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Bailouts in a federation: *A cooperative legislature at work*

Willem Sas*

Abstract

This paper revisits the soft budget constraint problem arising in decentralised countries. Capturing the specific dynamics of political decision making in a federation, new light is shed on the incentives at work when lower-level (state) governments overborrow and are bailed out by the federal level. An intertemporal model developed by Goodspeed (2002) is supplemented by the citizen-candidate approach of Besley and Coate (1997), to further align federal decision making with reality. In our model, where a *cooperative* legislature of locally elected representatives decides on federal grants going to the states, voters are shown to elect candidates with a higher preference for debt accumulation than would be expected. This strategic voting behaviour not only leads to overly generous bailout policies. Also, and compared to a setting where federal decision making follows the median voter, states are proven to overborrow more inefficiently because of this federal generosity. A case can then be made for *federal* constituencies where politicians are elected from across the entire federation, which would neutralize these additional inefficiencies.

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1 Introduction

In countries where both tax and spending powers are partially allocated to lower levels of government, a so called 'vertical fiscal imbalance' almost always takes shape. Indeed, when fiscal decentralisation is not balanced in terms of tax and expenditure allocation, a lower-level (state) government will have more or less means at its disposal to finance its own public expenditure. In the latter case, the remaining funds will be channeled from the federal to state governments in the form of grants, or are accounted for by states themselves issuing debt. Convincing arguments can be formulated in favour of such an imbalance, where state governments only partially cover expenditures with own revenue raising ¹. Practice seems to have followed theory moreover, as the share of state expenditure not covered by state revenues was 35,4% across OECD countries in 1998 (World Bank, 2000). Percentages in non-OECD countries run even higher, e.g. South Africa comes in at 82%. In light of this evolution, focusing on the possible downsides to these vertical imbalances as identified by more recent theories, seems overly justified ².

A downside which is increasingly claimed to be important, is the fact that state governments may face a 'soft budget constraint' (SBC) when not all state expenditures are covered by state revenues. Following Rodden et al. (2003), such a situation occurs when 'an entity (e.g. a state government) can manipulate its access to funds in undesirable ways'. More specifically, when the federal government fails to generate 'no bailout' expectations, states have the incentive to overborrow or pay insufficient attention to the quality of public provision financed by their borrowing (Kornai, 1986; Besfamille and Lockwood, 2008). This readiness to finance state deficits thus boils down to a commitment problem on behalf of the federal government, which the state government will seek to turn to its advantage. Looking at the well-known Argentinian or Brazilian cases, where the federal government had to step in to bail out several profligate states over a decade ago, the theory seems plausible. Indeed, many studies have empirically identified various aspects of soft budget constraints for sub-national governments ³.

Our focus here will be purely theoretical, shedding more light on the incentives at work when a SBC problem arises. This theoretical line of research was pioneered by Wildasin (1997), who finds that the size of a state positively affects its likelihood of demanding and obtaining a bailout. Crivelli and Klaas (2008) find the exact opposite, which follows from the way the spill-overs of state public provision are modeled. Indeed, what drives both models are precisely these spill-overs, which provide the federal government with incentives to prop up public spending in an under-performing state. A limitation according to Goodspeed (2002), whose intertemporal political economy model explains how a SBC problem may present itself

¹See e.g. Boadway & Shah (2009) for a splendid overview of arguments developed in the extensive literature on Fiscal Federalism.

²See Lockwood (2005) for an overview of the political economy strand within the theory of Fiscal Federalism.

³For country specific studies see e.g. Jones, Sanguinetti and Tommassi (1999) for Argentina, Poterba (1995) and Von Hagen (1991) for US States, Baskaran (2012) for Germany, Borge and Rattso (2003) for Norway, Von Hagen and Dahlberg (2004) for Sweden, Garcia-Mila, Goodspeed and McGuire (2002) or Sorribas-Navarro, (2010) for Spain and Bordignon (2000) for Italy. A cross-country analysis was undertaken by Rodden (2002).

even when spill-overs do not occur. A situation of which many real world examples can be found. In this article we will build on this broader model, which we aim to supplement by introducing a different way of federal decision making ⁴.

In Goodspeed's political economy model, the federal government increases grants in response to state borrowing to maximize expected votes. Increasing grants will keep welfare from plummeting through maintained state public provision, since this way less of the debt will have to be repayed by the states themselves over time. Depending on the probability of re-election which will be different across states, the federal level decides 'as one' in which states to keep welfare up and collect the most votes.

Now, even though the classical critique on Downsian models could certainly apply here ⁵, we believe that this political economy model may also fail to grasp the dynamics at work in certain, specific federations. Consider e.g. the case of Belgium, where the absence of nationwide political parties leads to situations where the federal government can hardly be described as a single entity independent of state interests. Once parties win the election in their respective state and find themselves in the federal coalition, they will always defend the interests of those that will keep them there: the voters of their own state. Indeed, one can even question whether any federal government is ever exclusively above regional interests to consider the *national* good (and/or assure certain re-election in the process). We will therefore complement Goodspeed's model by introducing the citizen-candidate approach to its workings, so that federal legislators will be elected locally. Indeed, applying the citizen-candidate model to a federal setting as done by Besley and Coated (2003), goes a long way in capturing the specific dynamics of political decision making in a federation.

This paper proceeds as follows. In section 2 we discuss the citizen-candidate approach in greater detail, and illustrate how it fits in the greater scheme of things by setting up the model. Sections 3 to 5 then set the model to work, deriving the main findings which will depend heavily on the kind of political decision making driving the model. Section 6 concludes.

2 The framework

Key to the citizen-candidate model developed by Besley and Coate (1997), is that public spending of the federal government will be determined by a legislature of *locally* elected representatives. Secondly, both the behaviour of representatives in the federal legislature as well as voters will be modeled.

⁴Yet other interesting theoretical work on the SBC is certainly worth reading. Breuillé et al. (2006) e.g. discuss the effect of tax competition on the SBC. Inman (2001) incorporates a reputation for hard budget constraints on the part of the federal government. Besfamille and Lockwood (2008) lastly, question whether a hard budget constraint is always best from an efficiency point of view when moral hazard is introduced to the analysis.

⁵The fact that in a Downsian model citizens care about policies whilst politicians are infinitely pliable, and simply want to get re-elected, would be a first critique. The absence of a selection/voting mechanism explaining how the government rose to power to begin with, would be a second. See Besley (2011) for further argumentation.

Representatives come together in a legislature, and start bargaining on public spending based on their *personal* preferences. Their behaviour at this point is described by the *utilitarian bargaining solution*, which means they will agree to a specific public goods allocation which maximises their joint surplus⁶ (hence cooperative legislature). The election process is then set up as a Stackelberg game where voters take into account this behaviour of legislators, and vote accordingly by picking that citizen *from their ranks* whose preferences will maximise their welfare. Hence the name of the model, each citizen is a potential candidate for federal office. As Besley and Coate (2003) have shown, 'such legislative behaviour creates incentives for voters to *strategically delegate* by electing representatives with high demands for public spending'. Especially when spill-overs are absent, this will lead to over-provision in a centralized system. Now, whilst Besley and Coate use their model to provide stronger footing for the Oates decentralisation theorem (the higher the spill-overs, the better the case for centralisation), we will employ it here to study federal decision making in light of the SBC problem. The state governments in our model on the other hand, will simply follow the median voter of their state and be re-elected as long as they do.

Following Goodspeed (2002), we set up a two-period inter-temporal model which considers federal government grant decisions as well as inter-temporal state spending decisions. As we discussed above, voter decision making will be an addition to the model. Now, since the federal government will have a hand in state financing through its grants, the interaction between the federal and state governments will be vital.

Much like Goodspeed, we assume the choice of second period grants (federal government) and first period borrowing and taxation (states) follows from a sequential Stackelberg game. More specifically, each state will be a Stackelberg leader vis-à-vis the federal government, and consequently knows how the federal government will behave in period 2. Each state then takes this behaviour into account when it decides on borrowing and taxation in period 1. In other words, states maximise the welfare of the median voter subject to the *reaction function* of the federal government. A function which will describe the federal response in terms of period 2 grants as states borrow in period 1. If its derivative with respect to state borrowing is positive, state governments face a soft budget constraint and will be tempted to overborrow.

Deciding in period one, states will take the decisions of other states as given (they play a simultaneous Nash game), as well as the outcome of the federal voting process which takes place once simultaneously to state decision making. Whilst voters take into account the behaviour of the federal government as they vote, they thus take state decisions as given. In period 2, the federal as well as state governments play Nash. Before play begins in period 1 lastly, the central government is assumed to decide on an initial level of grants for each state in period 1. An initial decision which is exogenous to the game to be played, and has no impact on the outcome.

Since such a model is to be solved using backward induction, the following sec-

⁶This Utilitarian solution is motivated by the literature on universalism in legislatures (see Weingast, 1979)

tion will start out with the federal government's problem. The federal government's reaction function and its derivative, which will determine whether the federal government follows a hard or soft budget constraint, is discussed here in detail. Section 4 will then tackle the voting process, followed by the regional government's decision making presented in section 5.

3 The federal government

We assume a federation with m states, governed by a cooperative legislature on the federal level, and where the federal legislators (representatives) will maximise the following objective function:

$$Max_{g_{i2}} \sum_i^m \{U_{ij}\} \quad (1)$$

As explained above and expressed by (1), the m elected representatives will decide on public spending according to the Utilitarian bargaining solution. Maximising the sum of their own utilities, they arrive at the optimal level of period 2 per capita grants for each state (g_{i2}). How a specific voter of type j rose to power in state i , in other words why his preferences were chosen above the preferences of the n_i voters living in a specific state i , will be examined in section 4. For now, it suffices to see how utility of this elected legislator j representing state i is defined by per-capita public spending in his state in period 1 (X_{i1}) and period 2 (X_{i2}), as well as his private consumption in period 1 (C_{i1}) and period 2 (C_{i2}):

$$U_{ij} = \ln(X_{i1}) + \ln(X_{i2}) + z(C_{i1}) + w(C_{i2}) \quad (2)$$

With w and z increasing and concave. Laying out the constraints under which the objective function will be maximised, will clarify things further. We begin with public spending in period 1 in state i :

$$X_{i1} = g_{i1} + t_{i1}Y_{i1} + \lambda_{iE}^*B_{i1} \quad (3)$$

Here g_{i1} will be the per capita federal grant allocated to state i in period 1. As specified above, this grant will be exogenous to the game. With t_{i1} the tax rate set by state i in period 1, and Y_{i1} the per-capita private income (exogenous) of voters living in state i , $t_{i1}Y_{i1}$ will be the state's portion in public spending. Notice that we have implicitly assumed all voters living in the same state to have identical private incomes. In fact, the only difference between voters within a certain state, will be their preference type concerning debt accumulation. It is here that the second main diversion from Goodspeed's model comes in. We assume people to have preferences when it comes to state debt, preferences which may be psychologically tinged (dislike of being indebted) or even irrational (some people just don't like the word), or reflect myopia or rational expectations. The state government will then make its borrowing decision in period 1 (B_{i1}) taking into account this preference (which will be the median voter's), but more on this in section 5. Each state is characterised by a range of debt preference types $[0, \bar{\lambda}]$, where we assume the

mean type λ_{im} will be equal to the median type. We will denote the preference type of the candidate elected in state i as λ_{iE}^* (E for elected). Moving on to public spending in period 2, which has the borrowed amount of period 1 subtracted at the going (exogenous) interest rate r , we get:

$$X_{i2} = g_{i2} + t_{i2}Y_{i2} - \lambda_{iE}^*B_{i1}(1+r) \quad (4)$$

Private consumption subsequently, will simply be the remaining after tax private income:

$$C_{i1} = Y_{i1}(1 - t_{i1}) \quad (5)$$

$$C_{i2} = Y_{i2}(1 - t_{i2} - t_{f2}) \quad (6)$$

With t_{f2} the federal tax rate in period 2. The federal tax will finance the total amount of grants going to the states, which closes the model:

$$t_{f2} \sum_i n_i Y_{i2} = \sum_i n_i g_{i2} \quad (7)$$

Keeping things simple, we assume the number of voters as well as per-capita private incomes are identical across states. Deriving and rewriting the first order conditions of the problem, we get an expression for the optimal level of the per capita federal grant going to a state i (see Appendix A):

$$g_{i2}^* = \frac{\partial C_{i2}}{\partial w} - t_{i2}Y_{i2} + \lambda_{iE}^*B_{i1}(1+r) \quad (8)$$

First of all, the grant size and the marginal utility of private consumption of voters living in state i , are shown to be inversely related. Equally logical, we see that grants will be lower the higher state i 's spending will be. Lastly, and most importantly here, (8) tells us how the federal government responds to state borrowing. The first derivative of this reaction function w.r.t. state i 's borrowing decision in period 1 will be positive:

$$\frac{\partial g_{i2}^*}{\partial B_{i1}} = \lambda_{iE}^*(1+r) > 0 \quad (9)$$

As was the case in Goodspeed's model, we have thus modeled a situation where the federal government finds it optimal to increase grant allocation when states borrow more. The reason is simple. Since state borrowing hollows out welfare in period 2 as can be seen in (4), the federal response will be to compensate for this drop in public spending by use of its grants system. This is what Goodspeed's calls a 'soft budget constraint policy' which will lower the opportunity cost of borrowing for the state governments, as we will see in section 5. We also learn from (8) that this federal response to state borrowing depends on the preference type of the respective elected legislator for that state. If a state is represented by a legislator who for some reason isn't too keen on accumulating debt, the grant increase will be tempered. The question then evidently becomes, of which preference type will this legislator be? Examining the federal voting process provides us with an answer.

4 The federal voting process

Voters in each state will pick a federal representative from among their ranks, knowing full well how this representative will behave once in office. In other words, voters are perfectly informed of the federal decision making process described above. Deciding on which preference type to send to the federal level (λ_{iE}) in period 1, they will consequently maximise their personal welfare based on this knowledge. In other words, the federally optimised decision on grants (g_{i2}^*) is included in their optimisation. Voter j of state i will thus solve the following problem to decide on his vote:

$$Max_{\lambda_{iE}} \ln(X_{i1}) + \ln(X_{i2}) + z(C_{i1}) + w(C_{i2}) \quad (10)$$

Subject to the same constraints as before, only here with g_{i2} specified by the federal government's reaction function $g_{i2}^*(\lambda_{iE})$:

$$g_{i2}^* = \frac{\partial C_{i2}}{\partial w_i} - t_{i2}Y_{i2} + \lambda_{iE}B_{i1}(1+r) \quad (11)$$

Rewriting the first order conditions of this problem, we get the following expression (see Appendix B):

$$\lambda_{iE} = \lambda_{ij} + \frac{\frac{\partial C_{i2}}{\partial w} \sum_{j \neq i}^m (n_j Y_{j2})}{n_i Y_{i2} B_{i1} (1+r)} \quad (12)$$

As (12) shows, a voter of type j will vote for a candidate which is more favourably inclined towards accumulating debt than he himself is ($\lambda_{iE} > \lambda_{ij}$). He will vote strategically, making full use of the knowledge that if he votes in a candidate with such preferences, his welfare will increase. Indeed, as can be seen in (11), the per capita grant will increase in λ_{iE} . On the other hand, he will omit the fact that the lion's share of this grant will be financed by the rest of the federation, since he does not take into account welfare in other states as he votes. This is a manifestation of the 'common pool problem', which can also be seen in (12) where λ_{iE} increases as state i 's share in total national income decreases. Now, for n_i voters in region i , and assuming preferences are single peaked, the median voter with preference λ_{im} will embody the majority in this state. The representative of state i will thus be of the following preference type:

$$\lambda_{iE}^* = \lambda_{im} + \frac{\frac{\partial C_{i2}}{\partial w} \sum_{j \neq i}^m (n_j Y_{j2})}{n_i Y_{i2} B_{i1} (1+r)} \quad (13)$$

We summarise in proposition 1:

Proposition 1. *In a federation where a cooperative legislature of locally elected representatives decides on federal grants going to the states, voters will elect candidates with a higher preference for debt accumulation than their own preference.*

The intuition here would be that representatives of this type will mind less when the state they represent accumulates debt, and will thus be more generous when cushioning state borrowing. To accomplish this they will gladly tap the common pool of federal funds. Knowing this in advance, voters will turn this behaviour to their advantage by voting in precisely such generous types. A result which will be pivotal when we analyse the decision making of state governments in what follows.

5 The state government

As explained above, the government of state i will maximise the welfare of the median voter of type λ_{im} . To decide on spending and borrowing in period 1 furthermore, it will take into account how the federal government will behave once it is in office. However, it does not know how the vote (held simultaneously to state decision making) will turn out. In other words, the state government will take up the reaction function g_{i2}^* in its optimisation problem without knowing of which type λ_{iE}^* its representative on the federal level will be. We consequently get the following problem:

$$Max_{B_{i1}, t_{i1}, t_{i2}} U_{im} = \ln(X_{i1}) + \ln(X_{i2}) + z(C_{i1}) + w(C_{i2})$$

Subject to:

$$X_{i1} = g_{i1} + t_{i1}Y_{i1} + \lambda_{im}B_{i1}$$

$$X_{i2} = g_{i2}^* + t_{i2}Y_{i2} - \lambda_{im}B_{i1}(1+r)$$

$$C_{i1} = Y_{i1}(1 - t_{i1})$$

$$C_{i2} = Y_{i2}(1 - t_{i2} - t_{f2})$$

$$t_{f2} \sum_i^m n_i Y_{i2} = \sum_i^m n_i g_{i2}^*$$

$$g_{i2}^* = \frac{\partial C_{i2}}{\partial w} - t_{i2}Y_{i2} + \lambda_{iE}^* B_{i1}(1+r)$$

Indeed, (13) does not appear among the constraints. Deriving and rewriting the first order conditions of this problem, we arrive at the following expression (see Appendix C):

$$\frac{\frac{\partial U_{im}}{\partial X_{i1}}}{\frac{\partial U_{im}}{\partial X_{i2}}} = \left\{ R_i \frac{\partial g_{i2}^*}{\partial B_{i1}} + \left(\lambda_{im}(1+r) - \frac{\partial g_{i2}^*}{\partial B_{i1}} \right) \right\} \frac{1}{\lambda_{im}} \quad (14)$$

With $R_i = \frac{n_i Y_{i2}}{\sum_i^m n_i Y_{i2}}$, or state i 's share in total federal income. Comparable to Goodspeed's result, (14) is crucial to the model. It expresses the Marginal Rate of Substitution (MRS) between public spending in period 1 and period 2, and will thus be the cost of borrowing faced by state i . The incentive for the state government to overborrow emerges here. To see this, assume first of all that the federal government would follow a hard budget constraint policy ($\frac{\partial g_{i2}^*}{\partial B_{i1}} = 0$), so that the MRS reduces to $(1 + r)$. State borrowing would then be efficient. Now, when the federal government follows a SBC policy (where $\frac{\partial g_{i2}^*}{\partial B_{i1}} > 0$) on the other hand, this clearly will have an impact on the MRS. As soon as the cost of borrowing comes out below $(1 + r)$, we know the state will inefficiently overborrow. This will be due to a trade-off between two sorts of costs, also tackled by Goodspeed, being the tax cost and the opportunity cost of borrowing.

The first term on the LHS of (14) describes the tax cost of borrowing. As the federal grant increases when state i borrows federal taxation will follow suit, to which state i only contributes according to its share in total federal revenue. The second term in (14) subsequently, represents the opportunity cost of X_{i1} in terms of foregone X_{i2} . This cost will be reduced since the federal government increases grants if state i borrows, as can be seen in (14). Less second period public consumption will need to be given up to pay off the debt incurred in period 1 in this case. Now, when this reduction in opportunity costs outweighs the increase in tax costs, state i will overborrow. In his model, Goodspeed shows this will indeed be the case since states carry but a fraction of the tax cost, again because of the common pool effect. Question remains how this trade-off will turn out in our model, when it is a a cooperative legislation deciding on public spending.

Plugging (9) into our expression for the MRS (14), we obtain:

$$\frac{\frac{\partial U_{im}}{\partial X_{i1}}}{\frac{\partial U_{im}}{\partial X_{i2}}} = \left\{ R_i \frac{\lambda_{iE}^*}{\lambda_{im}} + \left(1 - \frac{\lambda_{iE}^*}{\lambda_{im}} \right) \right\} (1 + r) \quad (15)$$

From (15) we learn that also in our model the tax cost will weigh in more than the opportunity cost. Indeed, keeping in mind that R_i as a share of total federal income will always be smaller than 1, the MRS will clearly be smaller than $(1 + r)$:

$$\frac{\frac{\partial U_{im}}{\partial X_{i1}}}{\frac{\partial U_{im}}{\partial X_{i2}}} = \left\{ 1 + (R_i - 1) \frac{\lambda_{iE}^*}{\lambda_{im}} \right\} (1 + r) < (1 + r) \quad (16)$$

We have thus shown that also when federal decision making is modeled by use of the citizen-candidate model, states will not only face a soft budget constraint but overborrow because of it. What is more, the borrowing cost faced by states in our setting will be lower compared to a situation where the federal government simply follows the median voter. In this case λ_{im} would be equal to λ_{iE}^* , so that the MRS reduces to:

$$\frac{\frac{\partial U_{im}}{\partial X_{i1}}}{\frac{\partial U_{im}}{\partial X_{i2}}} = \{ \lambda_{im} R_i \} \frac{(1 + r)}{\lambda_{im}} < (1 + r) \quad (17)$$

Which is clearly larger than the MRS obtained in our model, rewritten by plugging in (13) for λ_{iE}^*

$$\frac{\frac{\partial U_{im}}{\partial X_{i1}}}{\frac{\partial U_{im}}{\partial X_{i2}}} = \left\{ \left(\lambda_{im} R_i + \frac{\frac{\partial C_{i2}}{\partial w} \sum_{j \neq i}^m (n_j Y_{j2})}{n_i Y_{i2} B_{i1} (1+r)} \right) (R_i - 1) \right\} \frac{(1+r)}{\lambda_{im}} \lll (1+r) \quad (18)$$

This result suggests the SBC to be an even more pressing problem in a cooperative federal setting, since here states will overborrow more than they would have if the federal government behaved in the classical Downsian fashion. We summarise in proposition 2:

Proposition 2. *In a federation where a cooperative legislature of locally elected representatives decides on public spending, states will face a soft budget constraint and inefficiently overborrow. Compared to a setting where federal decision making follows the median voter, states will overborrow more.*

At first glance, such a result may readily be harnessed as further critique on fiscal imbalances. On the other hand, and in light of the arguments in favour of imbalances as referred to in our introduction, a more constructive stance is also at hand. From this perspective, proposition 2 can be seen as adding more weight to recent calls for installing truly *federal* constituencies ⁷. Indeed, when federal politicians are held accountable by all voters of a federation, and not just by a favoured regional fraction, we return to the outcome obtained in a median voter model. The excess in inefficiency would thus be undone without altering grant policies, grants which can be welfare enhancing for a variety of other reasons ⁸.

Secondly, proposition 2 might also render Goodspeed's proposed solution to the SBC problem more effective. As Goodspeed pointed out, when the federal government responds to increased state borrowing not only by nudging up grants going to the borrowing state in question, but to *all* states, things take a turn for the better. In this case the tax cost to borrowing could have a disciplining effect, since states would realise they are indeed also partially financing grants going to *other* states. When footing this bill becomes too costly compared to the decrease in opportunity cost (which stays the same), state governments are less tempted to overborrow. If this increase in tax costs exactly offsets the drop in opportunity costs, the SBC policy would even result in efficient borrowing decisions. Since our model has the federal government doling out overly generous grants, it could deliver a stronger disciplining mechanism. Of course, such a setting needs to be modeled to fully grasp its dynamics, which is why Goodspeed suggests adding spillovers to the model after all. When state public spending also affects the welfare of non-residents, the federal government may indeed have good reason to increase all grants when only one state borrows more. A promising avenue for further research.

⁷For Belgium, see e.g. Horowitz (2009), or Deschouwer & Van Parijs (2009).

⁸Again, see Boadway & Shah (2009).

6 Summary and concluding remarks

This paper revisited the soft budget constraint (SBC) problem, empirically shown to arise in many federations. Capturing the specific dynamics of political decision making in a federation, new light was shed on the incentives at work when lower-level (state) governments overborrow and are bailed out by the federal level.

The model presented here relied both on the work of Goodspeed and Besley & Coate. A two-period framework set up by Goodspeed, which endogenously models a SBC (2002), was supplemented by introducing the citizen-candidate model of Besley and Coate (1997) to its workings. Indeed, using a model where federal legislators are locally elected as done by Besley and Coate (2003), goes a long way in capturing the political decision making in a federation such as e.g. the Belgian one. Not only do federal representatives pay more heed to the interests of voters living in their regional constituency, they also have to work together with legislators representing *other* regions once in office. The compromise is an often well-balanced mix of regional preferences. The citizen-candidate model achieves just this, as representatives come together in a federal legislature once elected locally and start bargaining on public spending. They will agree on a specific allocation which maximises their joint surplus, following the Utilitarian bargaining solution, which is why we speak of a *cooperative* legislature. State governments on the other hand were simply assumed to follow the median voter.

A second diversion from Goodspeed's model concerned people's perception of state debt accumulation. Voters, and thus also candidates for federal office, were assumed to have specific preferences when it comes to debt. Preferences which may be psychologically tinged (dislike of being indebted) or even irrational (some people just don't like the word), or simply reflect myopia or rational expectations.

Setting the model to work, voters were shown to elect representatives with a higher preference for debt accumulation than their own preference type. Representatives of such a higher type will mind less when the state they represent accumulates debt, and will thus be more generous when cushioning state borrowing by use of bailouts. To accomplish this they will gladly tap the common pool of federal funds. Knowing this in advance, voters will turn this behaviour to their advantage by voting in precisely these generous types. This strategic voting behaviour not only leads to overly generous bailout policies. Also, and compared to a setting where federal decision making follows the median voter, states are proven to overborrow more inefficiently because of this federal generosity.

A case was then made for *federal* constituencies where politicians are elected from across the entire federation, which would neutralize these additional inefficiencies. Also, the overly generous bailouts were suggested to render Goodspeed's solution to the SBC problem more effective. If the federal government were to increase grants to all regions and not just to the borrowing state, as Goodspeed proposes, our model may deliver a stronger disciplining mechanism because of this generosity.

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Appendix

A Calculations federal government's problem

Deriving the only first order condition gives us:

$$\frac{\partial \sum_k^m \{U_{ij}\}}{\partial g_{i2}} = \frac{1}{g_{i2} + t_{i2}Y_{i2} - \lambda_{iE}^* B_{i1}(1+r)} - \sum_k^m Y_{k2} \frac{\partial w}{\partial C_{k2}} \frac{n_i}{\sum_k^m n_k Y_{k2}} = 0$$

Which, under our simplifying assumptions, reduces to:

$$\frac{\partial \sum_i^m \{U_{ij}\}}{\partial g_{i2}} = \frac{1}{g_{i2} + t_{i2}Y_{i2} - \lambda_{iE}^* B_{i1}(1+r)} - \frac{\partial w}{\partial C_{i2}} = 0$$

Or:

$$g_{i2} = \frac{\partial C_{i2}}{\partial w} - t_{i2}Y_{i2} + \lambda_{iE}^* B_{i1}(1+r)$$

B Calculations voting process

Voter j in state i maximises his utility whilst voting:

$$\text{Max}_{\lambda_{iE}} \ln(X_{i1}) + \ln(X_{i2}) + w_i(C_{i1}) + z_i(C_{i2})$$

Subject to:

$$X_{i1} = g_{i1} + t_{i1}Y_{i1} + \lambda_{ij}B_{i1}$$

$$X_{i2} = g_{i2}^* + t_{i2}Y_{i2} - \lambda_{ij}B_{i1}(1+r)$$

$$C_{i1} = Y_{i1}(1 - t_{i1})$$

$$C_{i2} = Y_{i2}(1 - t_{i2} - \frac{\sum_i^m n_i g_{i2}^*}{\sum_i^m n_i Y_{i2}})$$

$$t_{f2} \sum_i^m n_i Y_{i2} = \sum_i^m n_i g_{i2}$$

$$g_{i2}^* = \frac{\partial C_{i2}}{\partial w_i} - t_{i2}Y_{i2} + \lambda_{iE} B_{i1}(1+r)$$

Which yields the following first order condition:

$$\frac{U_{ij}}{\partial g_{i2}} = \frac{1}{\frac{\partial C_{i2}}{\partial w_i} - t_{i2}Y_{i2} + \lambda_{iE} B_{i1}(1+r) + t_{i2}Y_{i2} - \lambda_{ij} B_{i1}(1+r)} B_{i1}(1+r) - \frac{\partial w}{\partial C_{i2}} \frac{n_i Y_{i2}}{\sum_i^m n_i Y_{i2}} B_{i1}(1+r) = 0$$

Or:

$$\frac{\partial C_{i2}}{\partial w_i} + (\lambda_{iE}^* - \lambda_{ij}) B_{i1}(1+r) = \frac{\partial C_{i2}}{\partial w} \frac{\sum_k^m n_k Y_{k2}}{n_i Y_{i2}}$$

Which gives us:

$$\lambda_{iE} = \lambda_{ij} \frac{\partial C_{i2}}{\partial w} \left(\frac{\sum_{j \neq i}^m n_j Y_{j2}}{n_i Y_{i2}} \right) \frac{1}{B_{i1}(1+r)}$$

C Calculations state government's problem

The optimisation problem yields the following first order conditions:

$$\frac{\partial U_{im}}{\partial X_{i1}} Y_{i1} - \frac{\partial z}{\partial C_{i2}} Y_{i1} = 0$$

$$\frac{\partial U_{im}}{\partial X_{i2}} Y_{i2} - \frac{\partial w}{\partial C_{i2}} Y_{i2} = 0$$

$$\frac{\partial U_{im}}{\partial B_{i1}} = \frac{\partial U_{im}}{\partial X_{i1}} \lambda_{im} + \frac{\partial U_{im}}{\partial X_{i2}} \frac{\partial X_{i2}}{\partial B_{i1}} - \frac{\partial w}{\partial C_{i2}} \frac{n_i Y_{i2}}{\sum_k^m n_k Y_{k2}} \frac{\partial g_{i2}^*}{\partial B_{i1}} = 0 \quad (19)$$

So that we can rewrite (19) as:

$$\frac{\partial U_{im}}{\partial X_{i1}} \lambda_{im} = - \frac{\partial U_{im}}{\partial X_{i2}} \left(\frac{\partial g_{i2}^*}{\partial B_{i1}} - \lambda_{im} (1 + r) \right) + \frac{\partial U_{im}}{\partial X_{i2}} \frac{n_i Y_{i2}}{\sum_k^m n_k Y_{k2}} \frac{\partial g_{i2}^*}{\partial B_{i1}} \quad (20)$$

Or:

$$\frac{\frac{\partial U_{im}}{\partial X_{i1}}}{\frac{\partial U_{im}}{\partial X_{i2}}} = \left\{ R_i \frac{\partial g_{i2}^*}{\partial B_{i1}} + \left(\lambda_{im} (1 + r) - \frac{\partial g_{i2}^*}{\partial B_{i1}} \right) \right\} \frac{1}{\lambda_{im}} = 0 \quad (21)$$