (Jones 1984, p. 327). We read this historical event as a case study in which increasing financial frictions to private savings for retirement grew exogenously (because the Friendly Societies were mismanaged) and, as a result, a new entitlement was created by the state to replace frictional private savings.

[30] This was viewed as a revolutionary entitlement because it was "gender-blind, redistributive, and [...] represented social reform as socialists sought it," and also because, as Prime Minister Lloyd George put it, it was "incomplete ... purely the first step." (Macnicol 2002, p. 163).

8.5 Entitlements crowd out public good provision

In our model, entitlements crowds out public good provision. In this section we propose suggestive evidence in support of that theoretical prediction.

As illustrated in Figure 5, in the U.S. entitlements have grown rapidly since the 1960s and have overtaken discretionary spending, suggesting that entitlement programs must be crowding out other types of government spending such as, perhaps, infrastructure and R&D spending.[31]

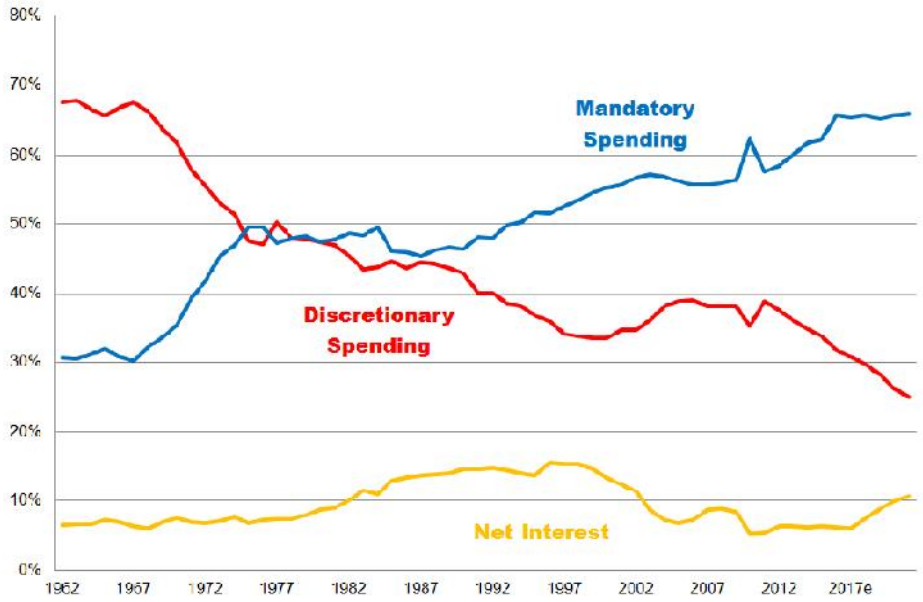

Figure 5: Evolution of U.S. Federal Government Expenditurs by type, 1962-2017e. Data Source: U.S. Office of Management and Budget 2015; Budget of the United States Government, Fiscal Year 2015: Historical Tables, 2014, Table 8.4.

A similar pattern in the growth of entitlements, and thus in possible crowding out, holds across OECD countries.[32]

8.6 Joint growth of debt and entitlements

In most OECD countries, fiscal pressure has been ratcheted up by the *simultaneous growth* in debt and entitlements since the mid 1970s.[33] Our model sheds some light on this co-evolution.

Our model highlights the relevance of a factor that has been previously identified as a determinant in the growth in debt over the same period (see Yared 2019), namely: the

[31] See also the footnotes 1 and 2 in the Introduction.

[32] Defined as public social expenditure as a percent of GDP in 1960-2014. Source: OECD (2014).

[33] For the U.S., see, e.g., U.S. Office of Management and Budget 2015; Budget of the United States Government, Fiscal Year 2015: Historical Tables, 2014, Tables 1.2 and 8.4.

polarization of advanced economies. As shown in Figure 6 that growth in polarization started in the mid 1960s. Our model predicts that an increase in polarization may lead to an increase in both debt and entitlements.[34]

Polarization and Fractionalization in the Legislature in Advanced Economies

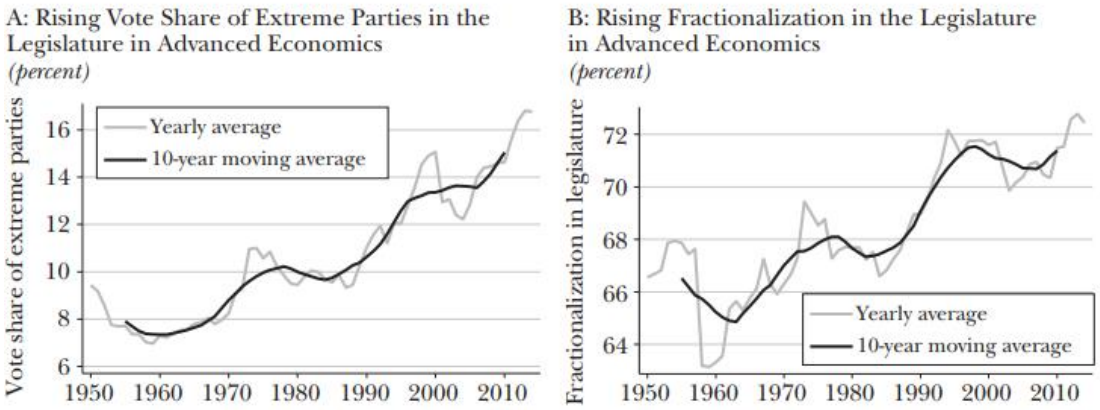

Figure 6: Reproduced from Yared (2019, Figure 4).

Given that entitlements crowd out savings in our model, another prediction is that savings should have decreased over the same time period (or borrowing should have increased). This is what Dynan and Kohn (2007) documents for the US (see Figure 7).[35]

8.7 Government credit ratings reflect both debt and entitlements

Our baseline model does not allow for government default.[36] However, intuitively one can relate government solvency to the size of its obligations. Since in our model these are the sum of debt and entitlements, intuitively our model predicts that government credit ratings should depend on both debt and entitlements. In this section we marshall support for this evidence.

Regarding US states, Killian et al (2016) report that "between 2010 and 2013, Moody's Investors Service downgraded the credit ratings of six states due largely to growing pension liabilities." Martell et al. (2013) reviews the funding status of US state-administered pension plans and their impact on state credit quality. They find that "As the fund ratio

[34] Our model also excludes some potential explanations for this joint growth. The strategic substitute property between debt and entitlements highlighted in our model indicates that the comonotonicity of debt and entitlements cannot be explained by a factor that only affects one of them since this would cause them to evolve in opposite directions. This excludes, for instance, the possibility that this joint growth is due to the "mechanical" and positive effect of population aging on payout due to pre-existing payment formulas. In order to see this, assume that there is a mechanical increase in entitlements due to population aging. In this case, group A should be less willing to use debt. We discuss this topic formally in the Online Appendix.

[35] See also the discussion in Zinman (2015).

[36] We discuss the issue of default in the next Section.

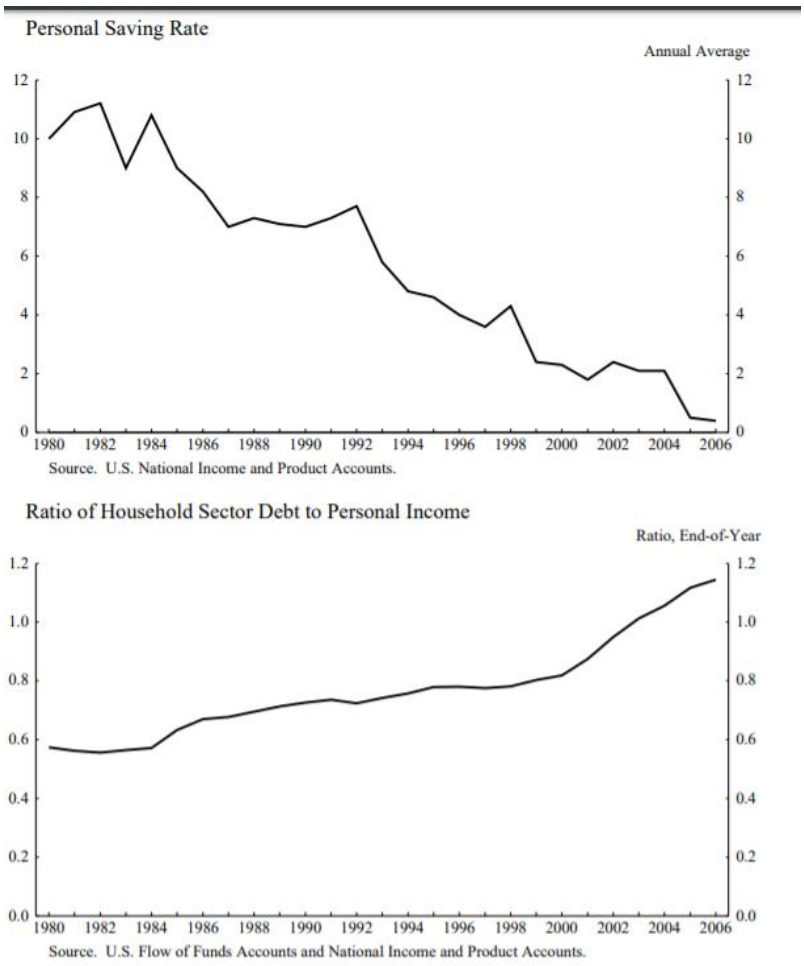

Figure 7: Reproduced from Dynan and Kohn (2007, Figure 1).

(actuarial assets/actuarial accrued liability) of state-administered pension plans decreases, states are more likely assigned a lower rating." For US cities, Benson and Marks (2016) report that "the level of pension funding is strongly related to the credit rating on municipal debt."

9 Allowing for Default

In our model we assume that there is no default on either debt or entitlements. This assumption is in line with most of the prior literature on the political economy of debt. However, a novel question arises in our context: the possibility that default may impact debt and entitlements differentially. This is a rich question with many possible angles. For instance, an important difference between debt and entitlements arises because debt is partly owed to outsiders (sovereign debt), while entitlements are only "owed" to a specific group of voters. This difference potentially generates different political incentives

to default. We believe that this is an important difference, and we plan to purse it in follow-up work. Yet, it requires a major departure from the model that we have worked with so far. Tabellini (1991) also points out that there is an additional potential difference among the coalitions supporting default, even if he focuses on domestic debt and does not focus on the comparative statics of default.

Here we discuss some preliminary analysis of the consequences of default for the size of debt and entitlements. To fix ideas, let us begin by assuming that there are exogenous probabilities δ and η with which debt repayments and entitlement payments are reduced by a fixed amount λ (the default size). In equilibrium, for investors to be willing to lend, the interest rate on debt has to be adjusted to reflect this probability of default. This, of course, affects the willingness of group A to take on debt. This market discipline effect is absent in the case of entitlements. In fact, we believe that we can construct scenarios in which debt decreases with the probability and size of default, while entitlements are increasing in the same quantities. Note that these are statements about the effect of default on one given obligation–say entitlements–on the endogenous size of that obligation. The effect of an increase in the default probability for entitlements on the equilibrium size of debt is complex and may well be positive: if lenders expect pensions to be reduced, they may be more willing to lend.

A richer model of default incorporates an endogenous default response by group B2 to the size of debt and entitlements. A particularly simple way to do this is to assume that there is a default technology for debt $F\left(d, d^r, I^r\right)$ and one for entitlements $H\left(E, E^r, I^E\right)$. These reflect the cost for group B2 to change the amount of debt (entitlements) from d to d^r (E to E^r). In order to introduce uncertainty about these possibilities, we could add some shocks to the size of the endowment available in period 2. In turn group A may, at some cost, build institutions I^E and I^d in period 1 that raise the cost of defaulting on these promises in the subsequent period. We conjecture that in equilibrium, group A would over-entitle itself relative to the target level of desired entitlements and build institutions to protect debt and entitlements in anticipation of partial default on both.

10 Conclusions

Entitlements are a key determinant of fiscal sustainability beyond the level of sovereign debt. Despite the policy relevance of entitlements, the political economy literature has not yet focused on the interplay between debt and entitlements. And yet there is a lot we can learn from taking a closer look at the interplay between these two different government obligations.

In this paper we have presented a very simple politico-economic model where entitlements and debt are jointly determined. The main findings are the following. First,

the presence of endogenous entitlements dampens the incentives of politically powerful groups to accumulate debt, but it leads to an increase in total government obligations. Second, fiscal rules can have perverse effects: if entitlements are unconstrained, and there are capital market frictions, debt limits robustly lead to an increase in total government obligations and to a Pareto-deterioration. Analogous results hold for entitlement limits if debt is unconstrained. This finding points to the importance of fiscal rules that constrain both debt and entitlements. Third, our model sheds some lights on how capital market frictions affect the incentives of governments to adopt fiscal rules, and implement entitlement programs. Finally, we identify the polarization of preferences as a possible explanation for the joint growth of debt and entitlements.

We view this paper as an instructive first step in a larger research program that explores the forces that shape total government obligations, that is, the sum of debt and entitlements.

Appendix A: Proofs and Examples for Section 5

Proof of Lemma 1. Uniqueness follows directly from the concavity of the problem, and differentiability from the implicit function theorem. Using the constraint to substitute for x and taking the first order conditions with respect to c we have:

$$-h'(1-c-g)+v'(g)=0. \tag{7}$$

Replacing g with $G(c)$ and differentiating yields:

$$v''(G(c))G'(c)=-h''(1-c-G(c))(1+G'(c)),$$

hence

$$G'(c)=-\frac{h''(1-c-G(c))}{v''(G(c))+h''(1-c-G(c))}\in(-1,0).$$

Because at the optimum the constrain holds with equality, we have:

$$X(c)+G(c)=1-c$$

Differentiating, we have $X'(c)=-1-G'(c)\in(-1,0)$. ■

Lemma 2 ***(sufficient conditions for concavity)*** *$v(G(\cdot))$ is concave if $G(x)$ is concave.*

1. *$G(x)$ is concave if and only if $\frac{v''\left([v']^{-1}(x)\right)}{h''\left([h']^{-1}(x)\right)}$ is nonincreasing in x.*
2. *(symmetric case) $G(x)$ is concave if $h(x)=v(x)$.*
3. *(proportional CRRA functions) $G(x)$ is concave if $v(x)$ is CRRA and $h(x)=\alpha v(x)$ for $\alpha>0$.*
4. *(CRRA functions with different curvatures) Suppose $v(x)=x^p/p$ and $h(x)=x^q/q$, with $p,q<1$. Then $G(x)$ is strictly concave if and only if $p<q$.*

Proof.

Part 1. $X(c),G(c)$ solve:

$$\max_{(x,g)} h(x)+v(g) \text{ s.t. } x+g\leq 1-c.$$

$G(c)$ is concave in c iff $G(1-c)$ is concave in c. So, let's make the change of variables $k=1-c$ and write the following auxiliary problem:

$$\max_{(x,g)} h(x)+v(g) \text{ s.t. } x+g\leq k.$$

Denote the solutions to the auxiliary problem by $\widetilde{X}(k),\widetilde{G}(k)$. Let us derive necessary and sufficient conditions for $\widetilde{G}(k)$ to be globally concave.

Form the auxiliary problem's Lagrangian to get the first order conditions:

$$h'\left(\widetilde{X}(k)\right) = \lambda(k) = v'\left(\widetilde{G}(k)\right). \tag{8}$$

Differentiate with respect to k :

$$h''\left(\widetilde{X}(k)\right)\widetilde{X}'(k) = \lambda'(k) = v''\left(\widetilde{G}(k)\right)\widetilde{G}'(k).$$

Note that $\lambda'(k) < 0$. Use (8) to substitute for $\widetilde{X}(k)$ and $\widetilde{G}(k)$:

$$h''\left(\left[h'\right]^{-1}(\lambda(k))\right)\widetilde{X}'(k) = \lambda'(k) = v''\left(\left[v'\right]^{-1}(\lambda(k))\right)\widetilde{G}'(k).$$

Eliminate $\lambda'(k)$ to get:

$$\frac{\widetilde{X}'(k)}{\widetilde{G}'(k)} = \frac{v''\left(\left[v'\right]^{-1}(\lambda(k))\right)}{h''\left(\left[h'\right]^{-1}(\lambda(k))\right)}.$$

Since the constraint $x + g \leq k$ must hold with equality, we must have $\widetilde{X}'(k) + \widetilde{G}'(k) = 1$, whence our equation can be rewritten as follows:

$$\frac{1}{\widetilde{G}'(k)} - 1 = \frac{v''\left(\left[v'\right]^{-1}(\lambda(k))\right)}{h''\left(\left[h'\right]^{-1}(\lambda(k))\right)}.$$

Therefore $\widetilde{G}'(k)$ is decreasing in k if and only if:

$$\frac{v''\left(\left[v'\right]^{-1}(\lambda(k))\right)}{h''\left(\left[h'\right]^{-1}(\lambda(k))\right)} \text{ is nondecreasing in } k.$$

Since $\lambda(k)$ is decreasing in k (recall that $\lambda'(k) < 0$), the above condition is equivalent to:

$$\frac{v''\left(\left[v'\right]^{-1}(x)\right)}{h''\left(\left[h'\right]^{-1}(x)\right)} \text{ nonincreasing in } x.$$

Part 2. In this case we can see directly that $\widetilde{G}(c)$ is linear. Indeed, symmetry and concavity guarantee that $\widetilde{X}(c) = \widetilde{G}(c) = c/2$. Thus $\widetilde{G}(c)$ is (weakly) concave.

Part 3. Consider now $\widetilde{v}(x) = \alpha v(x)$. Then:

$$\begin{aligned}
\widetilde{v}'(x) &= \alpha v'(x) \\
\widetilde{v}''(x) &= \alpha v''(x) \\
\left[\widetilde{v}'\right]^{-1}(x) &= \left[v'\right]^{-1}\left(\frac{x}{\alpha}\right).
\end{aligned}$$

When $v(x) = x^p/p$ we get:

$$\begin{aligned} v'(x) &= x^{p-1} \\ v''(x) &= (p-1)\,x^{p-2} \\ [v']^{-1}(x) &= (x)^{1/(p-1)}. \end{aligned}$$

Thus:

$$\begin{aligned} \widetilde{v}''(x) &= \alpha(p-1)\,x^{p-2} \\ [\widetilde{v}']^{-1}(x) &= [v']^{-1}\left(\frac{x}{\alpha}\right) = \left(\frac{x}{\alpha}\right)^{1/(p-1)} = \left(\frac{1}{\alpha}\right)^{1/(p-1)} [v']^{-1}(x). \end{aligned}$$

So

$$\begin{aligned} & \widetilde{v}''\left([\widetilde{v}']^{-1}(x)\right) \\ = \;& \alpha(p-1)\left([\widetilde{v}']^{-1}(x)\right)^{p-2} \\ = \;& \alpha(p-1)\left(\left(\frac{1}{\alpha}\right)^{1/(p-1)} [v']^{-1}(x)\right)^{p-2} \\ = \;& \left(\frac{1}{\alpha}\right)^{(p-2)/(p-1)} \alpha(p-1)\left([v']^{-1}(x)\right)^{p-2} \\ = \;& \left(\frac{1}{\alpha}\right)^{(p-2)/(p-1)} \alpha v''\left([v']^{-1}(x)\right) \\ = \;& \alpha^{\frac{1}{p-1}} v''\left([v']^{-1}(x)\right). \end{aligned}$$

Thus

$$\frac{\widetilde{v}''\left([\widetilde{v}']^{-1}(x)\right)}{v''\left([v']^{-1}(x)\right)} = \alpha^{\frac{1}{p-1}} \text{ independent of } x.$$

Thus the condition in part 1 of the lemma is verified trivially.

Part 4. Given the functional forms of $v(x)$ and $h(x)$ we get:

$$\begin{aligned} v''\left([v']^{-1}(x)\right) &= (p-1)\,(x)^{(p-2)/(p-1)}, \\ h''\left([h']^{-1}(x)\right) &= (q-1)\,(x)^{(q-2)/(q-1)}, \end{aligned}$$

so that

$$\frac{v''\left([v']^{-1}(x)\right)}{h''\left([h']^{-1}(x)\right)} = \left(\frac{p-1}{q-1}\right) x^{\frac{(p-2)}{(p-1)} - \frac{(q-2)}{(q-1)}}.$$

Because $p, q < 1$ the term in parentheses is positive. Therefore, the RHS is decreasing in x if and only if

$$\frac{(p-2)}{(p-1)} < \frac{(q-2)}{(q-1)}.$$

Because $p, q < 1$ this equation is equivalent to $q > p$. ■

Proof of Proposition 1.

We need to prove that $d^* + E^* > 0$. Suppose, by way of contradiction, that $d^* + E^* \leq 0$. Because $E^* > 0$, it must then be that $d^* < 0$. Then, we show that public good provision must be higher in period 2 than in period 1 (i.e. $G(d^* + E^*) > g^*$). Fix any d (for example, $d = d^*$) and consider the vector (x, g, E) that solves problem (4) conditional on the debt level being set at d. The conditional problem is separable in the sense that the x and g that solve the conditional problem (4) are the solutions to the following simpler problem which does not involve E:

$$\max_{(x,g)} h(x) + v(g) \text{ s.t. } x + g \leq 1 + d.$$

This problem was introduced in Definition 1, and so the g that solves the conditional problem (4) must be exactly $G(-d)$. The solution to the unconditional problem (4) is then $g^* = G(-d^*)$. Now from Lemma 1 we know that $G(\cdot)$ is a decreasing function, so if d^* is negative, $g^* = G(-d^*) < G(0)$. If $d^* + E^* \leq 0$, we also have $G(0) \leq G(d^* + E^*)$, and hence $G(d^* + E^*) > g^*$. By the concavity of $v(G)$, we conclude that $v'(g^*) > -v'(G(d^* + E^*))G'(d^* + E^*)$. But then, group A could increase its lifetime payoff by increasing public good provision in period 1 (and decreasing public good provision in period 2). To do so, group A just has to increase debt (or reduce surplus). Therefore, $d^* + E^* \leq 0$ cannot hold in equilibrium.

Fix any E and consider the vector (x, g, d) that solves problem (4) conditional on the entitlement level being set at E. Denote the d that solves this conditional problem as $d(E)$.

First, we prove $d^* < d^*_{E=0}$. To this end, we prove that the $d(E)$ is decreasing in E. Note that $d(E)$ is the solution to the following simpler problem:

$$\max_{(x,g,d)} h(x) + v(g) + v(G(d + E)) \text{ s.t. } x + g \leq 1 + d.$$

The first order conditions read:

$$h'(1 + d - g) = -v'(G(d + E))G'(d + E). \tag{9}$$

The LHS is a decreasing function of d. Because $v(G(d + E))$ is concave in d, its first derivative with respect to d, $v'(G(\cdot))G'(\cdot)$, is a decreasing function of d. The RHS is its opposite, and therefore an increasing function of d. Now increase E. The LHS function stays unchanged. The RHS function shifts up. Therefore the two functions now cross at a lower level of d. This proves that the $d(E)$ is decreasing in E. Since it is optimal for generation A to choose $E^* > 0$, it follows that $d^* = d(E^*) < d(0) = d^*_{E=0}$.

We now prove that $d^* + E^* > d^*_{E=0}$. To this end, we prove that $d(E) + E$ is increasing in E. Consider any $\overleftarrow{E} < \overline{E}$. Suppose by contradiction that $\overleftarrow{E} + d\left(\overleftarrow{E}\right) > \overline{E} + d\left(\overline{E}\right)$. Then, because the RHS of (9) is an increasing function of $d + E$, we have:

$$-v'\left(G\left(\overleftarrow{d} + E\left(\overleftarrow{d}\right)\right)\right)G'\left(\overleftarrow{d} + E\left(\overleftarrow{d}\right)\right) > -v'\left(G\left(\overline{d} + E\left(\overline{d}\right)\right)\right)G'\left(\overline{d} + E\left(\overline{d}\right)\right). \tag{10}$$

Now, given that $d(E)$ is decreasing in E we have $d\left(\overleftarrow{E}\right) > d\left(\overline{E}\right)$, so marginal utility of consumption

in period 1must be lower under $\overleftarrow{E}$, and hence:

$$h'\left(1+d\left(\overleftarrow{E}\right)-g\left(\overleftarrow{E}\right)\right)<h'\left(1+d\left(\overline{E}\right)-g\left(\overline{E}\right)\right). \tag{11}$$

By definition of $d\left(\overline{E}\right)$, the RHS of (10) must equal the RHS of (11). But then it follows that:

$$h'\left(1+d\left(\overleftarrow{E}\right)-g\left(\overleftarrow{E}\right)\right)<-v'\left(G\left(\overleftarrow{d}+E\left(\overleftarrow{d}\right)\right)\right)G'\left(\overleftarrow{d}+E\left(\overleftarrow{d}\right)\right),$$

which contradicts the definition of $d\left(\overleftarrow{E}\right)$. Thus $d(E)+E$ must be increasing in E. Hence $d^*+E^*=d(E^*)+E^*>d(0)+0=d^*_{E=0}$, where the inequality follows because it is optimal for generation A to choose $E^*>0$. ■

Appendix B: Proofs of Section 6

Proof of Proposition 2. First, note that Lemma 1 and Corollary 1 apply verbatim to the case with non-zero savings because they characterize group B's behavior as a function of $d+E$ only. This means that, taking d as a fixed parameter, generation A's problem can be written as:

$$\begin{aligned}&\max_{x,g,s,E} h(x)+v(g)+h(s\phi+E)+v(G(d+E))\\&s.t.\ x+g+s\leq 1+d,\end{aligned}$$

or:

$$\max_{g,s,E} h(1+d-g-s)+v(g)+h(s\phi+E)+v(G(d+E)).$$

Denote the argmax of the parameterized problem by $\{g(d),s(d),E(d)\}$. We want to prove that the resources available to group $B2$ are decreasing when d decreases, i.e., that $d+E(d)$ is increasing in d.

The first order conditions w.r.t. g, E, and s are, respectively:

$$h'(1+d-g-s)=v'(g), \tag{12}$$

$$h'(E+\phi s)=-v'(G(d+E))G'(d+E), \tag{13}$$

and

$$h'(1+d-g-s)=\phi h'(s\phi+E). \tag{14}$$

By assumption, $\bar{d}$ is sufficiently low such that $s\left(\bar{d}\right)<0$. which also implies that $\phi=\bar{\phi}>1$. Now, consider $d'<\bar{d}$. We want to show that $E\left(\bar{d}\right)+\bar{d}<E(d')+d'$. Suppose by contradiction that $E\left(\bar{d}\right)+\bar{d}\geq E(d')+d'$. In that case, by the concavity of $v(G(d+E))$ in $d+E$, we have:

$$-v'(G(E(d')+d'))G'(E(d')+d')\leq -v'\left(G\left(\bar{d}+E\left(\bar{d}\right)\right)\right)G'\left(\bar{d}+E\left(\bar{d}\right)\right).$$

Together with the first order conditions (13), this implies that

$$h'\left(E\left(\bar{d}\right)+\bar{\phi}s\left(\bar{d}\right)\right)\geq h'\left(E(d')+\bar{\phi}s(d')\right),$$

and hence

$$\bar{\phi}h'\left(E\left(\bar{d}\right)+\bar{\phi}s\left(\bar{d}\right)\right)\geq\bar{\phi}h'\left(E\left(d'\right)+\bar{\phi}s\left(d'\right)\right).$$

Therefore, using the first order conditions (12) and (14), we also have

$$\begin{aligned}h'(1+\bar{d}-g\left(\bar{d}\right)-s\left(\bar{d}\right)) &\geq h'(1+d'-g\left(d'\right)-s\left(d'\right)),\text{ and}\\ v'\left(g\left(\bar{d}\right)\right) &\geq v'\left(g\left(d'\right)\right).\end{aligned}$$

From the concavity of h and v it follows that:

$$E\left(\bar{d}\right)+\bar{\phi}s\left(\bar{d}\right) \leq E\left(d'\right)+\bar{\phi}s\left(d'\right), \tag{15}$$

$$\begin{aligned}1+\bar{d}-g\left(\bar{d}\right)-s\left(\bar{d}\right) &\leq 1+d'-g\left(d'\right)-s\left(d'\right),\text{ and} \qquad (16)\\ g\left(\bar{d}\right) &\leq g\left(d'\right)\end{aligned}$$

From (16), we have

$$s\left(\bar{d}\right)-s\left(d'\right)\geq\bar{d}-d'+g\left(d'\right)-g\left(\bar{d}\right),$$

and using $g\left(\bar{d}\right)\leq g\left(d'\right)$, we obtain:

$$s\left(\bar{d}\right)-s\left(d'\right)\geq\bar{d}-d'.$$

Using (15), we obtain:

$$E\left(\bar{d}\right)+\bar{\phi}\left(s\left(\bar{d}\right)-s\left(d'\right)\right)\leq E\left(d'\right),$$

Using $s\left(\bar{d}\right)-s\left(d'\right)\geq\bar{d}-d'$, we have that the following must be true:

$$E\left(\bar{d}\right)+\bar{\phi}\left(\bar{d}-d'\right)\leq E\left(d'\right),$$

and hence

$$\begin{aligned}E\left(\bar{d}\right)-E\left(d'\right) &\leq \bar{\phi}\left(d'-\bar{d}\right)\\ &\leq \left(d'-\bar{d}\right),\end{aligned}$$

where the second inequality results from $d'-\bar{d}<0$ and $\bar{\phi}>1$. This inequality contradicts our assumption that $E\left(\bar{d}\right)+\bar{d}\geq E\left(d'\right)+d'$, thus achieving the desired contradiction. ■

Proof of Proposition 3. First, note that Lemma 1 and Corollary 1 apply verbatim to the case with non-zero savings because they characterize group B's behavior as a function of $d+E$ only. This means that, taking E as a fixed parameter, generation A's problem can be written as:

$$\begin{aligned}&\max_{x,g,s,d} h(x)+v\left(g\right)+h\left(s\phi+E\right)+v\left(G\left(d+E\right)\right)\\ &s.t.\ x+g+s\leq 1+d\end{aligned}$$

or

$$\max_{g,s,d} h(1+d-g-s)+v\left(g\right)+h\left(s\phi+E\right)+v\left(G\left(d+E\right)\right)$$

Denote the argmax of the parameterized problem by $\left\{g\left(E\right),s\left(E\right),d\left(E\right)\right\}$. We want to prove that

the resources available to group $B2$ are decreasing when E decreases, i.e. $d(E)+E$ is decreasing in E.

The first order conditions w.r.t. g, d, and s are, respectively:

$$h'(1+d-g-s) = v'(g), \tag{17}$$

$$h'(1+d-g-s) = -v'(G(d+E))\,G'(d+E), \tag{18}$$

and

$$h'(1+d-g-s) = \phi h'(s\phi+E). \tag{19}$$

By assumption, $\bar{E}$ is sufficiently low such that $s\left(\bar{E}\right) > 0$. Now, consider $E' < \bar{E}$. We want to show that $\bar{E}+d\left(\bar{E}\right) < E'+d(E')$. Suppose by contradiction that $\bar{E}+d\left(\bar{E}\right) \geq E'+d(E')$. Then, by the concavity of $v(G(\cdot))$ we have

$$-v'(G(E'+d(E')))\,G'(E'+d(E')) \leq -v'\left(G\left(\bar{E}+d\left(\bar{E}\right)\right)\right)G'\left(\bar{E}+d\left(\bar{E}\right)\right).$$

Together with the first order conditions (18), this implies that

$$h'(1+d\left(\bar{E}\right)-g\left(\bar{E}\right)-s\left(\bar{E}\right)) \geq h'(1+d(E')-g(E')-s(E')).$$

Therefore, using the first order conditions (17) and (19), we also have

$$v'\left(g\left(\bar{E}\right)\right) \geq v'(g(E'))$$

and

$$\underline{\phi}h'\left(\bar{E}+\underline{\phi}s\left(\bar{E}\right)\right) \geq \underline{\phi}h'\left(E'+\underline{\phi}s(E')\right).$$

From the concavity of h and v it follows that:

$$\begin{aligned} \bar{E}+\underline{\phi}s\left(\bar{E}\right) &\leq E'+\underline{\phi}s(E'), & (20)\\ 1+d\left(\bar{E}\right)-g\left(\bar{E}\right)-s\left(\bar{E}\right) &\leq 1+d(E')-g(E')-s(E'), \text{ and} & (21)\\ g\left(\bar{E}\right) &\leq g(E'). \end{aligned}$$

From (21), we have

$$s\left(\bar{E}\right)-s(E') \geq d\left(\bar{E}\right)-d(E')+g(E')-g\left(\bar{E}\right) \geq d\left(\bar{E}\right)-d(E'),$$

where the second inequality uses $g\left(\bar{E}\right) \leq g(E')$.

Using (20), we obtain:

$$\begin{aligned} E'-\bar{E} &\geq \underline{\phi}\left(s\left(\bar{E}\right)-s(E')\right)\\ &\geq \underline{\phi}\left(d\left(\bar{E}\right)-d(E')\right), \end{aligned}$$

where the second inequality uses $s\left(\bar{E}\right)-s(E') \geq d\left(\bar{E}\right)-d(E')$. Now recall from the proof of Proposition 1 that $d(E)$ is decreasing in E, whence $d\left(\bar{E}\right)-d(E') < 0$ and $\underline{\phi}\left(d\left(\bar{E}\right)-d(E')\right) >$

$d\left(\bar{E}\right) - d\left(E'\right)$. Therefore the above inequality implies:

$$E' - \bar{E} > d\left(\bar{E}\right) - d\left(E'\right),$$

contradicts our assumption that $\bar{E} + d\left(\bar{E}\right) \geq E' + d\left(E'\right)$, thus achieving the desired contradiction.

■

Soft Fiscal Rule

In this Appendix, we consider a situation in which the debt ceiling is soft. In particular, when group A borrows more than the debt ceiling, it needs to pay an extra interest, $r > 0$. Thus, if group A chooses a debt level d which is $d - d_\ell$ units above the debt ceiling d_ℓ, the reimbursement in period 2 is $d_\ell + (1 + r)(d - d_\ell)$. These wasted resources do not benefit anybody in the economy. We also assume that entitlements are fixed at E and that there is no savings.

The following proposition proves our main result:

Proposition 5 *Fix $E, s \equiv 0$, and any soft debt ceiling d_ℓ that is stringent enough that it is exceeded in equilibrium. Then the equilibrium choice of debt level, $d(d_\ell)$, is increasing in d_ℓ, but the total government obligations inherited by group B2, $d_\ell + (1 + r)(d - d_\ell)$, are decreasing in d_ℓ. Hence, tightening the debt limit harms all groups.*

Proof. First, note that Lemma 1 and Corollary 1 characterize second period policy choices $X(c)$ and $G(c)$, where now $c = c(d; d_\ell) = d_\ell + (1 + r)(d - d_\ell)$. Group A's problem can be written as:

$$\begin{aligned} &\max_{x,g,d} h(x) + v(g) + h(E) + v\left(G\left(c\left(d; d_\ell\right)\right)\right) \\ &s.t.\ x + g \leq 1 + d \end{aligned}$$

or

$$\max_{g,d} h(1 + d - g) + v(g) + h(E) + v\left(G\left(c\left(d; d_\ell\right)\right)\right),$$

and let $\{g(d_\ell), d(d_\ell)\}$ denote the optimal choices when the debt ceiling is d_ℓ.

The first order conditions w.r.t. g and d are, respectively:

$$h'(1 + d - g) = v'(g), \tag{22}$$

and

$$h'(1 + d - g) = -(1 + r) v'\left(G\left(c\left(d; d_\ell\right)\right)\right) G'\left(c\left(d; d_\ell\right)\right), \tag{23}$$

By assumption, d_ℓ is sufficiently low such that $d_\ell < d(d_\ell)$. Now, consider any $d'_\ell < d_\ell$. We want to show that both $d(d'_\ell) < d(d_\ell)$ and $c\left(d\left(d'_\ell\right); d'_\ell\right) > c\left(d\left(d_\ell\right); d_\ell\right)$ are true. Let's proceed by contradiction. There are three ways in which this statement can be violated: (i) if $c\left(d\left(d'_\ell\right); d'_\ell\right) > c\left(d\left(d_\ell\right); d_\ell\right)$ but $d(d'_\ell) > d(d_\ell)$, (ii) if $d(d'_\ell) < d(d_\ell)$ but $c\left(d\left(d'_\ell\right); d'_\ell\right) < c\left(d\left(d_\ell\right); d_\ell\right)$, and (iii) if

both $d(d'_\ell) > d(d_\ell)$ and $c(d(d'_\ell); d'_\ell) < c(d(d_\ell); d_\ell)$. Note that case (iii) is not possible given the definition of $c(d; d_\ell)$. Thus, we only have to consider cases (i) and (ii).

Case (i): by the concavity of $v(G(\cdot))$, $c(d(d'_\ell); d'_\ell) > c(d(d_\ell); d_\ell)$ implies:

$$-(1+r)\,v'(G(c(d(d'_\ell); d'_\ell)))\,G'(c(d(d'_\ell); d'_\ell)) \geq -(1+r)\,v'(G(c(d(d_\ell); d_\ell)))\,G'(c(d(d_\ell); d_\ell)).$$

Because $d(d'_\ell) > d(d_\ell)$ implies $g(d'_\ell) > g(d_\ell)$, using (22) we get:

$$h'(1 + d(d'_\ell) - g(d'_\ell)) < h'(1 + d(d_\ell) - g(d_\ell))$$

Combining these two inequalities contradicts (23), as desired.

Case (ii): by the concavity of $v(G(c))$ in c, we have that $c(d(d'_\ell); d'_\ell) < c(d(d_\ell); d_\ell)$ implies:

$$-(1+r)\,v'(G(c(d(d'_\ell); d'_\ell)))\,G'(c(d(d'_\ell); d'_\ell)) \leq -(1+r)\,v'(G(c(d(d_\ell); d_\ell)))\,G'(c(d(d_\ell); d_\ell)).$$

Because $d(d'_\ell) < d(d_\ell)$ implies $g(d'_\ell) < g(d_\ell)$, using (22) we get:

$$h'(1 + d(d'_\ell) - g(d'_\ell)) > h'(1 + d(d_\ell) - g(d_\ell)).$$

Combining these two inequalities contradicts (23), as desired. ■

Appendix C: Proof and figure for Section 7

Proof of Proposition 4. From Proposition 9 in the Online Appendix, we have that: E^* is decreasing in α for any $\rho > 0$; for $\rho < 1$, d^* is decreasing in α if and only if α is larger than $\left[\frac{\rho^{\frac{\rho}{1-\rho}}}{\left(1-\rho^{\frac{\rho}{1-\rho}}\right)}\right]^{\rho}$; for $\rho > 1$, d^* is decreasing in α if and only if α is smaller than $\left[\frac{\rho^{\frac{\rho}{1-\rho}}}{\left(1-\rho^{\frac{\rho}{1-\rho}}\right)}\right]^{\rho}$. ■

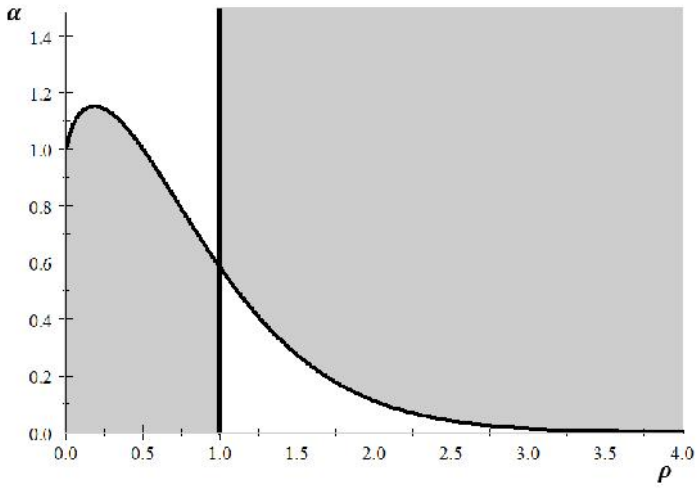

Figure 8: Shaded areas give the combinations of parameters such that debt and entitlements co-move when conflict increases.

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