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On public spending and unions

Fernando Broner
Alberto Martin
Jaume Ventura

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On Public Spending and Economic Unions

Fernando Broner, Alberto Martin, and Jaume Ventura*

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Abstract

We analyze the conduct of fiscal policy in a financially integrated union in the presence of financial frictions. Frictions create a wedge between the return to investment and the union interest rate. This leads to an over-spending externality. While the social cost of spending is the return to investment, governments care mostly about the (depressed) interest rate they face. In other words, the crowding out effects of public spending are partly "exported" to the rest of the union. We argue that it may be hard for the union to deal with this externality through the design of fiscal rules, which are bound to be shaped by the preferences of the median country and not by efficiency considerations. We also analyze how this overspending externality – and the union's ability to deal with it effectively – changes when the union is financially integrated with the rest of the world. Finally, we extend our model by introducing a zero lower bound on interest rates and show that, if financial frictions are severe enough, the union is pushed into a liquidity trap and the direction of the spending externality is reversed. At such times, fiscal rules that are appropriate during normal times might backfire.

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Keywords: public spending, economic union, crowding out, financial frictions, spending externalities, fiscal coordination

*Broner: fbroner@crei.cat. Martin: amartin@crei.cat. Ventura: jventura@crei.cat. Broner and Ventura: CREi, Universitat Pompeu Fabra and Barcelona GSE. Martin: ECB, CREi, and Barcelona GSE. We thank Philippe Martin, Linda Tesar, and participants at the IMF's 20th Jacques Polak Annual Research Conference and LBS seminar for their comments. Broner and Martin acknowledge support from the Spanish Ministry of Economy, Industry and Competitiveness through the I+D Excelencia grant (ECO2016-79823-P). Broner, Martin and Ventura acknowledge support from Spanish Ministry of Science and Innovation, through the Severo Ochoa Programme for Centers of Excellence in R&D grant (CEX2019-000915-S), from the Generalitat de Catalunya (AGAUR grant 2017SGR01393), the CERCA Programme/Generalitat de Catalunya, and from the Barcelona GSE Research Network. In addition, both Martin and Ventura acknowledge support from the ERC Consolidator Grant FP7-615651-MacroColl and Horizon 2020 Programme, Advanced Grant 2020-693512-GEPPS respectively. Janko Heineken and Carl-Wolfram Horn provided excellent research assistance. The views presented here are those of the authors and not of the European Central Bank.

1 Introduction

During the last three decades there has been a large and growing spread between estimates of the return to capital and the interest rates at which many governments borrow. This increase in the spread has been driven mostly by a reduction in interest rates, while estimates of the return to capital have remained stable. Figure 1 illustrates this for European countries.[1] Since 1990 real interest rates have fallen from 5% to -2%, while the return to capital has remained around 7%-8%.[2]

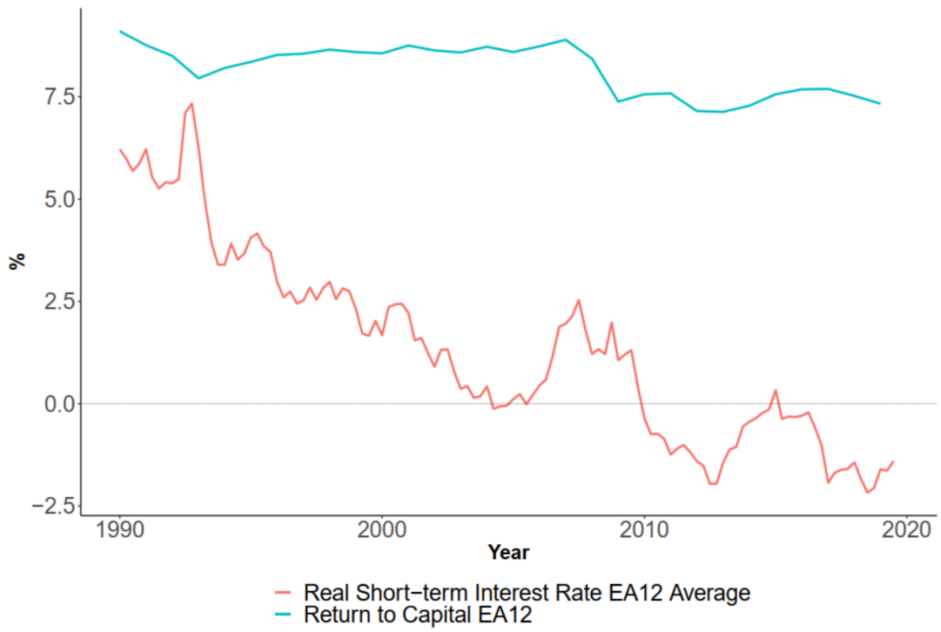

Figure 1: Return to Capital and Real Interest Rate in Europe

What are the implications of these trends for fiscal policy? A popular view is that the downward trend in interest rates implies that governments should increase public spending. The argument is very simple: If the rates at which governments borrow reflect the social cost

[1]Real short-term interest rates are computed from OECD data, by combining the series 'Short-term interest rates' and 'Inflation (CPI)'. To compute the EA12 average, each country is weighted by its GDP in each year. The return to capital is constructed with data from the AMECO database, which provides aggregated measures for the EA12 countries. We divide the series 'Net operating surplus: total economy' by 'Net-Capital Stock at 2015 prices: total economy', where the latter is multiplied by 'Price deflator gross fixed capital formation: total economy'. EA12 includes Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, and Greece.

[2]Similar trends have been documented for the US. See, for instance, Caballero, Farhi, and Gourinchas (2017) and Farhi and Gourio (2019).

of funds, and the marginal value of public spending has not declined dramatically, governments should react to a reduction in their cost of borrowing by spending more.[3]

This view seems quite natural, but it relies on the assumption that interest rates do in fact reflect the social cost of funds. Whether this is the case is not at all clear, especially given the large and growing spread between interest rates and estimates of the return to capital. And how one interprets this spread turns out to make a big difference for the effects of fiscal policy.

A first interpretation is that the spread in Figure 1 mostly reflects growing mismeasurement of the return to capital, possibly due to the rise of intangibles.[4] In other words, there has been no change in the spread as the return to capital has fallen alongside the interest rate. A second interpretation is that the spread reflects growing risk premia from higher investment risk or lower investor tolerance for such risk. In other words, the risk-adjusted return to capital has instead fallen alongside interest rates.[5] Both of these interpretations suggest that interest rates reflect the social cost of funds.

In this paper we focus on a third interpretation of the spread. Market frictions, such as financial constraints and market power, depress investment demand, creating a spread between the (risk-adjusted) return to capital and the interest rate.[6] To the extent that public spending crowds out private investment, its social cost is the return to capital, and interest rates provide a misleading measure of these costs. This would not be a problem in financial autarky since governments would internalize this discrepancy. But this is not the world we live in. During the last few decades, there has been a strong process of financial integration, especially within economic unions such as the euro area.[7] We argue that, in such an integrated world, the spread between the return to capital and the interest rate can lead to excessive public spending.

To study this problem, we construct a simple multi-country model. Each country has a government, which chooses how much to spend on a public good that raises the utility of the country's residents. The private sector, in turn, organizes production within firms. These

[3]See for example Blanchard (2019). Note that one does not need to appeal to Keynesian arguments to argue this.

[4]For evidence consistent with this view, see Farhi and Gourio (2019).

[5]For evidence in support of this view, see Caballero, Farhi, and Gourinchas (2017), Farhi and Gourio (2019), and Marx, Mojon, and Velde (2019).

[6]For evidence consistent with the relevance of such market frictions see Eggertsson, Robbins, and Wold (2018), Farhi and Gourio (2019), and Faltermeier (2019). The former two show that market power plays a significant role in accounting for the spread, while the latter shows that financial frictions must also play a role.

[7]For an overview of the evidence on international financial integration see Lane and Milesi-Firretti (2017). For evidence of even faster integration within the euro area see Kalemli-Ozcan, Papaioannou, and Peydró (2010).

firms hire workers in the labor market, and borrow from savers in the credit market to finance investment.

We make two crucial assumptions regarding the credit market. First, it is integrated across borders, i.e., savers located in any country within the union can lend to firms and governments located in any other of the union's countries without additional transaction costs. This is the defining feature of an economic union for us. Second, credit is hampered by a financial friction, namely, firms can only pledge a fraction of their capital income to savers. This friction limits borrowing and investment by firms, and generates a wedge between the return to capital and the interest rate.

Our first result is that this setup generates an overspending externality. To see this, assume countries are small relative to the union and take the interest rate as given. From the perspective of any country, the opportunity cost of its public spending equals the union interest rate. From the perspective of the union as a whole, the opportunity cost of public spending is the return to the private investment that it crowds-out. Since the interest rate is lower than the return to capital, public spending inefficiently high. This raises the question of whether some power over public spending should be transferred to the union.

Our second result, however, is that it is generically difficult for the union to correct the overspending externality through a centralized system of taxes or limits on spending. To show this, we make two assumptions about the union's policy-making process. The first one is that decisions are made democratically, i.e. by majority vote. The second assumption is that compliance with union decisions is compulsory, i.e. there are no opt-out clauses.

We then proceed in two steps. First, we endow the union with the power to set idiosyncratic spending limits on its members. Unfortunately, this institutional arrangement produces undesirable outcomes, as the union uses its fiscal power to impose extreme fiscal austerity and policy uniformity. The union's median voter, which effectively sets the policy of the group, does not internalize the local benefits of public spending but only its costs to the rest of the union in terms of crowding-out. Second, we endow the union with the power to tax public spending and distribute the proceedings among its members lump-sum. This institutional arrangement works much better, and might help to mitigate the overspending externality. But it can also worsen it, or even convert it into an underspending problem. The reason is that the policy adopted by the union will be guided by the preferences of the median voter and not by efficiency considerations.

These results are derived under the assumption that public spending crowds out investment in the union one-to-one. But this is not the case if part of the union's public spending can

be financed with foreign resources, i.e., by issuing debt outside of the union. To allow for this realistic possibility, we consider the effects of financial integration between the union and the rest of the world. In particular, we assume that some governments are "credible" and can issue debt outside of the union. By doing so, they effectively export the crowding-out effect of their public spending outside of the union. Financial integration with the rest of the world thus mitigates the overspending externality and raises the efficiency of the decentralized equilibrium. Somewhat paradoxically, we show that it may also reduce the union's ability to deal effectively with the overspending externality that remains. The reason is that credible governments have an incentive to impose excessively tight spending limits on union governments without credibility.

Finally, we reconcile the view developed here, in which financial frictions lead to excessive public spending, with the widespread notion that public spending may sometimes be insufficient because governments do not internalize the positive demand externalities of their spending. To do so, we extend the model and introduce a lower bound on the real interest rate. When financial frictions are not too severe, the interest rate remains above this lower bound and our main results remain valid. But if financial frictions become severe enough, private demand becomes so low that the interest rate reaches its lower bound. At this point, the economy enters a liquidity trap, output becomes demand-determined and there is economic slack. From the perspective of the union, the cost of public spending falls discontinuously from the marginal return to private investment, which is higher than the interest rate, to the marginal cost of production, which is below the interest rate. Consequently, the overspending externality is replaced by an underspending externality. We use this extension of the model to provide a narrative of the European crisis and to illustrate how austerity measures adopted during "normal" times can backfire when the economy is in a liquidity trap.

Our paper is related to the literature on fiscal spillovers. To the extent that most estimates of fiscal multipliers are lower than one, they suggest that there is some crowding out of private spending.[8] Most of these studies focus on domestic multipliers, however. Those that account for cross-border spillovers find that these are positive but quantitatively small. More specifically, spillovers appear to be significant during recessions or when the zero lower bound binds, and negligible otherwise.[9]

This evidence is consistent with our framework. Our model suggests that spillovers should

[8]Boehm (2011), for instance, estimates the fiscal multipliers of government consumption in the OECD to be around 0.8, and those of government investment to be practically zero.

[9]See for instance Beetsma, Giuliodori, and Klaassen (2006), Beetsma and Giuliodori (2011) and Blagrave, Koloskova, and Vesperoni (2017) on the former, and Auerbach and Gorodnichenko (2013) and Blagrave, Koloskova, and Vesperoni (2018) on the latter.

depend negatively on financial linkages, which lead to crowding-out externalities, and – at least in certain states of nature – positively on trade linkages, which lead to demand externalities. Unfortunately, the literature accounts for trade linkages but has not paid attention to financial linkages. Still, indirect evidence on the role of the latter exists. First, Faini (2006) shows that fiscal expansions in the euro area raise the interest rate throughout the union, and thus presumably lead to crowding out abroad. Second, Broner and others (2019) show that fiscal multipliers are increasing in the share of public debt held by foreigners. This is presumably because, under strong financial linkages, the negative crowding-out effects of public spending are suffered less domestically and more abroad.

Fiscal spillovers create the need for policy coordination, which has been widely studied. Part of this work was motivated by Europe's adoption of the Maastricht Treaty as it advanced towards monetary integration.[10] A general result is that uncoordinated fiscal policy is suboptimal if (i) countries have power in world markets;[11] (ii) there are distortions that create a wedge between the "local" and the "global" cost of public spending;[12] or (iii) governments are able to shift part of the fiscal cost of their spending to others.[13] Here we focus on (ii) and study an environment with financial frictions, in which the interest rate (the "local" cost) lies below the return to capital (the "global" cost). Note that, while most of the work based on (iii) has emphasized externalities generated by fiscal deficits, we focus here on those generated by public spending itself.

When analyzing the need for policy coordination, we are indeed touching upon a large literature in political economy that asks which level of government (here the countries or the union) is the right one to make a decision (here public spending). The traditional approach to this problem, due to Oates (1972, 1999), views the union as a benevolent dictator subject to a policy-uniformity constraint that forces it to impose the same policies to all its member countries. We do not take this approach here. Instead, we assume that the union can tailor its policies to the needs of its members, and that it chooses policies democratically. See Lockwood (2002), Besley and Coate (2003) and Ventura (2019). This last paper shows that the political equilibria discussed here are robust under more complex voting schemes, and it

[10] See Beetsma and Giuliodori (2010) for a survey of this literature.

[11] Devereux (1991), Epifani and Gancia (2009), and Hettig and Müller (2018) show that, when public spending improves countries' terms of trade, global spending may be inefficiently high. The latter, like us, also find that the externality may switch signs when the interest rate is constrained by a lower bound.

[12] See Chang (1990), Chari and Kehoe (1990) and Canzoneri and Diba (1991).

[13] The literature on "balanced budget rules", for instance, emphasizes the benefits of limiting fiscal deficits in the presence of cross-border fiscal transfers (e.g. Bassetto and Sargent (2006) and Azzimonti, Battaglini, and Coate (2016)). In a similar vein, Gourinchas, Martin, and Messer (2018) analyze the cross-border spillovers that arise from fiscal transfers or inflationary bias within a monetary union.

compares them to those that arise in the traditional approach.

The paper is structured as follows. Section 2 develops the baseline model and derives the over-spending externality. Section 3 analyzes the effects of endowing the union with fiscal powers. Section 4 introduces financial integration between the union and the rest of the world. Finally, Section 5 modifies the baseline model to allow for liquidity traps. Section 6 concludes.

2 A fiscal policy problem

We study an economic union with countries that have heterogeneous preferences over public spending. Labor markets are local, but there is a single financial market for all union members. As a result, public spending choices in one country are transmitted to the rest of the union through the common interest rate.

Public spending crowds out investment. Its social cost, thus, is the marginal product of the capital it displaces. Its private cost, however, is the interest rate paid on the debt used to finance it. If financial markets work well, the interest rate equals the marginal product of capital and decentralized governments choose the efficient level of public spending. If financial markets do not work well, a wedge arises between the interest rate and the marginal product of capital. In particular, the interest rate drops below the marginal product of capital if credit constraints depress the demand for credit. As a result, decentralized governments do not pay the full social cost of borrowing and choose levels of public spending that are too high.

This section describes this overspending externality and the factors that determine its importance. It also provides a recipe to fight it consisting of: (i) a set of fiscal policies that move the union from the decentralized equilibrium to a constrained Pareto optimum, and (ii) a set of country transfers that ensure that the efficiency gains from this move are equally shared by all union members.

2.1 The setup

There are two dates, Today and Tomorrow. The union contains a unit mass population, uniformly distributed across countries. There is a single consumption good that can be shipped across countries at zero trade costs. There are two factors of production, capital and labor, which can produce together only if located in the same country. The union has removed all barriers to trade.

Countries differ on their taste for public goods, as measured by a parameter $\gamma \in [\gamma_L, \gamma_H]$. Let $F(\gamma)$ be its distribution function, i.e., $F(x)$ is the measure or share of member countries

such that $\gamma \leq x$. Since all countries have the same population, $F(x)$ is also the measure or share of the union's population such that $\gamma \leq x$. Since (i) there is no other source of heterogeneity across countries; and (ii) we always focus on symmetric equilibria, we can index country variables by γ . For instance, we refer to the country with parameter γ as "country γ ", and write its utility function as $U(\gamma)$.

Country γ maximizes the utility function

$$U(\gamma) = c(\gamma) + \gamma \cdot \ln g(\gamma), \tag{1}$$

where $c(\gamma) \geq 0$ and $g(\gamma) \geq 0$ are the consumption of private and public goods Tomorrow. Equation (1) implies that (i) there is no consumption of private or public goods Today; and (ii) utility is linear in the consumption of private goods Tomorrow. This choice of preferences simplifies the analysis substantially. For instance, it makes the savings decision trivial as countries save any income they have Today.[14]

All countries start Today with an endowment of private goods equal to ω . Tomorrow, their income will consist of the wage $w(\gamma)$, plus the return to savings $R \cdot \omega$, minus taxes $t(\gamma)$. Thus, we can write the budget constraint of country γ Tomorrow as follows:

$$c(\gamma) = w(\gamma) + R \cdot \omega - t(\gamma). \tag{2}$$

Note that the wage can vary across countries, since labor markets are local. But the interest rate is common to all countries since there is a global financial market.

To produce private goods, firms use capital and labor using a standard constant-returns technology:

$$y(\gamma) = f(k(\gamma)), \tag{3}$$

where $y(\gamma)$ and $k(\gamma)$ are output and capital per worker, respectively. The function $f(\cdot)$ is continuous, twice differentiable, with $f'(\cdot) > 0$, $f''(\cdot) < 0$ and $\lim_{k \to 0} f'(k) = \infty$. To produce one unit of capital for Tomorrow, one unit of private goods must be invested Today.

To produce public goods, governments use public capital only. We normalize units so that one unit of public capital produces one unit of public goods. To produce one unit of public capital for Tomorrow, one unit of private goods must be spent Today. Thus, $g(\gamma)$ stands for both public goods and public capital, and we refer to it as public spending.

[14] With quasi-linear preferences, it is theoretically possible to have equilibria with corner solutions, i.e., such that $c(\gamma) = 0$ for some γ . We disregard these equilibria throughout and consider only equilibria such that $c(\gamma) > 0$ for all γ .

Let us now describe how firms work. Firms are nothing but contracts between workers that provide labor and savers that provide funds to invest in capital, respectively. Under the optimal contract, workers receive the marginal product of labor while savers receive the marginal product of capital. Ex-post, however, both factors would like to appropriate all output. We now introduce a standard limited-pledgeability constraint. In particular, firms are controlled by workers and they can only pledge a fraction $\lambda \in (0,1)$ of the capital income to savers. Thus, ex-ante contracts must reflect this constraint and output is distributed as follows:

$$w(\gamma) = f(k(\gamma)) - \lambda \cdot f'(k(\gamma)) \cdot k(\gamma), \tag{4}$$

$$R = \lambda \cdot f'(k(\gamma)). \tag{5}$$

This limited-pledgeability constraint plays a central role in what follows. It reduces the demand for savings and it creates a wedge between the interest rate and the marginal product of capital. Thus, savers only receive a fraction λ of the marginal product of the capital they finance (See Equation (5)). And workers receive not only the full marginal product of their labor, but also a fraction $1-\lambda$ of the marginal product of capital (see Equation (4)).[15]

Since all countries have the same technology and the friction λ is common to all countries, it follows that all countries must have the same stock of capital and wage. Indeed, for a given interest rate R , Equations (4) and (5) define these common values $w(\gamma) = w$ and $k(\gamma) = k$. Thus, factor prices are equalized across countries and, despite the limited-pledgeability constraint, the union's capital stock is efficiently distributed across countries. We shall see shortly, however, that this constraint distorts the size of the union's capital stock.

Let us consider next the financial market. On the supply side, savers supply funds. On the demand side, firms and governments demand funds to invest. Since there is no production or default risk, there is a unique interest rate R for all borrowers that clears the financial market

$$\omega = \int_{\gamma_L}^{\gamma_H} [k + g(\gamma)] \cdot dF(\gamma). \tag{6}$$

[15]To provide a more formal justification for this constraint, assume that only a subset of individuals ("entrepreneurs") with with mass ε in each country can write contracts with savers and workers. Assume, moreover, that entrepreneurs can divert a fraction $1-\lambda$ of capital income ex post. It is straightforward to show that the financing that entrepreneurs obtain from savers cannot exceed

$$\frac{\lambda \cdot f'(k)}{R - \lambda \cdot f'(k)} \cdot \varepsilon \cdot \omega.$$

The case that we consider can be interpreted as the limit in which $\varepsilon \to 0$, so that – to satisfy market clearing – the borrowing constraint is always binding and $R \to \lambda \cdot f'(k)$.

Equation (6) simply says that the interest rate must be such that the supply of funds by savers must equal the demand for funds by firms and governments.

We can now collect the results obtained so far to find that

$$U(\gamma) = f(\omega - g) + \lambda \cdot f'(\omega - g) \cdot g - t(\gamma) + \gamma \cdot \ln g(\gamma), \tag{7}$$

where g is total union public spending or public capital (as a rule, we denote union totals by omitting the index γ)

$$g = \int_{\gamma_L}^{\gamma_H} g(\gamma) \cdot dF(\gamma). \tag{8}$$

Equations (7)-(8) show how utility depends on the fiscal policies of all countries. Naturally, low taxes and high public spending at home raise welfare. But fiscal policy in the rest of the union also affects welfare at home. In particular, high public spending around the union reduces the capital stock and this lowers utility. This crowding-out effect will play a central role in the discussion that follows.

To complete the model, we need to explain how fiscal policy is determined. That is, we need a theory for the functions $\{g(\gamma), t(\gamma)\}$. Before developing such a theory, we note that the equilibrium functions $\{g(\gamma), t(\gamma)\}$ must be such that

$$\int_{\gamma_L}^{\gamma_H} [\lambda \cdot f'(\omega - g) \cdot g(\gamma) - t(\gamma)] \cdot dF(\gamma) = 0. \tag{9}$$

Equation (9) says that debt payments must be financed by taxes. This is an aggregate or union resource constraint for governments. But it does not preclude transfers between country governments. If $\lambda \cdot f'(\omega - g) \cdot g(\gamma) > t(\gamma)$ for some γ , for instance, part of the debt payments of country γ are financed by a transfer from governments of other countries. Since private consumption cannot be negative, the equilibrium functions $\{g(\gamma), t(\gamma)\}$ must also satisfy

$$t(\gamma) \leq f(\omega - g) + \lambda \cdot f'(\omega - g) \cdot g. \tag{10}$$

2.2 The decentralized equilibrium

Let us start by describing the decentralized or Nash equilibrium of this world. In such an equilibrium, (i) there are no transfers across governments, i.e., $t(\gamma) = R \cdot g(\gamma)$; and (ii) each government chooses $g(\gamma)$ so as to maximize $U(\gamma)$.

Without transfers, we can write the utility function in Equation (7) as follows:

$$U(\gamma) = f(\omega - g) + \lambda \cdot f'(\omega - g) \cdot [g - g(\gamma)] + \gamma \cdot \ln g(\gamma). \tag{11}$$

Then, government maximization implies

$$\frac{\gamma}{g^D(\gamma)} = \lambda \cdot f'\left(\omega - g^D\right), \tag{12}$$

where $g^D(\gamma)$ is public spending in the decentralized equilibrium, and $g^D = \int_{\gamma_L}^{\gamma_H} g^D(\gamma) \cdot dF(\gamma)$. Equation (12) says that governments choose spending so that the marginal utility of public goods equals the interest rate.[16]

Equation (12) defines $g^D(\gamma)$ as a function of g^D . We can use it to obtain (implicitly) the entire distribution of public spending:

$$g^D \cdot f'\left(\omega - g^D\right) = \frac{\gamma_A}{\lambda}, \tag{13}$$

$$g^D(\gamma) = \frac{\gamma}{\gamma_A} \cdot g^D, \tag{14}$$

where γ_A is the union average γ , i.e. $\gamma_A = \int_{\gamma_L}^{\gamma_H} \gamma \cdot dF(\gamma)$. Equation (13) implicitly defines the union's average public spending. For $g^D \in [0, \omega]$, the LHS defines a continuous and increasing function that takes values in $[0, \infty)$, while the RHS is a constant. Thus, we know that Equation (13) defines a unique solution g^D . Moreover, it is easy to check that this solution is increasing in ω and decreasing on λ . The reason is that an increase in ω lowers the interest rate, while an increase in λ raises it. Equation (14) shows how the union's public spending is distributed across countries. Not surprisingly, country level public spending is increasing in γ . Also, we note that changes in ω and λ affect public spending in all countries proportionally.

2.3 The overspending externality

From a country perspective, the cost of government debt is the interest rate. From a union perspective, however, the cost of government debt is the marginal product of capital. To see

[16]The simplicity of Equation (12) is in part due to some convenient assumptions. One should read this equation essentially as stating the optimal rule to allocate public and private capital from the perspective of the country. This rule says that the marginal product of public capital (which here is one!) times the marginal utility of public goods must equal the interest rate times the marginal utility of private goods (which here is one!).

this, we construct the set of constrained Pareto optima. In particular, we choose the functions $\{g(\gamma), t(\gamma)\}$ so as to maximize the utility in Equation (7) for some country γ , keeping the utility of all other countries constant at some pre-specified levels. By changing these levels, we find the set of all optima. Note that this is a notion of constrained Pareto efficiency since it takes the allocation of capital and labor as given by the market.

There are many Pareto optima in this subset, each of them with a different function $t(\gamma)$. But all of them have the same function $g^P(\gamma)$, which is defined as[17]

$$\frac{\gamma}{g^P(\gamma)} = f'\left(\omega - g^P\right), \tag{15}$$

where $g^P(\gamma)$ the Pareto efficient provision of public goods, and $g^P = \int_{\gamma_L}^{\gamma_H} g^P(\gamma) \cdot dF(\gamma)$. Equation (15) says that Pareto efficiency requires that public spending be chosen so that the marginal utility of public goods equals the marginal product of capital.

Equation (15) defines $g^P(\gamma)$ as a function of g^P . We can use it to obtain (implicitly) the entire distribution of public spending:

$$g^P \cdot f'\left(\omega - g^P\right) = \gamma_A, \tag{16}$$

$$g^P(\gamma) = \frac{\gamma}{\gamma_A} \cdot g^P. \tag{17}$$

Equation (16) defines a unique solution g^P which is increasing in ω . Comparing equations (13) and (16), we find that union spending in the decentralized equilibrium is too high relative to the Pareto optima, i.e. $g^D > g^P$. Equation (17) shows that public spending is indeed too high in all countries, i.e. $g^D(\gamma) > g^P(\gamma)$ for all γ .

The pledgeability constraint depresses the interest rate and this creates an overspending externality. From a union perspective, an additional unit of public spending by country γ reduces the union's capital stock by one unit, which in turn reduces union's output by $f'(\omega - g)$ units. The unit reduction in the union's capital stock is split across countries uniformly, so that all countries experiment an infinitesimal reduction in their capital stock and output. A fraction λ of the output loss is suffered by savers all over the union. But this loss is compensated by country γ , who needs to borrow to pay for the additional unit of public spending and offers savers government debt that is a perfect substitute for capital. A fraction $1 - \lambda$ of the output loss is suffered by workers all over the union. But workers receive no compensation for their loss. Since country γ is infinitesimal, only an infinitesimal

[17]This is because we are ignoring equilibria with corner solutions. See footnote 13.

fraction of this loss affects its own workers. Thus, country γ does not take this output cost into account when choosing its public spending.

Some readers might be asking why do we use the label "overspending" instead of "overborrowing" when we refer to the externality. After all, country governments are financing their public spending exclusively with debt. Is it really spending or is it debt that matters?

To find out, assume now that countries can finance their spending with a combination of taxes Today, i.e. $t_0(\gamma)$; and taxes Tomorrow, i.e. $t_1(\gamma)$. Then, the budget constraint of country γ becomes:

$$c(\gamma) = w(\gamma) + R \cdot [\omega - t_0(\gamma)] - t_1(\gamma), \tag{18}$$

In the decentralized equilibrium, there are no transfers among countries and the budget constraint of the government of country γ is now given by:

$$t_1(\gamma) = R \cdot [g(\gamma) - t_0(\gamma)]. \tag{19}$$

For given spending, taxes Today reduce government debt and the need for taxes Tomorrow. A quick look at Equations (18) and (19) reveals that this extension makes no difference. Equation (11) still holds and all our results flow from it.[18] Thus, Ricardian equivalence applies and a shift from debt to taxes has no effects on consumption and welfare.

This is an important observation. We analyze next various policies such as limits and taxes on spending. As we do so, we should keep in mind that these policies cannot simply be replaced by limits and taxes on debt. The latter would only produce a shift from debt to taxes without affecting consumption and welfare.

2.4 A blueprint for a policy improvement

We next show how to produce a Pareto improvement over the decentralized equilibrium. Consider the gain that country γ would experience after a move from the decentralized equilibrium

[18] To see this, use Equation (18) instead of Equation (2) to find that:

$$U(\gamma) = f(\omega - g) + \lambda \cdot f'(\omega - g) \cdot g - R \cdot t_0(\gamma) - t_1(\gamma) + \gamma \cdot \ln g(\gamma).$$

Then, use Equation (19) to recover Equation (11).

to a Pareto optimum with a tax function $t^P(\gamma)$

$$\begin{aligned} U^P(\gamma) - U^D(\gamma) = & f\left(\omega - g^P\right) - f\left(\omega - g^D\right) + \gamma_A \cdot \left(\ln g^P - \ln g^D\right) \\ & + (\gamma - \gamma_A) \cdot \left(1 - \lambda + \ln g^P - \ln g^D\right) \\ & + \lambda \cdot \gamma - t^P(\gamma). \end{aligned} \tag{20}$$

Equation (20) provides a useful decomposition of this gain. The first line shows the average utility effect of the move, which is always positive. The second line contains the differential utility effect of the move in the absence of transfers, i.e. if we impose $t^P(\gamma) = R \cdot g^P(\gamma) = \lambda \cdot \gamma$. On the one hand, countries with $\gamma > \gamma_A$ experiment a larger reduction in their borrowing and debt payments and therefore a larger increase of private consumption. On the other hand, these countries also experience a larger utility loss as their consumption of public goods shrinks. Finally, the third line shows the transfer that country γ receives which can be positive or negative.

There are various sets of transfers such that all countries gain from a move from the decentralized equilibrium to a Pareto optimum. For instance, if we set taxes as follows:

$$t^P(\gamma) = \lambda \cdot \gamma + (\gamma - \gamma_A) \cdot \left(1 - \lambda + \ln g^P - \ln g^D\right) \tag{21}$$

we have that (i) the union raises enough funds to pay for the public spending $g^P(\tau)$; and (ii) all countries equally share the gains from a shift from $g^D(\gamma)$ to $g^P(\gamma)$.[19] The set of transfers implicit in Equation (21) are given by $t^P(\gamma) - R \cdot g^P(\gamma) = (\gamma - \gamma_A) \cdot \left(1 - \lambda + \ln g^P - \ln g^D\right)$.

This discussion sets the stage for the analysis that follows. There are gains from cooperation and the question is how to structure interactions among countries to reap these gains. In particular, if a move from $g^D(\gamma)$ to $g^P(\gamma)$ can be coupled with an appropriate set of country transfers it raises the welfare of all countries. How could the union produce such a move?

3 A union with fiscal powers

A pure economic analysis of the fiscal policy problem would end with the solution described by Equations (16) and (17). These equations provide the recipe for a fiscal policy that eliminates the overspending externality, while Equation (21) provides a financing scheme that ensures equal sharing of the gains from such a move. What else could one wish for? Unfortunately, it

[19] To show (i) substitute Equation (21) into Equation (9) and use Equation (15). To show (ii), substitute Equation (21) into Equation (20) and note that only the first line remains.

is unlikely that such a fiscal policy be the outcome of the union's policy-making process. Economic unions are not mythical social planners, but real-life institutions that produce imperfect outcomes. It is to these outcomes that we turn next.

We make two assumptions about the union's policy-making process. The first one is that decisions are made democratically, i.e. by majority vote. The second assumption is that compliance with union decisions is compulsory, i.e. there are no opt-out clauses.

First, we endow the union with the power to set spending limits. Unfortunately, this institutional arrangement produces undesirable outcomes, as the union uses its fiscal power to impose extreme fiscal austerity and policy uniformity. Second, we endow the union with the power to tax public spending and distribute the proceedings among its members lump-sum. This institutional arrangement works much better. It might help mitigate the overspending externality. But it can also worsen it, or even convert it into an underspending problem.

3.1 Setting spending limits

Let the union have the power to set spending limits. Recognizing that countries have different tastes for public goods, we allow these limits to be country-specific. That is, the union chooses a function $\bar{g}(\gamma) \geq \varepsilon$ and then countries choose $g(\gamma)$ subject to $g(\gamma) \leq \bar{g}(\gamma)$. The lower bound on spending limits $\varepsilon > 0$ is assumed to be arbitrarily small but not zero. This is just a technical requirement to ensure that utilities are always well defined.

These case-by-case spending limits provide a natural starting point for the analysis. First, they are relevant in practice. Even though economic unions are often built on common rules (e.g. Maastricht for the European Union), it is also common to grant individual exceptions to these rules. In the case of the euro area, for instance, individual countries have received idiosyncratic treatment in times of crisis. Through the lens of our model, these are equivalent to country-specific restrictions. Second, case-by-case limits are conceptually important. They illustrate why a high degree of flexibility, which might seem appropriate in an heterogeneous union, may backfire in practice.

The equilibrium with spending limits satisfies: (i) there are no transfers across governments, i.e., $t(\gamma) = R \cdot g(\gamma)$; (ii) spending limits are chosen case by case through majority voting; and (iii) each government chooses $g(\gamma)$ so as to maximize $U(\gamma)$ subject to $g(\gamma) \leq \bar{g}(\gamma)$.

Without transfers, Equation (11) still applies. Thus, for given spending limits $\bar{g}(\gamma)$, country γ chooses its spending as follows:

$$g^U(\gamma) = \min\left\{\frac{\gamma}{\lambda \cdot f'(\omega - g^U)}, \bar{g}(\gamma)\right\}, \tag{22}$$

where $g^U(\gamma)$ is the equilibrium fiscal policy under the union, and $g^U = \int_{\gamma_L}^{\gamma_H} g^U(\gamma) \cdot dF(\gamma)$. Equation (22) says that, if the spending limit is not binding, country γ chooses public spending so that the marginal utility of public goods equals the interest rate. If the spending limit is binding, though, the country sets its public spending equal to the limit. Adding up across countries, we find that the union's average spending is implicitly determined as follows:

$$g^U = \int_{\gamma_L}^{\gamma_H} \min\left\{\frac{\gamma}{\lambda \cdot f'(\omega - g^U)}, \bar{g}(\gamma)\right\} \cdot dF(\gamma). \tag{23}$$

Equation (23) shows that relaxing a binding limit $\bar{g}(\gamma)$ for country γ raises the union's average spending g^U , i.e. $\partial g^U / \partial \bar{g}(\gamma) > 0$. There is a direct effect, which is the increase in public spending in country γ itself. But there is also an indirect effect since the interest rate increases and this lowers public spending in countries where the spending limit is not binding. This indirect effect cannot fully offset the direct one, though.

Equations (22)-(23) determine the equilibrium fiscal policy for given spending limits $\bar{g}(\gamma)$. The union would implement a Pareto optimum if it could somehow deliver the policy outcome: $\bar{g}(\gamma) = g^P(\gamma)$ for all γ . Unfortunately, this is not going to happen as it will become clear soon.

The first step is to determine preferences over policy. An almost trivial observation is that relaxing its own spending limit cannot lower the welfare of country γ , i.e. $\partial U(\gamma) / \partial \bar{g}(\gamma) \geq 0$. A less trivial observation is that relaxing the spending limit for other countries, i.e. $\gamma' \neq \gamma$, has the following effect on the welfare of country γ :

$$\frac{\partial U(\gamma)}{\partial \bar{g}(\gamma')} = -\frac{\partial g^U}{\partial \bar{g}(\gamma')} \cdot \left\{(1-\lambda) \cdot f'\left(\omega - g^U\right) + \lambda \cdot f''\left(\omega - g^U\right) \cdot \left[g^U - g^U(\gamma)\right]\right\}. \tag{24}$$

Relaxing spending limits in other countries increases the union's average public spending, and this raises the interest rate and crowds out capital. This has two effects for country γ , which correspond to the two terms inside the brackets. The first term captures the wage loss in country γ that results from a reduction in its capital stock. This is nothing but the cost of the overspending externality. The second term is a terms-of-trade effect that results from an increase in the interest rate. This terms-of trade effect is a cost for debtor countries (i.e., $g^U(\gamma) > g^U$), but a benefit for creditor ones (i.e., $g^U(\gamma) < g^U$). Since the only asymmetry across countries is the taste for public goods, public spending is the key determinant of the net foreign asset position. Countries choosing high public spending are debtors, while countries choosing low public spending are creditors.

Preferences over other countries' spending limits are determined by the balance of these

effects. If country γ is either a debtor or a small creditor, the balance of these effects is negative and its welfare grows monotonically as the spending limit of any other single country becomes tighter. If country γ is instead a large enough creditor, the terms-of-trade benefit exceeds the cost of the overspending externality and its welfare declines monotonically as the spending of any other single country becomes tighter. Thus, for a given set of spending limits for all other countries, country γ 's preferences over the spending limit of country γ' are single-peaked. There is a threshold value of γ such that for all countries below the threshold the peak corresponds to the tightest spending limit, while for all countries above the threshold the peak corresponds to any non-binding spending limit.

The union chooses spending limits case by case, which means that a specific spending limit is voted for each country separately. Since preferences are single peaked and the policy space is unidimensional, the median voter theorem applies to each of these votes. Thus, the spending limits for all countries coincide with the bliss point of the median country γ_M , i.e. $F(\gamma_M) = 0.5$.[20] Interestingly, this procedure might generate multiple equilibria. The reason is that the outcome of the vote for the spending limit of a given country depends on the outcomes of the votes for the spending limits of other countries.

There is always an equilibrium in which all spending limits are as tight as possible:

$$\bar{g}(\gamma) = \varepsilon. \tag{25}$$

To prove this, we simply note that, if $\bar{g}(\gamma) = \varepsilon$ for all γ , the median country is neither a debtor nor a creditor and it prefers to set $\bar{g}(\gamma) = \varepsilon$ for all $\gamma \neq \gamma_M$. Thus, the union ends up imposing a single limit to all countries. Moreover, this limit is the tightest possible one. Since ε is arbitrarily small, endowing the union with the power to set spending limits produces an arbitrarily large utility loss. One can describe this undesirable outcome as the union imposing an extreme austerity bias and a strong policy uniformity.

Why does the union exhibit such extreme austerity bias? An increase in public spending in any one country would generate a local benefit, but also a negative externality in all other countries in the union. In the decentralized equilibrium, countries maximize the local benefit and disregard the externality. Since the externality is negative, the decentralized equilibrium produces overspending. In the union equilibrium, the union minimizes the externality and disregards the local benefit. Since the local benefits are positive, the union equilibrium produces underspending.

[20]To be precise, the assumption that $F(\cdot)$ is continuous and differentiable ensures that in all votes the median voter is always arbitrarily close to γ_M .

Why does the union exhibit such a strong policy-uniformity? We have assumed that the lower bound for the spending limit is the same for all countries. If this lower bound were to vary across countries, the spending limits chosen by the union would be equal to each country's lower bound. Thus, the strong policy-uniformity result follows from the combination of extreme austerity and a common lower bound for spending limits.

Is this undesirable equilibrium unique? The answer is affirmative if the median country's taste for public goods is not too low relative to that of the average country. Otherwise, there is also an equilibrium in which the spending limits are irrelevant, i.e.

$$\bar{g}(\gamma) \geq g^D(\gamma). \tag{26}$$

To prove this, simply note that, if $g(\gamma) = g^D(\gamma)$ for all γ , the median country prefers to set a non-binding limit if and only if

$$\frac{\gamma_M}{\gamma_A} < 1 - \frac{1-\lambda}{\lambda} \cdot \frac{f'\left(\omega - g^D\right)}{-f''\left(\omega - g^D\right) \cdot g^D}. \tag{27}$$

That is, the median country has to have a sufficiently large creditor position in the decentralized equilibrium. If this is the case, there is an equilibrium in which the union sets non-binding limits and these have no effects on public spending.

We conclude therefore that endowing the union with the power to set spending limits is a bad idea. At best, it is ineffective. At worst, it generates harmful uniformity and austerity biases. The union sets policy country by country and, when each country is considered, all the other countries (which naturally form a majority) care only about externalities and disregard local benefits. Thus, they all vote for the tightest possible spending limit. This converts an overspending problem into an underspending one.

One way to soften the austerity bias created by the union is to reduce its power and force it to impose a single uniform spending limit for all countries. Such a restriction links local benefits and externalities in the union's decision-making process. When each country votes for this single limit, it knows that it will affect its own spending in addition to the spending of other countries. Thus, a single spending limit $\bar{g}$ would soften the austerity bias. This cannot be the right solution, though, since it does so by imposing an undesirable degree of policy uniformity. This seems too high a cost to pay. Indeed, there are better institutional arrangements that produce outcomes that respect preference heterogeneity.

An alternative, more classic, approach to fight the overspending externality consists of taxing public spending. If we give the union the power to set a tax schedule country by

country, the same problems resurface. Essentially, the union's strong austerity bias leads it to choose a set of country-specific taxes that produce a uniform and arbitrarily low level of public spending. If we instead restrict the union to choose a single tax for all countries, local benefits and externalities become linked in the union's decision-making process. Moreover, this is achieved without much of a cost. Having a uniform tax is much less costly (in fact, it is the right thing to do!) than having a single spending limit (which is clearly the wrong thing to do!). We explore this idea next.

3.2 Taxing public spending

Let us now endow the union with the power to choose a single tax schedule for all countries. In particular, let the union choose $t \geq 0$ such that

$$t(\gamma) = -z + t \cdot R \cdot g(\gamma), \tag{28}$$

where z is a lump-sum transfer that balances the union's budget:

$$z = (t-1) \cdot \int_{\gamma_L}^{\gamma_H} R \cdot g(\gamma) \cdot dF(\gamma). \tag{29}$$

If $t = 1$, each country pays for its own public spending and there are no transfers, $z = 0$. If $t > 1$ the union imposes a tax on public spending and transfers are positive, $z < 0$. If instead $t < 1$, the union gives a subsidy on public spending and transfers are negative, $z < 0$. As before, we assume for technical reasons that $t < \tau$, where τ is assumed to be arbitrarily large.

The equilibrium with taxes/subsidies on public spending is such that (i) the tax schedule is given by Equations (28)-(29); (ii) the union chooses t through majority voting; and (iii) each government chooses $g(\gamma)$ so as to maximize $U(\gamma)$.

We can now write the utility of country γ as follows:

$$U(\gamma) = f(\omega - g) + t \cdot \lambda \cdot f'(\omega - g) \cdot [g - g(\gamma)] + \gamma \cdot \ln g(\gamma). \tag{30}$$

Thus, for a given tax/subsidy t , we now have that:

$$\frac{\gamma}{g^U(\gamma)} = t \cdot \lambda \cdot f'\left(\omega - g^U\right), \tag{31}$$

where $g^U(\gamma)$ is again the equilibrium fiscal policy under the union, and $g^U = \int_{\gamma_L}^{\gamma_H} g^U(\gamma) \cdot dF(\gamma)$. Equation (31) says that country γ chooses public spending so that the marginal utility of

public goods equals the after-tax interest rate. Equation (31) implies the following distribution of spending:

$$g^U \cdot f'\left(\omega - g^U\right) = \frac{\gamma_A}{t \cdot \lambda}, \tag{32}$$

$$g^U(\gamma) = \frac{\gamma}{\gamma_A} \cdot g^U. \tag{33}$$

The comparative statics are essentially the same as those of the decentralized equilibrium, except that now we have an additional variable which is the tax/subsidy t .[21] An increase in t raises the cost of borrowing and reduces public spending in all countries proportionally. Thus, there is a one-to-one mapping between g^U and t and, as a result, also between $g^U(\gamma)$ and t .

Equations (32)-(33) determine the equilibrium fiscal policy for a given tax/subsidy t . If the union somehow chose $t = \lambda^{-1}$, it would implement a Pareto optimum.[22] Whether this happens is unclear, though.

Let us start again by describing the policy preferences of country γ . That is, we want to know how $U(\gamma)$ changes with t , under the restriction that the distribution of public spending is given by Equations (32)-(33). A bit of straightforward algebra shows that country γ has preferences over t that exhibit an inverted-U shape with a maximum given when $t = \frac{\gamma_A}{\gamma} \cdot \lambda^{-1}$.[23] This implies that the optimal tax/subsidy for country γ is such that $g^U(\gamma) = g^U$.

The union chooses the tax/subsidy by majority vote. Since preferences are single-peaked and the policy-space is unidimensional, the median voter theorem applies. Thus, the equilibrium tax rate is the bliss point of the median country

$$t = \frac{\gamma_A}{\gamma_M} \cdot \lambda^{-1}. \tag{34}$$

The equilibrium tax achieves a Pareto optimum if and only if $\gamma_M = \gamma_A$. Generically, there is no reason to expect this to happen. If the median country has a strong taste for public goods,

[21] To see this, compare Equations (32)-(33) to Equations (13)-(14).

[22] To see this, simply note that, as $t \to \lambda^{-1}$, Equations (32)-(33) converge to Equations (16)-(17).

[23] To see this, use Equations (32)-(33) to rewrite the utility function in Equation (30) as follows:

$$U(\gamma) = f\left(\omega - g^U\right) + \gamma_A - \gamma + \gamma \cdot \ln\left(\frac{\gamma}{\gamma_A} \cdot g^U\right).$$

Thus, $U(\gamma)$ is increasing in g^U when g^U is low, but decreasing when g^U is large. The maximum or peak is given by:

$$f'\left(\omega - g^U\right) = \frac{\gamma}{g^U}.$$

Equation (32) shows that the tax rate that delivers this outcome is $t = \frac{\gamma_A}{\gamma} \cdot \lambda^{-1}$.

then the equilibrium tax is too low and it can even be a subsidy. If the median country has a weak taste for public goods, then the tax is too high.

3.3 Discussion

All of our results so far have been derived assuming that countries are heterogeneous only in their taste for public goods. This dimension of heterogeneity is important because it allows us to consider the issue of policy uniformity. A natural question is whether other dimensions of heterogeneity might lead to different results. Assume, for instance, that countries differ only in their wealth or savings: in particular, wealth $\omega \in [\omega_L, \omega_H]$, and ω_A denotes the average level of wealth.

It can be shown that, in this case, all countries have the same equilibrium level of public spending and investment. However, since they have different levels of wealth some countries are creditors (those with $\omega > \omega_A$) and others are debtors (those with $\omega < \omega_A$). Still, none of our main results change. Relative to the constrained optimum, equilibrium public spending is too high. A union with fiscal powers, moreover, has a hard time restoring constrained efficiency. To see this, consider first the case of spending limits. Let ω_M denote the wealth of the median country. If $\omega_M < \omega_A$, the median country is a debtor and spending limits lead to extreme austerity. Tight spending limits benefit the median country both by reducing the crowding-out effect of public spending and by lowering the equilibrium interest rate. If $\omega_M > \omega_A$, these two effects go in opposite directions and, once the median country becomes a large enough creditor, the spending limits will become irrelevant. Thus, the same two equilibria arise.

Consider next the case of a union tax on public spending. This tax will in general be inefficient. The reason is that, if the median country is a debtor (i.e., $\omega_M < \omega_A$), it will prefer a suboptimally high tax to benefit from the lower equilibrium interest rate. Conversely, if the median country is a creditor (i.e., $\omega_M > \omega_A$), it will prefer a suboptimally low tax.

The key takeaway is that endowing the union with the power to tax public spending is likely to work if the median country is not too far from the average one. Is this result robust though? It seems to rely heavily on the observation that, in our environment, a single or common tax to public spending is the right solution to the overspending problem. And this, in turn, seems to be a direct consequence of assuming that a unit of spending by any government reduces private investment by exactly the same amount. But this need not be the case if some governments have access to financial markets outside of the union. We show this next.

4 Domestic and foreign debt

Let us consider the effects of financial integration between the union and the rest of the world. To simplify the analysis, we adopt the classic small-economy assumption and take the world interest rate as given. This approach allows us to analyze the effects of alternative institutional arrangements for union welfare, but not for the rest of the world. In this regard, our welfare analysis should be considered only as partial.

Financial integration has one key benefit for the union: namely, it allows it to "export" some of the crowding out effects of public spending. When the union is in a regime of financial autarky, as in the previous sections, all the resources needed to finance public spending must come from within the union, i.e. by issuing "domestic" debt. Under financial integration, however, some of the resources to finance public spending can be imported from the rest of the world, i.e., by issuing "foreign" debt.

By enabling the union to (at least partially) finance its public spending through foreign debt, financial integration mitigates the crowding-out effect of public spending and the associated externality. This clearly enhances welfare in the decentralized equilibrium. But the ability to issue foreign debt may be unevenly distributed across countries in the union. Some countries may have substantial access to the rest of the world's financial markets, whereas others may have none at all. This difference among countries may exacerbate their heterogeneity in preferences, in turn, which may severely distort their collective decision making under a fiscal union. Ultimately, there are potentially two reasons why financial integration reduces the benefits of providing the union with fiscal tools: it mitigates the overspending externality and it distorts the union's decision-making process.

4.1 Financial integration

The effects of financial integration depend on the assumptions we make about international financial frictions. We have assumed so far that these frictions are so severe that the union cannot trade with the rest of the world. If we went to the other extreme and made these frictions negligible, the overspending externality would disappear at once. To see this, note that we would simply have to replace Equation (6) with

$$R = R^*, \tag{35}$$

where R^* is the interest rate in the rest of the world. It is straightforward to check that, in this case, the capital stock of the union is independent of public spending. All the crowding-out

effects are exported to the rest of the world. There is no fiscal policy problem (at least from the union's perspective), and there is therefore no need to endow the union with any fiscal power.[24]

But this extreme case is not realistic either. In earlier research, we have argued that contract enforcement tends to discriminate against foreigners (see Broner and others (2014)). For instance, courts might discriminate against foreigners when enforcing debt contracts. In this case, workers could only pledge a fraction λ^* of the marginal product of capital to foreigners, with $\lambda^* < \lambda$. As a result, there is a range of inaction in which firms do not borrow from foreign savers, while union savers do not lend to the rest of the world. This range is given by

$$\lambda^* \cdot f'(k) < R^* < \lambda \cdot f'(k), \tag{36}$$

where k is the equilibrium capital in the union.[25] Since we are interested in the crowding-out effects of public spending, we focus throughout on equilibria that satisfy Equation (36).[26]

Financial integration offers governments around the union the opportunity to borrow from the rest of the world at an interest rate that is below that of the union. All governments would want to take advantage of this opportunity. The question is, of course, whether they can. After all, courts also discriminate against foreigners when enforcing public debt contracts. We assume that there is a fraction $1 - \nu$ of governments that have built a reputation and can credibly commit to repay their debts without resorting to courts. These "credible" governments can borrow from the rest of the world at the low interest rate R^* , and they naturally choose to do so. The remaining fraction ν of union governments are not credible and cannot borrow from the rest of the world. To denote country types, we use the indicator variable $\delta \in \{0, 1\}$, and set $\delta = 1$ to indicate a country with a credible government and $\delta = 0$ otherwise. Thus, countries are now defined by the pair (γ, δ) .

[24]If the union were large relative to the world, all the effects we discussed in previous sections would still apply. Spending would crowd out union capital, although less than one-to-one. Part of the crowding-out effect would be exported outside of the union. Also, the union would import crowding-out effects from the rest of the world. To determine the welfare effects of these "exports" and "imports" we would need to take a stand on how strong financial frictions are outside the union, and how policymaking is conducted there. These dimensions of the problem are certainly interesting and worth studying in future research.

[25]Sufficient conditions for Equation (36) to hold are that (i) $R^* < \lambda \cdot f'(\omega)$; and (ii) λ^* be low enough.

[26]If R^* lies outside of this range, public spending does not crowd out union investment. To see this, note that there are only two possibilities in any such equilibrium. First, $R^* = \lambda^* \cdot f'(k)$, in which case union firms borrow from the rest of the world at the margin. Second, $R^* = \lambda \cdot f'(k)$, in which case union savers lend to the rest of the world at the margin. In either case, the capital stock in the union is independent of public spending in the union.

4.2 Decentralized equilibrium

In a decentralized equilibrium, each government chooses $g(\gamma, \delta)$ so as to maximize

$$\begin{aligned} U(\gamma, \delta) = & f(\omega - g_0) + \lambda \cdot f'(\omega - g_0) \cdot g_0 \\ & - [(1-\delta) \cdot \lambda \cdot f'(\omega - g_0) + \delta \cdot R^*] \cdot g(\gamma, \delta) + \gamma \cdot \ln g(\gamma, \delta), \end{aligned} \tag{37}$$

where g_0 denotes spending by "non-credible" countries, i.e., $g_0 = \int_{\gamma_L}^{\gamma_H} g(\gamma, 0) \cdot dF(\gamma, 0)$, where $F(\gamma, \delta)$ is the joint cdf over γ and δ . The share of countries that are not credible is given by $\nu = \int_{\gamma_L}^{\gamma_H} dF(\gamma, 0)$.

Letting $g^D(\gamma, \delta)$ denote public spending in the decentralized equilibrium, it follows from maximization of Equation (37) that

$$\frac{\gamma}{g^D(\gamma, \delta)} = \begin{cases} \lambda \cdot f'\left(\omega - g_0^D\right) & \text{if } \delta = 0, \\ R^* & \text{if } \delta = 1, \end{cases} \tag{38}$$

where $g_0^D = \int_{\gamma_L}^{\gamma_H} g^D(\gamma, 0) \cdot dF(\gamma, 0)$. Equation (38) says that, in the decentralized equilibrium, governments equalize the marginal utility of public goods to the interest rate paid on public debt. In this regard, financial integration changes nothing.[27] But now the relevant interest rate differs across countries: for credible countries that borrow from the rest of the world (i.e., $\delta = 1$), the relevant interest rate is R^* ; for non-credible countries that issue debt inside the union (i.e., $\delta = 0$), the relevant interest rate is $\lambda \cdot f'\left(\omega - g_0^D\right)$.

Equation (38) defines $g^D(\gamma, 0)$ as a function of g_0^D . To find the latter, note that

$$g_0^D \cdot f'\left(\omega - g_0^D\right) = \frac{\nu \cdot \gamma_{A,0}}{\lambda}, \tag{39}$$

where $\gamma_{A,0}$ is the average γ among non-credible countries, i.e. $\gamma_{A,0} = \nu^{-1} \cdot \int_{\gamma_L}^{\gamma_H} \gamma \cdot dF(\gamma, 0)$. Once g_0^D has been found, it follows from Equations (38)-(39) that

$$g^D(\gamma, \delta) = \begin{cases} \dfrac{\gamma}{\gamma_{A,0}} \cdot \dfrac{g_0^D}{\nu} & \text{if } \delta = 0, \\ \dfrac{\gamma}{R^*} & \text{if } \delta = 1. \end{cases} \tag{40}$$

In both credible and non-credible countries, public spending is increasing in γ . In non-credible countries, moreover, spending depends on the union interest rate and thus on the equilibrium

[27] From our discussion in Section (2.3), it makes no difference whether non-credible countries finance their spending through taxes or through domestic debt. To simplify the exposition, we assume throughout that they resort fully to domestic debt.

within the union. In particular, public spending in these countries is increasing in ω , which expands the supply of savings and reduces the union interest rate; it is also decreasing in $\gamma_{A,0}$ and ν , since both raise total public spending by non-credible countries thereby increasing the union interest rate. For credible countries, instead, the union interest rate is irrelevant and spending depends only on the international interest rate R^* .

4.3 Foreign versus domestic debt and overspending

From the perspective of each individual country, the cost of public spending is the interest rate on public debt. From the perspective of the union, this cost is accurate for credible countries that finance their public spending with foreign debt. But it is not accurate for non-credible countries that issue domestic or union debt: due to the crowding-out effect, their social cost of public spending equals the marginal product of capital.

To see this, consider once again the subset of Pareto optima with positive consumption of private goods for all countries. In all of them, it is straightforward to show that the following condition holds:

$$\frac{\gamma}{g^P(\gamma,\delta)} = \begin{cases} f'\left(\omega - g_0^P\right) & \text{if } \delta = 0, \\ R^* & \text{if } \delta = 1, \end{cases} \tag{41}$$

where $g^P(\gamma,\delta)$ the Pareto efficient provision of public goods, and $g_0^P = \int_{\gamma_L}^{\gamma_H} g^P(\gamma,0)\cdot dF(\gamma,0)$. Equation (41) says that, in a Pareto efficient allocation, the marginal utility of public goods must be equal to the international interest rate in credible countries, and to the marginal product of capital in non-credible countries.

Again, Equation (41) defines $g^P(\gamma,0)$ as a function of g_0^P . The latter is given by

$$g_0^P \cdot f'\left(\omega - g_0^P\right) = \nu \cdot \gamma_{A,0}. \tag{42}$$

Comparing equations (39) and (42) we can verify that, relative to the Pareto efficient allocation, spending in the decentralized equilibrium is efficient in credible countries but it is too high in non-credible countries, i.e. $g_0^D > g_0^P$. Moreover, since

$$g^P(\gamma,0) = \frac{\gamma}{\gamma_{A,0}} \cdot \frac{g_0^P}{\nu}, \tag{43}$$

it follows that public spending is too high in all non-credible countries, i.e. $g^D(\gamma,0) > g^P(\gamma,0)$ for all γ .

The intuition for this result is by now familiar. The financial friction depresses the equi-

librium interest rate of the union. This creates an overspending externality, but only for non-credible countries that finance their spending with domestic debt. From the perspective of these countries, the cost of an additional unit of spending equals the union interest rate $\lambda \cdot f'(\omega - g_0)$. From a union perspective, however, an additional unit of public spending by these countries reduces the union's capital stock by one unit, which in turn reduces union's output by $f'(\omega - g_0)$ units. For credible countries, on the other hand, there is no overspending externality because they finance their spending with foreign debt: from the perspective of both, these countries and the union, the cost of a unit of public spending is the interest rate paid to the rest of the world, R^* .

4.4 Implications for a fiscal union

It is straightforward to show that, relative to autarky, financial integration raises aggregate welfare in both the decentralized equilibrium and Pareto efficient allocations. It also has natural implications for the design of a fiscal union. Namely, the need to control public spending varies across union members depending on whether they finance their public spending with domestic or foreign debt. In principle, the union should tax the share of public spending that is financed through domestic debt. In practice, this amounts to taxing public spending by non-credible countries, since credible countries are able (and willing) to finance their spending fully through foreign debt.

In light of this, let us consider a differentiated tax/subsidy system that depends both on public spending and on δ ,

$$t(\gamma, \delta) = \begin{cases} -z + t \cdot R \cdot g(\gamma, \delta) & \text{if } \delta = 0, \\ -z & \text{if} \delta = 1 \end{cases} \tag{44}$$

where z is a lump-sum transfer that balances the union's budget,

$$z = (t - 1) \cdot R \cdot g_0. \tag{45}$$

It is clear that this differentiated spending tax is enough for the union to implement a Pareto efficient allocation. By setting $t = \lambda^{-1}$, the union can induce non-credible countries to fully internalize the externality that their spending generates to the rest of the union, and it does so without distorting spending by credible countries.

But would the union choose such a tax in equilibrium? The equilibrium with taxes/subsidies on public spending is such that (i) the tax is given by Equations (44)-(45); (ii) the union

chooses t by majority voting; and (iii) each government chooses $g(\gamma, \delta)$ so as to maximize $U(\gamma, \delta)$.

The preferences of country (γ, δ) can be written as:

$$U(\gamma, \delta) = \begin{cases} f(\omega - g_0) + t \cdot \lambda \cdot f'(\omega - g_0) \cdot [g_0 - g(\gamma, \delta)] + \gamma \cdot \ln g(\gamma, \delta) & \text{if } \delta = 0, \\ f(\omega - g_0) + t \cdot \lambda \cdot f'(\omega - g_0) \cdot g_0 - R^* \cdot g(\gamma, \delta) + \gamma \cdot \ln g(\gamma, \delta) & \text{if } \delta = 1. \end{cases} \tag{46}$$

Thus, for a given tax/subsidy t , we now have that

$$\frac{\gamma}{g^U(\gamma, \delta)} = \begin{cases} t \cdot \lambda \cdot f'\left(\omega - g_0^U\right) & \text{if } \delta = 0, \\ R^* & \text{if } \delta = 1, \end{cases} \tag{47}$$

where $g^U(\gamma, \delta)$ is once again the equilibrium fiscal policy under the union, and $g_0^U = \int_{\gamma_L}^{\gamma_H} g^U(\gamma, 0) \cdot dF(\gamma, 0)$. As before, all countries set public spending so that the marginal utility of public goods equals its marginal cost.

To determine the equilibrium policy of the union, we begin once again by describing the policy preferences of country (γ, δ) . That is, we want to know how $U(\gamma, \delta)$ changes with t , under the restriction that the distribution of public spending satisfies Equation (47). A little bit of algebra delivers two results.

First, credible countries maximize their welfare by setting an arbitrarily high value of t , i.e., $t = \tau$. By doing so, they minimize the crowding-out effect of public spending by non-credible union members, but they do not have to pay taxes themselves. In other words, they capture the benefits of taxation while fully avoiding its costs.[28]

What about non-credible countries? Maximization of Equation (46) yields a preferred tax rate of

$$t = \frac{\nu \cdot \gamma_{A,0}}{\gamma} \cdot \lambda^{-1}, \tag{48}$$

for country $(\gamma, 0)$.[29] This result mirrors the tax rate of Section 3.2, with one key difference.

[28]To see this, use Equations (47) to rewrite the utility function in Equation (46) as follows:

$$U(\gamma, 1) = f(\omega - g_0) + \nu \cdot \gamma_{A,0} - R^* g(\gamma, 1) + \gamma \cdot \ln g(\gamma, 1).$$

Thus, $U(\gamma, 1)$ is maximized by setting t as high as possible to minimize the crowding out effect of g_0 . Some readers may wonder why there are no terms-of-trade effects. In particular, credible countries are net creditors in the union and they are hurt when taxes on public spending reduce the union interest rate. This terms-of-trade effect, however, is offset by a positive redistribution effect, which arises because part of the union's tax revenues is appropriated by credible countries.

[29]To see this, use Equations (47) to rewrite the utility function in Equation (46) as follows:

$$U(\gamma, 0) = f(\omega - g_0) + \nu \cdot \gamma_{A,0} - \gamma + \gamma \cdot \ln\left(\frac{\gamma}{\nu \cdot \gamma_A} \cdot g_0^U\right),$$

The average preference for public spending among non-credible countries, $\gamma_{A,0}$, is "normalized" by the measure of these countries ν . The reason is that country $(\gamma, 0)$ takes into account that a fraction of tax revenues is being transferred to credible union members. When $\nu \to 1$ this leakage is insignificant and we are back in the world of Section 3.2. Instead, when $\nu \to 0$ this leakage is extreme and non-credible countries prefer to set taxes as low as possible.

Whose preferences will be reflected in equilibrium? The union chooses the tax/subsidy by majority vote and the median voter theorem applies. If the median country is credible, the tax rate will never be Pareto optimal: it follows from our previous discussion that the union will display an extreme austerity bias and the tax rate will be arbitrarily high. This is desirable from the perspective of credible countries, who minimize the crowding-out effect of public spending and transfer resources to themselves in the process. But it is undesirable from the perspective of the union: taxation is in this case decided by a subset of countries that capture its benefits without internalizing any of its costs.

If the median country is instead non-credible, the union will set a tax rate

$$t = \frac{\nu \cdot \gamma_{A,0}}{\hat{\gamma}_M} \cdot \lambda^{-1}, \tag{49}$$

where $\hat{\gamma}_M$ is implicitly defined by

$$F(\hat{\gamma}_M, 0) = \nu - 0.5.$$

Equation (49) says that, when the median country is non-credible, there are two effects that distort the union's tax rate relative to the one that would be set in autarky (see Equation (34)). On the one hand, non-credible countries want low taxes to limit the transfers to credible union members: this is captured by the presence of ν in the numerator of Equation (49). On the other hand, credible countries want taxes to be as high as possible and – even if the median country is not credible – these preferences affect the voting outcome: this is captured by $\hat{\gamma}_M < \gamma_M$ in the denominator of Equation (49). These two effects distort the equilibrium tax rate in opposite directions, so that the latter achieves a Pareto optimum if and only if $\hat{\gamma}_M = \nu \cdot \gamma_{A,0}$.

The key takeaway of this discussion is that financial integration can further distort the union's equilibrium tax rate. All else equal, the presence of credible countries introduces an austerity bias and leads to inefficiently high tax rates. Since these countries can issue foreign debt, they do not pay the tax themselves but they still benefit from setting it as high as

Thus, $U(\gamma, 0)$ is maximized by setting t to satisfy Equation (48).

possible. This force is present regardless of whether the median country is credible or not. If the median country is non-credible, moreover, there is an additional force that operates in the opposite direction because these countries take into account that their taxes are partially transferred to the rest of the union. Ultimately, financial integration raises welfare in the decentralized equilibrium and reduces the need for a fiscal union in the first place. But it may also hinder a fiscal union's ability to set policy efficiently.

4.5 A union stability mechanism

If some countries in the union are credible and others are not, is there any way in which the former can "transfer" some of their credibility to the latter? Credible countries could, for instance, act as intermediaries, borrowing from the rest of the world and then lending part of these resources to the union's less credible members. We can think of this intermediation as being carried out through a Union Stability Mechanism (USM) that is run by credible members of the union: this institution borrows from the rest of the world and then lends to some of the union's less credible members at the international interest rate R^* .[30] Effectively, the USM reduces the share of non-credible countries.

As described, the benefits of such a USM are transparent. By raising the share of public spending that can be financed with foreign debt, it reduces the crowding-out effects of public spending and thus the strength of the overspending externality. In this sense, the establishment of the USM is analogous to greater financial integration. Although such an institution may seem like a theoretical contraption, it resonates with the recent experience of the euro area.

Prior to the financial crisis, all euro area countries had ample access to the rest of the world and private financial markets worked well.[31] Through the lens of our model, $\nu = 0$, which resulted in high public spending but also in high investment because crowding out was low. Between 2009 and 2012, however, countries in the euro area periphery lost access to the rest of the world. Through the lens of our model, ν increased, which led to a rise in crowding out throughout the union and generated two types of policy responses. First, there was a strong pressure for periphery countries to engage in fiscal consolidation. Second, various mechanisms were put in place that de facto resulted in intermediation of funds by

[30]Thus, we focus throughout on the case in which the USM makes zero profits. Nothing substantial would change if the USM made profits by lending to non-credible governments at an interest rate $R > R^*$.

[31]Even in this period, there is evidence of intermediation by banks located in credible euro area countries (i.e., "core" countries) between international financial markets and borrowers located in the rest of the euro area (i.e., "periphery" countries). See Hale and Obstfeld (2016).

countries with higher credibility. This started with bilateral agreements and IMF programs, followed by loans from the European Financial Stability Facility and the European Stability Mechanism. The same could be said, albeit less directly, of various measures taken by the European Central Bank, such as the Securities Markets Program, the modification of collateral rules, the Long-Term Repurchase Operations, and even the possibility of purchasing unlimited amounts of sovereign securities through Outright Monetary Transactions. All these actions reduced the cost of borrowing for periphery governments, which allowed them to soften their fiscal consolidations.

Without denying these benefits, our model also suggests that a word of caution may be in order: namely, insofar as these intermediation schemes change the political equilibrium of the union, they may also entail costs. To see this, suppose that by lending to a subset of non-credible countries, the USM changes the identity of the union's median voter. After all, membership in the USM *de facto* turns a non-credible country into a credible one. In this case, we speculate that the USM's net effect on efficiency is ambiguous. On the one hand, it eliminates the overspending externality in non-credible countries that are granted membership to the scheme. On the other hand, it might lead to excessive austerity for the remainder of non-credible countries. If this last effect dominates, the establishment of a USM may actually reduce welfare in the union.

5 Liquidity traps

We have so far emphasized the role of financial frictions in generating public spending externalities in unions. In particular, we have shown that financial frictions depress market interest rates relative to the marginal return to private investment. Since the cost of public spending from the point of view of an individual country is the interest rate, financial frictions lead to overspending by governments.

The literature on fiscal spillovers has often emphasized an alternative view that relies on aggregate demand externalities. According to this view, there is underspending because governments do not fully internalize the beneficial value of their own spending on total demand in the union. This perspective became popular in the wake of the recent financial crisis in the euro area, which led to a large reduction in aggregate demand and an increase in "economic slack."

Are these two views compatible? Is there overspending or underspending? In this section, we show that these views can be reconciled in our simple framework as long as there exists a

lower bound on the real interest rate. When financial frictions are not too severe, the interest rate remains above this lower bound and the analysis of the previous sections remains valid, i.e. there is overspending. But if financial frictions become severe enough, private demand becomes so low that the interest rate reaches its lower bound. Once this happens, output in the union becomes demand-determined. As a result, the cost of public spending falls from the marginal return to private investment, which is above the interest rate, to the marginal cost of goods, which is below the interest rate. In this regime, there is underspending.

To formalize this discussion, we extend the model by incorporating a lower bound on interest rates. We analyze formally how the nature of spending externalities varies with the severity of financial frictions. We describe both the optimal policy response and the policy that is likely to arise in the union equilibrium. Finally, we use these results to provide some insights on the euro area financial crisis.

5.1 Zero lower bound on real interest rates

Let us return to the baseline model in which the union is in financial autarky. We introduce two key modifications. First, at $t = 0$, instead of receiving an exogenous endowment ω , savers in each country have the ability to produce up to $\bar{\omega}$ units of output by exerting a positive but very small per-unit effort. In other words, the endowment is now endogenous and given by $\omega \in [0, \bar{\omega}]$. Second, following many recent papers in the New Keynesian tradition, we assume that there is a zero lower bound on the real interest rate, i.e. $R \geq 1$.[32] , [33]

To obtain the decentralized equilibrium, note that nothing changes regarding the choice of public spending and capital accumulation. Namely, it is still true that in equilibrium both the return to public spending and the pledgeable return to investment are equal to the union interest rate,

$$g^D(\gamma) = \frac{\gamma}{R} \quad \text{and} \quad \lambda \cdot f'(k(\gamma)) = R. \tag{50}$$

As for the market clearing condition, it is still true that total public spending plus investment

[32] The lower bound on the real interest rate is typically justified as an implication of two assumptions. (i) There is an upper bound on inflation that arises either from nominal rigidities or from the central bank's commitment to price stability. As a result, there is an upper bound on the difference between nominal and real interest rates. (ii) The central bank is the only producer of money, and it sets the nominal interest rate by trading money for nominal bonds. As a result, the nominal interest rate cannot be negative, since otherwise the demand for money would be infinite and the central bank would go bankrupt. (See Krugman 1998, Eggertsson and Woodford 2003, 2004).

[33] The zero lower bound usually applies to the nominal interest rate. To save on notation, we assume that inflation is zero so the zero lower bound applies to the real interest rate as well. Nothing would change if the lower bound were different from zero.

must equal union-wide resources ω ,

$$k + g^D = \omega, \tag{51}$$

where k denotes the stock of capital in every country. The key difference is that now ω is endogenous and may be below its potential level.

In particular, the decentralized equilibrium can be in one of two regimes. There is an unconstrained regime in which $R \geq 1$, $k + g^D = \omega = \bar{\omega}$ and the equilibrium is as in Section 2. This happens when the total demand for goods by governments and firms is high enough, so that the interest rate that clears the market with $\omega = \bar{\omega}$ lies above the zero lower bound. But there is also a constrained regime, or liquidity trap, in which $R = 1$ and $k + g^D = \omega < \bar{\omega}$. This happens when the total demand for goods by governments and firms is insufficient, so that the interest rate that would clear the market with $\omega = \bar{\omega}$ lies below the zero lower bound. Since the interest rate cannot fall below zero, however, market clearing is instead attained through a reduction in output below potential, i.e., $\omega < \bar{\omega}$.[34] Formally, the equilibrium satisfies,

$$R \geq 1,\ \omega \leq \bar{\omega} \quad \text{and} \quad (R-1) \cdot (\omega - \bar{\omega}) = 0. \tag{52}$$

Equations (50)-(52) characterize the decentralized equilibrium.

From the perspective of each country, the cost of public spending is equal to the interest rate. From the perspective of the union, however, the cost of public spending depends on whether the zero lower bound is binding or not. To see this, we construct the set of Pareto optima as before. A Pareto optimal allocation satisfies,

$$g^P = \max \left\{ \frac{\gamma_A}{f'\left(\omega - g^P\right)}, \hat{g}\left(\lambda\right) \right\}, \tag{53}$$

where

$$\hat{g}\left(\lambda\right) = \bar{\omega} - f'^{-1}\left(\lambda^{-1}\right), \tag{54}$$

and

$$g^P\left(\gamma\right) = \frac{\gamma}{\gamma_A} \cdot g^P. \tag{55}$$

Equation (53) says that the Pareto optimal allocation can be in one of two regimes. In the unconstrained regime everything is as in the baseline model, and Pareto optimality requires

[34] During liquidity traps there is rationing since, at prevailing prices, all savers would like to produce and sell all their potential output $\bar{\omega}$. We focus throughout on symmetric equilibria in which all savers in the union produce and sell the same fraction of potential output $\omega / \bar{\omega}$.

equalizing the marginal benefit of spending in all countries to the marginal product of capital in the union. But there is also a liquidity-trap regime, in which the zero lower bound on the interest rate is binding and output is below potential. Instead of equalizing the return to spending to the marginal product of capital, Pareto optimality in this case requires raising public spending up to the level $\hat{g}$ to eliminate slack. The reason is that, as long as $g < \hat{g}$, there is no crowding out of investment and the marginal cost of public spending is effectively zero from the perspective of the union.

By comparing the decentralized equilibrium with the constrained optimal allocation, it is immediate that the former can entail too much or too little public spending depending on the regime. If the decentralized equilibrium is in the unconstrained regime, there is overspending and the analysis of Section 2 applies. If instead the decentralized equilibrium is in a liquidity trap, there is underspending.

5.2 Implications for a fiscal union

Whether the economy lies in the unconstrained regime or in a liquidity trap depends on parameter values. A key parameter in the model is the level of pledgeability λ , which determines the severity of financial frictions. A reduction in λ decreases investment demand and thus makes liquidity traps more likely. There are two critical values, $\hat{\lambda}^D$ and $\hat{\lambda}^P$, which respectively determine whether the decentralized equilibrium and the Pareto optimal allocation lie in a liquidity trap. These critical values are defined implicitly by

$$\gamma_A = \hat{g}\left(\hat{\lambda}^D\right) \text{ and } \hat{\lambda}^P \cdot \gamma_A = \hat{g}\left(\hat{\lambda}^P\right),$$

where $\hat{g}(\cdot)$ is as in Equation (54).[35]

If $\lambda \geq \hat{\lambda}^P$, the decentralized equilibrium entails overspending and the analysis of Section 2 applies. To restore optimality, the union would need to set a tax on public spending of $t = \lambda^{-1}$. If $\lambda \in \left(\hat{\lambda}^D, \hat{\lambda}^P\right)$, the decentralized equilibrium still entails overspending but the optimal tax is smaller, $t \in (1, \lambda^{-1})$. The reason is that, if the union tried to equalize the marginal benefit of public spending to the marginal product of capital by setting a spending tax equal to λ^{-1} , it would push the economy into a liquidity trap. For $\lambda < \hat{\lambda}^D$, the decentralized equilibrium entails underspending and the tax turns into a subsidy, $t < 1$. Formally, the optimal tax is

[35]These critical values are obtained by combining the decentralized equilibrium condition $\gamma_A / \hat{g} = \lambda \cdot f'(\bar{\omega} - \hat{g})$ and the optimality condition $\gamma_A / \hat{g} = f'(\bar{\omega} - \hat{g})$ with the zero lower bound condition $\lambda \cdot f'(\bar{\omega} - \hat{g}) = R = 1$. Since $\hat{g}(\lambda)$ is decreasing in λ , $\hat{g}(0) = \bar{\omega}$, and $\hat{g}(1) = \bar{\omega} - f'^{-1}(1)$, there is exactly one solution to both equations if $\bar{\omega} \in \left[\gamma_A, \gamma_A + f'^{-1}(1)\right]$.

given by

$$t^P = \min\left\{\frac{\gamma_A}{\hat{g}(\lambda)}, \lambda^{-1}\right\}.$$

Does the union set the tax on public spending at this level in equilibrium? As the analysis of the previous sections indicates, the answer to this question is unclear. One thing that is certain is that the union will never find itself strictly inside the liquidity trap. All countries, regardless of γ , prefer a low enough tax (or a high enough subsidy) to ensure that public spending does not fall below $\hat{g}$. The reason is that, even though all countries must pay the subsidy to raise spending to $\hat{g}$, they also benefit from the ensuing reduction in inefficient slack.[36] Outside of the liquidity trap, however, spending may be too high or too low due to the biases described in Section 3.2, i.e., insofar as the preferences of the median country may differ from the average. Formally, the tax adopted by the union is given by

$$t^U = \min\left\{\frac{\gamma_A}{\hat{g}(\lambda)}, \frac{\gamma_A}{\gamma_M}\cdot\lambda^{-1}\right\}. \tag{56}$$

Relative to the Pareto optimum, the union may thus set taxes that are too high or too low depending on whether γ_M is lower than or greater than γ_A . But it will never set taxes so high so as to push the economy inside the liquidity trap.[37]

5.3 Austerity during liquidity traps

We can use this simple extension of our baseline model to provide an interpretation of some salient features of the recent European experience. Before the crisis, financial markets worked relatively well and $\lambda > \hat{\lambda}^P$. Thus, there was a tendency for governments to overspend. To address this externality, the euro area adopted a set of rules to constrain the fiscal policy of

[36]To show this, note that when the economy is in a liquidity trap, welfare can be expressed as

$$U(\gamma) = f(f'^{-1}(1)) + \gamma_A - \gamma + \gamma\cdot\ln\left(\frac{\gamma}{\gamma_A}\cdot g\right),$$

which is monotonically increasing in g . So all countries, regardless of γ , benefit from an increase in g in liquidity traps. So no country would favor a tax that is so high (or a subsidy that is so low) that $g < \hat{g}$.

[37]To derive Equation (56), simply note that the analysis is exactly as in section 3.2 when the economy is outside the liquidity trap. Hence, the equilibrium tax is as in Equation (34). When the economy is inside the liquidity trap, the capital stock is fixed at $f'^{-1}(\lambda^{-1})$. Thus, the welfare of an individual country can be expressed as

$$U(\gamma) = f(f'^{-1}(\lambda^{-1})) + \gamma_A - \gamma + \gamma\cdot\ln\left(\frac{\gamma}{\gamma_A}\cdot g\right).$$

The welfare of all countries, including the median, is thus monotonically increasing in g when the economy is in a liquidity trap. The median country will thus never choose a tax rate higher than $\frac{\gamma_A}{\hat{g}(\lambda)}$, as this would imply that $g < \hat{g}$.

its members. These rules had the same underlying goal as the taxation scheme analyzed in Section 3.2; namely, to coerce its members into adopting a more austere fiscal stance.

The crisis was associated with a loss of trust in the enforcement of financial contracts, which can be interpreted as a fall in λ . As a consequence, investment demand fell throughout the union, leading to a decline in the interest rate. In fact, the crisis was so severe that the euro area was pushed into a liquidity trap. Aggregate demand was insufficient and output fell below potential. Individual governments had insufficient incentives to increase public spending because they did not internalize its effect on union demand. At this point it would have been beneficial to remove fiscal constrains and possibly incentivize public spending. Instead, most constraining rules remained in place, at least during the first years of the crisis. According to this narrative, the resulting austerity contributed to deepening the crisis.

One clear implication of this discussion is that, ideally, fiscal rules should be flexible and contingent on economic conditions. Rules designed to contain overspending are beneficial during "normal" times, but they may backfire during liquidity traps.

6 Concluding remarks

We build on three stylized facts of the global economy over the last few decades: (i) there has been large and sustained decline in the interest rates at which many governments borrow; (ii) yet the return to capital has remained fairly constant; (iii) against the backdrop of growing financial integration, especially within economic unions such as the euro area. We have shown that, jointly considered, these features of the world economy may lead to excessive public spending. Moreover, this excessive spending is hard to correct, even for economic unions that can limit the behavior of their members.

These results have important implications for how we think of fiscal policy in an integrated world. First, whereas most of the literature has emphasized the positive spillover effects of public spending through trade linkages, we show that there are also negative spillovers through financial linkages. These have been largely ignored but may be increasingly relevant. Second, most of the supra-national efforts to constrain national fiscal policies have so far focused on public deficits. We show that this exclusive emphasis on deficits may be misplaced, as sometimes public spending may itself be the source of the problem.

Our results have been derived under a set of stylized assumptions to keep the analysis simple and transparent. A crucial assumption is that compliance with union decisions is compulsory, i.e. there are no opt-out clauses for member countries. This assumption is clearly not realistic,

as has been recently demonstrated by Brexit. Relaxing it would lead to a theory of endogenous unions, in which gains from trade and similarity in preferences are likely to play an important role. Understanding the endogenous formation of unions is an exciting research avenue going forward.

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