

OPTIMAL FISCAL FEDERALISM IN THE PRESENCE OF TAX COMPETITION

by

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Abstract. This paper models the optimal division of public goods provision between central and regional governments in an economy with interregional tax competition. Regional provision is inefficient because governments compete for scarce capital by lowering their capital taxes and public good levels to inefficiently low levels. On the other hand, central provision is inefficient because it is determined by the minimum winning coalition within a legislature. The optimal degree to which public good provision should be decentralized depends on a tradeoff between these inefficiencies. We demonstrate that complete centralization is never optimal; regional governments should supply some public goods. In contrast, more ambiguous results are found in models where tax competition is replaced by interregional externalities associated with the spillover effects of regionally-provided public goods.

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## 1. Introduction

A fundamental question in public economics is how to allocate spending responsibilities and taxing powers between the central and lower-level governments. While multi-tier government structures are the norm in many countries today, the benefit of hierarchical government structures is not obvious. One of the more prominent approaches, originally put forward by Oates (1972), views federal structures as balancing the various inefficiencies of central and local provision of public goods. Under central provision, there is an inefficient uniformity of public good benefits across localities, whereas cross-border spillovers of public good benefits create inefficiencies under decentralized provision. Oates's decentralization theorem states that decentralization is preferable in the absence of spillovers.

In a related approach, Besley and Coate (2003) also view public goods as being inefficiently allocated across localities under centralization. But by giving careful attention to the exact form of legislative bargaining and strategic delegation under centralization, their approach yields inefficiencies involving the unequal distribution of public good expenditures across jurisdictions. In a complementary paper, Lockwood (2001) also compares the benefits from centralization relative to decentralization. He shows that legislative outcomes under centralization are not sufficiently sensitive to the within-region benefits of the public projects that are being allocated across regions.

All three of these models suggest that spillovers must be sufficiently small for decentralization to be more efficient than centralization. It is tempting to generalize this finding to other sources of interjurisdictional externalities.

In this paper, we replace spillover effects with the fiscal externalities associated with tax competition. This focus is particularly interesting, because standard tax competition models provide no justification for decentralizing public good provision. Only the inefficiencies associated with local government behavior are modeled, not inefficiencies at the central level. In particular, a major theme of the tax competition literature has been that competition for mobile capital by local governments leads to inefficiently low tax rates and public good levels.<sup>1</sup> By modeling inefficiencies in the legislative process at the central level, the literature reviewed above suggests that decentralization is the preferable outcome if the inefficiencies from tax competition are sufficiently small.

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<sup>1</sup> See Wilson (1986) and Zodrow and Mieszkowski (1986) for the initial contributions. Wilson (1999) and Wilson and Wildasin (2004) review the literature on tax competition, and Wilson (2006) reviews models of tax competition in a federal setting. An exception to the standard modeling of tax competition is Janeba and Schjelderup (forthcoming). Government inefficiencies occur in their model because self-interested politicians are only partially kept in check through reelection concerns.

We obtain a much stronger result: *some* decentralization of public goods provision is always preferable to complete centralization. To make this point, we use the Besley-Coate specification of centralized provision, but we replace their assumption of a single public good with many public goods, thereby enabling us to analyze equilibria in which some goods are centrally provided, while others are provided by regional governments. In the case of spillover effects, we cannot rule out the possibility that all goods are centrally provided, or that provision is entirely decentralized. Thus, the ambiguity identified by Besley and Coate and others remains. But when tax competition replaces spillover effects as the source of inefficiency at the regional level, we are able to show that it is always the case that some goods should be provided by regional governments. Although tax competition becomes more severe as the substitutability between mobile capital and immobile factors increases, this result holds regardless of the size of the substitution elasticity. Thus, the case for some decentralization as part of an optimal federal system is stronger when there is tax competition than when there are spillover effects.

To demonstrate this result, we extend the Zodrow-Mieskowski (1986) model of tax competition to include a continuum of public goods, all of which are imperfect substitutes from the consumers' perspective.<sup>2</sup> Regional (or "local") governments act in the best interest of their representative citizens but must use a distortionary tax on interregionally mobile capital to finance public good expenditures. A Nash game in tax rates is used to model competition for mobile capital. Thus, the tax increase required to raise a region's public expenditures one unit causes an outflow of capital, and the regional government treats as a cost the resulting loss in tax revenue. But this outflow represents an inflow for other regions, and the resulting increase in their tax revenue is the fiscal externality. The size of this externality clearly depends on the level of capital taxation. If most of the public goods supplied to a region's residents are centrally provided, then the region will need only a small tax rate to finance its provision of the remaining public goods, and so it will care little about the capital outflow that occurs when it raises its tax rate to supply an additional unit of one of its public goods. In this sense, the tax competition problem is relatively unimportant when only a small amount of public good provision is decentralized.

This last insight is the basis for our finding that some decentralization is always optimal. The actual proof is more complicated. Although regions are assumed to be *ex ante*

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<sup>2</sup> The continuum approach has been successfully used before by Lorz and Willmann (2005), as well as Wilson and Janeba (2005), both in the context of fiscal decentralization. The use of a continuum of public goods avoids the all-or-nothing decision between centralization and decentralization, and allows us to focus on the optimal degree of decentralization and the co-existence of several tiers of government.

identical, the central government favors some of them over others in the provision of public goods. We first model this favoritism using the Besley-Coate specification of a legislature representing two regions, with one interpreted as a minimum winning coalition (MWC). The model is then extended to include many regions, with one region's representative using its power as an agenda setter to form the minimum winning coalition.<sup>3</sup> As a result, central provision of most public goods will keep tax rates low only in the favored regions, and these regions will import capital from the non-favored regions. We must therefore deal with the misallocation of capital resulting from centralized provision, and our concept of "optimal fiscal federalism" must account for interregional differences in tax rates. Membership in the MWC is random, with equal probabilities of belonging, in which case an optimal federal system may be defined as one that maximizes the common expected welfare for each region, calculated prior to knowing this membership. To focus on efficiency issues, utility functions are assumed to be quasi-linear, leaving the discussion of distributional issues to our concluding section.

The literature contains other approaches to fiscal federalism. In our own work (Janeba and Wilson, 2005), we have examined how countries might use a federal structure to gain a strategic advantage over foreign rivals in their competition for internationally mobile capital. Another approach is based on the idea that lower-level governments possess informational advantages over the central government. In this case, the central government should act as a principal in an agency problem, confronting the lower-level governments (the "agents") with incentives to behave in ways that are optimal for the entire system of regions (see, e.g., Raff and Wilson, 1997). The microfoundations behind these informational asymmetries are not well-understood, however. Finally, it is widely understood that the distributional functions of the government should be allocated to the central government.<sup>4</sup> See Tresch (2002) for a careful and critical discussion of the argument concerning redistribution. In contrast, our approach focuses on the efficiency issues associated with tax competition, rather than income distribution problems.

The work by Lockwood (2001) and Besley and Coate (2003) are early contributions in a sizable political economy literature on fiscal decentralization, which is surveyed by Lockwood (2006). A number of other papers consider the benefits of centralization relative to decentralization in the presence of public good spillovers. These spillovers are important components of the models developed by Besley and Coate. Dur and Roelfsema (2005) show

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<sup>3</sup> Similar concerns have been used by Buchanan and Tullock (1962), Riker (1962) and Baron and Ferejohn (1989).

<sup>4</sup> Oates (1972) includes this insight as part of his decentralization theorem.

that underprovision of centrally-provided goods occurs when the cost of provision cannot be fully shared across districts, and regions therefore strategically delegate ‘conservatives’ under centralized decision making. Lorz and Willmann (2005) endogenize the range of public goods that are to be centrally provided, where local public goods differ in terms of their regional spillover degree. They show that in a political economy equilibrium, too few goods are centralized relative to the social optimum. Cheikbossian (2008) demonstrates that even in the presence of symmetric regions, centralization can lead to inefficient outcomes because of rent-seeking activities by jurisdictions to influence the policy choice under centralized decision making. Koethenburger (2007) revisits Oates’ Theorem and examines the difference in welfare levels of centralization (with uniform provision of public goods across districts) and decentralization. This difference is found to be non-monotonic in the spillover parameter for some preference parameters. All of the above papers share our interest in the merits of fiscal decentralization, but none emphasizes the difference between tax competition and public good spillovers.

The plan of this paper is as follows. The model is described in the next section, and then Section 3 presents the main results concerning fiscal federalism. These results are proved under the Besley-Coate assumption of two regions. Section 4 shows that the desirability of some decentralization remains when the model is extended to include many regions, with one serving as an agenda setter, although previous research has shown that the inefficiencies from tax competition increase with the number of competing regions.<sup>5</sup> Section 5 concludes.

## 2. The Model

We consider an economy consisting of two identical regions. Following the Zodrow-Mieszkowski (1986) model of tax competition, each region contains a representative resident, who supplies labor to competitive firms within the region. These firms use a constant-returns technology to produce output from this labor and mobile capital. Labor is fixed in supply within each region, whereas capital is mobile but fixed in supply for the economy as a whole. Thus, capital exhibits diminishing marginal productivity in a region, given the fixed labor supply. The representative resident possesses labor and capital endowments,  $L^*$  and  $K^*$ , which are used to finance private consumption,  $x$ . Thus, the resident’s budget constraint is  $x = rK^* + wL^*$ , where  $r$  is the after-tax return on capital, and  $w$  is the wage rate.

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<sup>5</sup> See Hoyt (1991).

The output produced from labor and capital is sold to individuals as the consumption good  $x$ , and also to the government for use as the sole input in the production of publicly-provided goods. There is a continuum of such goods, and we refer to them as “public goods” for short, although they possess the attributes of private goods because there are no scale economies in their production or consumption. An individual’s utility function takes the form

$$U = x + G; \quad G = \int_0^1 u(g(n))dn; \quad (1)$$

where  $G$  is “aggregate” public good consumption, and  $g(n)$  is the consumption of public good  $n$  in the given region, where  $n$  ranges from zero to one. The function  $u$  is increasing and strictly concave.

The rule for efficient public good provision for the economy as a whole is

$$u'(g(n)) = 1. \quad (2)$$

Thus, the efficient  $g(n)$  is identical across  $n$ .

To model a federal system of government, we assume two levels of government, central and regional (also called “local”). The central government will be allowed to provide a particular set of public goods,  $C$ , leaving the set of remaining goods,  $R$ , to be provided solely by regional governments. Regional governments play a Nash game in rates after they each learn how much of each public good is supplied by the central government. Using this knowledge, regional governments are able to also provide residents with goods in  $C$ , if central provision is not forthcoming or deficient.<sup>6</sup>

Each level of government finances its expenditures with a tax on capital. Let  $t_i$  denote the unit tax that region  $i$  imposes on the capital employed within its borders, and let  $T$  denote the unit tax that the central government imposes on all capital. Then the before-tax return on capital within region  $i$  is  $r + T + t_i$ . The after-tax return,  $r$ , is determined by the requirement that the total demand for capital equal the total supply:

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<sup>6</sup> Two alternative assumptions would be that regional governments must commit to supplying goods in  $C$  before they learn about central provision, or that they can never supply these goods. Each of these alternatives is likely to make central provision less desirable, by limiting the ability of regional governments to offset deficiencies in central provision.

$$\sum_{i=1}^2 K(r + T + t_i) = 2K^*, \quad (3)$$

where  $K(\cdot)$  is the function giving the demand for capital in a region. This equality determines  $r$  as a function of  $T$  and the vector of regional tax rates. Since  $T$  applies to the economy's entire fixed stock of capital, a rise in  $T$  lowers  $r$  by the same amount, i.e., there is full capitalization.

A major difference between governments is their objectives. Regional governments care only about the well-being of their own residents. Following Besley and Coate (2003), we assume that central government policies are determined by a legislative process, whereby one of the two regions is designated the “minimum winning coalition” (MWC) and given control of tax and expenditure policies. We refer to the MWC as the “insider region,” and to the other region as the “outsider region.” The insider region is able to use the revenue obtained from the tax on capital ( $T$ ) to distribute public good expenditures between the two regions in any desired manner. Its objective is to maximize the utility of its own residents. As a consequence, it will provide no public goods to the other region. We will consider the case with more than two regions in section 4. In the concluding section, we will argue that cooperative approaches to the policy decision process typically do not eliminate the inefficiency under centralization due to strategic delegation. Hence our use of a noncooperative approach such as the minimum winning coalition captures in a nutshell an interesting disadvantage of centralized decision making.

With this setup, both levels of government pursue inefficient policies from the viewpoint of the economy as a whole. At the regional level, there is the usual tax competition problem, consisting of inefficiently low taxes and expenditures. In contrast, two forms of inefficiency arise at the central level: expenditures are inefficiently varied between the two regions, and they are overprovided to the insider region, since part of the funding comes from taxing the capital used by the other region.

Our main task is to investigate how the federal system should be designed – i.e., what goods the central government should be allowed to supply – to achieve the most efficient allocation of goods and resources. Given our assumption of quasi-linear utility, the level of efficiency is easily measured by the aggregate “surplus” from public goods provision, summed across regions and public goods, where a single region's surplus is defined as the total utility it obtains from public goods provision net of the resource cost (where the unit cost of each public good has been normalized to equal one). If we follow Besley and Coate by

assuming that each region has an equal probability of becoming the MWC, maximizing this aggregate surplus is equivalent to maximizing the expected utility obtained by each region's representative resident. The federal system that provides the highest surplus and, therefore, highest expected utility, is referred to as "optimal."

Consider first the central government's problem, which is to choose  $T$  and the level of  $g(n)$  for each  $n$  in  $C$  to maximize welfare for the insider region, subject to the budget constraint

$$\left( \int_{n \in C} g(n) dn \right) = 2TK^*. \quad (4)$$

Assume initially that the insider government does not supplement centrally-provided public goods with its own supplies of the same goods (once it learns the levels of central provision). For the quasi-linear utility function given by (1), it follows that marginal increases in centrally-provided public goods have no effect on insider or outsider behavior. Thus, although the central government moves first, it may equate the marginal benefit and marginal cost of each of its public goods, holding fixed the  $g(n)$ 's supplied by regional governments. Using the budget constraint given by (4), the optimality condition becomes

$$u'(g(n)) = \frac{1}{2}. \quad (5)$$

Comparing (5) with the efficiency rule given by (2), we see that public goods are clearly overprovided by the central government. No capital flows enter this condition because regions do not alter their tax rates in response to a marginal rise in a central government's  $g(n)$ .

As described above, the two regions play a Nash game in tax rates. The goal of a regional government is to maximize utility subject to its government budget constraint. Continuing to assume that the insider region does not supplement the public goods supplied by the central government, we may write the government budget constraint for this region as follows:

$$\int_{n \in R} g(n) dn = tK(r + T + t), \quad (6)$$



where we drop the subscript on  $t$  for brevity. The same constraint applies to the outsider region, except that the range of integration is over all public goods ( $R$  and  $C$ ). In both cases, the optimality condition is

$$u'(g(n)) = \frac{1 + \left(1 - \frac{K^*}{K}\right) \frac{dr}{dt}}{1 + \frac{t}{K} K' \left(1 + \frac{dr}{dt}\right)}, \quad (7a)$$

or

$$u'(g(n)) = \frac{1 + \left(1 - \frac{K^*}{K}\right) \frac{dr}{dt}}{1 - \frac{t}{R} \varepsilon \left(1 + \frac{dr}{dt}\right)}. \quad (7b)$$

where  $\varepsilon$  is the (positively measured) demand elasticity for capital,  $-K'R/K$ , and  $dr/dt = -1/2$  in a symmetric equilibrium. The numerator reflects terms-of-trade effects, with the term multiplying  $dr/dt$  taking a negative (positive) sign if regions export (import) capital. Regions that export (import) capital are harmed (helped) by the negative impact of  $t$  on  $r$ , thereby raising (lowering) the marginal cost of public goods provision. The denominator is less than one, reflecting the cost of the tax-induced outflow of capital. But the terms-of-trade effects may outweigh the latter tax competition effect for an importing region, leading to overprovision of public goods.

The insider region's tax rate must be less than the outsider region's tax rate, since a portion of the former's public good consumption comes from the central government. Consequently, the insider region imports capital. We therefore cannot rule out the possibility that it will overprovide public goods relative to the first-best. This possibility becomes more likely as the share of public goods provided by the central government rises, since then the insider region's tax rate falls, reducing the importance of the tax competition effect relative to the terms-of-trade effect. In fact, the insider region's desired level of public good provision may exceed the level derived above for the central government, given by (5). But then the central government will anticipate that the insider region will "top off" the centrally-provided level of provision with its own provision of the same public goods. However, this "topping off" cannot be optimal for the insider region, because it is foregoing the opportunity to maximize the share of public good costs that is funded by the outsider region through the

central tax  $T$ . In other words, the central government should increase the level of central provision above the level dictated by (5), until the insider region's own provision of the same public goods drops to zero. We may therefore generalize condition (5) by replacing the equality with the following inequality:

$$u'(g(n)) \leq \frac{1}{2}. \quad (8)$$

In either case, those public goods in set  $C$  are overprovided by the central government, and the insider government provides no units of these goods. For the outsider region, both tax competition and terms-of-trade considerations dictate underprovision of all public goods.

For comparison purposes, consider a switch from tax competition to public good spillovers as the source of inefficiency. In particular, drop the assumption of capital taxation and assume instead that the public goods are financed by head taxes, which are set uniformly across regions in the case of centralized provision. To incorporate spillover effects into the model, the utility function given by (1) may be modified to read

$$U = x + G; \quad G = \int_0^1 (v(g(n)) + v^*(n, g^*(n))) dn; \quad (9)$$

where  $g(n)$  is the provision of public good  $n$  in the given region,  $g^*(n)$  is the provision of this good in the other region, and the function  $v^*$  measures the strength of the spillover effect, where the argument  $n$  allows this strength to vary across goods. With capital not taxed, neither region imports nor exports capital, implying no terms-of-trade effects. The rule for efficient public good provision is

$$v_g + v^*_g = I \quad (10)$$

for each public good  $n$ , but each region ignores the spillover effects given by the term,  $v^*_g$ , and instead underprovides public goods by setting  $v_g = I$ . Centralized provision continues to be inefficient because public goods are overprovided to the insider region and underprovided to the other region. One difference with the previous analysis is that the outsider region's residents might receive some public goods if the resulting spillover effects provide sufficiently large benefits to the insider region.

In Besley and Coate's analysis, centralized provision is preferable to decentralized provision if the spillover effects are sufficiently strong. By extending the analysis to multiple public goods, the current model allows for the decentralized provision of some public goods, but centralized provision of others. But the basic Besley-Coate insight still holds: any good that exhibits sufficiently strong spillover effects should be provided by the central government. In fact, there will be no decentralization if all goods satisfy this spillover-effect criteria. In contrast, we next argue that some decentralization is always optimal in the tax competition model.

### 3. Fiscal Federalism

In our model of tax competition, the sensitivity of a region's demand for capital to the tax rate depends on the capital demand elasticity [ $\varepsilon$  in (7b)]. Higher values of this elasticity tend to lead to greater underprovision of public goods by regional governments, since the tax base is more sensitive to the tax rate. Nevertheless, we next show that even for high elasticities, some decentralization of public good provision is optimal in the sense that it increases each resident's expected utility. For the formal proof, we assume a quadratic production function, which does not restrict the value of the capital demand elasticity but simplifies the analysis because the capital demand derivative,  $K'(R)$ , is a constant.<sup>7</sup> We argue below, however, that the results should extend to a much wider class of production functions.

**Proposition 1.** *Assuming a quadratic production function, there exists an  $n' > 0$  such that decentralizing the provision of public goods between 0 and  $n'$  raises expected utility.*

**Proof.** With all public goods centrally provided, the insider region supplies none of them, whereas the outsider region supplies all of them. Thus, the insider tax is initially zero, whereas the outsider tax is positive. Suppose instead that all public goods between zero and some  $n'$  are decentralized. Thus, the insider region must now provide them, implying that its tax rate becomes positive, satisfying the budget constraint

$$\int_0^{n'} g(n)dn = tK(r + T + t). \quad (11)$$

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<sup>7</sup> A corresponding constant-returns production function, with labor and capital as arguments, could be written,  $F(K, L) = \alpha_1L + \alpha_2K - \alpha_3(K^2/L)$ .

An important insight from this equality is that the insider region's tax rate goes to zero as  $n'$  goes to zero.

Provided  $n'$  is sufficiently small, (7b), and also (7a), shows that the insider region oversupplies public goods between 0 and  $n'$ , since the denominator converges to one as  $n'$  goes to zero, whereas the numerator stays bounded below some number that is less than one, due to the terms-of-trade effect.

On the other hand, suppose that  $n'$  were equal to one, implying no centralization of public goods provision. Then there would be no distinction between the insider and outsider regions; both would set the same tax rates, so terms-of-trade effects would disappear. By (7b), all public goods would be underprovided. If we then reduce  $n'$  below one, the insider region's tax rate will fall, as it must fund a decreasing share of the public goods. At some intermediate  $n'$ , the terms-of-trade effect in the numerator on the right side of (7b) will exactly offset the tax competition effect, given by the terms involving the elasticity  $\varepsilon$  in the denominator, and so the marginal cost expression on the right side will equal one implying efficient provision of all public goods provided by the insider region. In other words, decentralizing public goods between 0 and this  $n'$  causes their supplies to move from overprovision to their first-best levels, representing an efficiency improvement.

The rise in the insider region's tax rate from zero to the level satisfying (11) causes capital to flow to the outsider region, where the marginal product of capital is higher. As a result, the economy's total output rises, which represents another efficiency improvement.

The remaining task is to show that the decentralization policy improves the decision-making of the outsider region. It is convenient here to work with the public goods rule given by (7a). Turning to the marginal cost expression on the right side of (7a), note that the inflow of capital to this region is represented by a rise in  $K$ . Since the derivatives,  $K'(R)$  and  $dr/dt$ , do not change under our assumption of a quadratic production function, it follows that this cost expression declines. Suppose that the outsider region were to respond by lowering  $t$  enough to keep total tax revenue,  $tK$ , fixed. Then marginal benefit term on the left side of (7a) would be unchanged. But the fall in  $t$  would further lower the right side, implying that the marginal benefit of public good provision would exceed the marginal cost. By the second-order condition for utility maximization, equilibrium would require an expansion in public good levels.<sup>8</sup> Since these levels are initially inefficiently low, this change represents

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<sup>8</sup> But if  $t$  were raised to the point where  $K$  dropped back to its old level, then the left side of (7a) would fall below its original value, and the right side would rise, indicating that  $t$  was above the optimal level. Hence,

another welfare improvement. We may conclude that total welfare rises, measured by expected utility. Q.E.D.

The basic idea here is that decentralizing only a small number of public goods implies that tax competition is unimportant for the insider region because its tax is close to zero. Since this region is then an importer of capital, it will desire to increase the tax rate beyond its efficient level, to drive down the return it must pay on imported capital. At some higher level of decentralization, the tax competition effect becomes large enough to offset this terms-of-trade effect, causing the insider region to efficiently provide public goods. In addition, the capital tax now imposed by the insider region causes some capital to flow to the high-tax outsider region, which represents a further efficiency improvement, and this region uses the increase in the tax base to raise public good levels above their inefficiently-low values. All of these responses represent efficiency improvements.

Although these efficiency gains raise expected utility, calculated prior to the determination of the MWC, the partial decentralization of public goods provision may leave the insider region worse off *ex post*, since some of its public goods are no longer being partially financed by the outsider region. In contrast, the outsider region is definitely better off, since it is taxed less by the central government and benefits from the additional capital obtained as a result of the insider region's taxation of capital.

The assumption of quadratic production enables us to prove that the rise in  $t$  in insider regions causes public good supplies to rise in outsider regions. This result would seem to hold much more generally, since we would expect the outsider regions to respond to the rise in their tax bases at a given  $t$  by spending some of the additional revenue on additional public good supplies. Thus, Proposition 1 appears to extend well beyond quadratic production functions.<sup>9</sup>

Returning to the general case, it is tempting to search for a general result concerning the desirability of a small amount of central provision. But there may be no positive amount of central provision that improves welfare. The reason is that central provision creates first-order inefficiencies. To investigate this issue, we next consider variations in the substitution elasticity between labor and capital in production. To state the result, let us assume a CES production function, thereby allowing us to treat the substitution elasticity,  $\sigma$ , as a parameter.

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outsiders will always experience a rise in their capital supplies following a little decentralization, as previously claimed.

<sup>9</sup> The result also holds under the assumption that taxes are strategic complements in the Nash game played by regions, i.e., a rise in the taxes in one set of regions leads to a rise in the taxes in the remaining regions.

In particular, we compare economies with different values of  $\sigma$ , while holding fixed the income shares going to labor and capital in an equilibrium with no central government intervention.<sup>10</sup> We also assume that central provision dominates no or almost no provision of public goods, which can be ensured by imposing Besley and Coate's assumption that  $u(g)$  is logarithmic:  $u(g) = \ln g$ . More generally, let  $u(g)$  go to minus infinity as  $g$  goes to zero. We then have:

**Proposition 2:** *Assuming a CES production function, a sufficiently low substitution elasticity ensures that no centralized provision of public goods is optimal. If centralized provision of some public goods is preferable to no provision of these goods, then a sufficiently high substitution elasticity ensures that some centralized provision is optimal.*

**Proof.** Lowering the substitution elasticity towards zero moves the production function towards the fixed-proportions variety. As a result, the capital demand elasticity in (7b) converges to zero, turning the capital tax into a lump-sum tax. In this case, inefficiencies at the regional level disappear, whereas they remain at the central level. As a result, no amount of central provision can ever dominate regional provision.

In contrast, raising the substitution elasticity towards infinity causes the demand elasticity in (7b) to rise towards infinity. The unit tax rate on capital must therefore fall towards zero; otherwise, the cost term on the right side of (7b) would become negative, corresponding to the case where the region is on the wrong side of a Laffer curve. With the tax rate going to zero, each regionally-provided  $g(n)$  moves towards zero. Under our assumptions about utility, central provision dominates this situation. Q.E.D.

Proposition 2 corresponds to the Besley-Coate results about spillover effects. Just as large spillover effects lead to centralized provision being optimal, the high amount of tax competition implied by a large substitution elasticity implies that all public goods should be centralized in the current model. But Proposition 1 has shown that the correspondence does not go the other way: some decentralization is always desirable, regardless of the substitution elasticity.

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<sup>10</sup> The elasticity of demand is related to the substitution elasticity by the formula,  $\varepsilon = \sigma/\theta_L$ , where  $\theta_L$  is labor's income share.

#### 4. Many Regions

The assumption of only two regions simplifies the analysis but is not critical to the main insights. Suppose instead that there are a fixed number of regions,  $N$ , and that  $(N + 1)/2$  of them form a minimum winning coalition (assuming  $N$  is odd). Assume again that belonging to the MWC is random, so that the maximization of the sum of utilities is equivalent to the maximization of expected utility, calculated prior to the choice of the MWC. If all regions within the MWC are treated identically, then the previous analysis clearly remains unchanged. In fact, more can be said about the welfare-improving level of decentralization in Proposition 1 when  $N$  is large. In this case, the terms-of-trade effects will be small, and so the level of decentralization under which these effects are offset by tax competition will also be small. In other words, the set of decentralized public goods,  $[0, n']$ , under which the insider regions behave efficiently will go to zero as  $N$  goes to infinity, but  $n'$  will still be positive at any finite value of  $N$ . Note, however, that it will generally be desirable for  $n'$  to be set beyond this level, at a value that trades off the inefficiencies involving overprovision of centrally-provided public goods against the underprovision of public goods described by (7b) with  $K = K^*$  approximately.<sup>11</sup>

More generally, however, centrally-provided public good levels will differ across members of the MWC, depending on the political process. Let us consider the case in which one region is chosen randomly to be the agenda setter in the central legislature; that is, it specifies the alternatives to be voted over. This region is denoted “ $a$ .” We again assume that the central government taxes all capital at the same rate to finance its supplies of public goods, which can differ across regions. The agenda setter must induce a majority of regions to vote for its chosen policy over a default policy, which we take to be no centralized provision of public goods; that is, there is decentralized provision of all public goods. In particular, it must form a coalition by offering  $(N+1)/2 - 1$  other regions a policy that provides them with at least the utility that they could obtain under full decentralization. Then each of these other regions will be willing to vote for the proposed policy. These other regions are also chosen randomly by the agenda setter. The optimal proposal for the agenda setter provides no public goods to the regions outside of the coalition (again called the “outsiders”), while providing the other members of the coalition (“insiders”) with a common

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<sup>11</sup> Since  $dr/dt = 0$  in (7a) and (7b) when there are many identical regions, we may also prove Proposition 1 by replacing the assumption of a quadratic production function with the weaker assumption that the capital demand curve is convex, that is,  $K'' \geq 0$ .

level of each centrally-provided public good, denoted  $g_m$ , which leaves them indifferent about staying in the coalition.

To facilitate the formation of a coalition in a way that optimizes its welfare, the agenda setter would clearly benefit from having access to interregional income transfers. In the absence of these transfers, its only means of redistributing resources from other coalition members to itself would be to raise the common tax  $T$  collected on all capital, while setting its public good level,  $g_a$ , above  $g_m$ . In fact, as the number of regions grows, enabling the agenda setter to collect more rents from coalition members, the level of  $g_a$  would increase without bound, driving the marginal utility,  $u'(g_a)$ , to zero, thereby greatly heightening incentives to engage in transfers. To account for these incentives, we assume that central government revenue can be used in a limited way to provide income transfers. The limitation is that these transfers must be non-negative; that is, tax revenue can be used for “regional aid”, but the agenda setter cannot impose additional taxes on other regions. Finally, the transfers are assumed to go to a region’s residents; they cannot be used to fund the locally-provided public goods, a restriction that maintains our previous assumption that these public goods are financed with a tax on the mobile factor.<sup>12</sup>

Providing transfers to the outsider regions is clearly not in the interest of the agenda setter. But the agenda setter would benefit from an increase in the transfers going to both it and other coalition members. The utilities of the other members could be kept equal to their required level by increasing the common tax rate  $T$ . But with  $T$  being paid by outsider regions, the increase in the agenda setter’s transfer could be raised by an amount that exceeded the increase in its tax payments from the rise in  $T$ . Essentially, this policy perturbation shifts income from the outsider regions to the agenda setter, without affecting net income in the other insider regions.

Thus, the agenda setter will raise  $T$  as much as possible to finance transfers to both it and the other coalition members.  $T$  certainly cannot be raised higher than the point where the net return on capital goes negative, since no capital would be supplied. But there might be other constraints, such as the ability of the outsider regions to exit the federation. In any case,  $T$  is determined by these constraints.

Along with financing these transfers, the tax  $T$  finances public good expenditures for the insider regions. But with  $T$  fixed at its maximum level, the marginal source of financing is a reduction in the transfers. Thus, expenditures on a coalition member’s centrally-

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<sup>12</sup> If instead the transfers can replace local taxes in the funding of local public goods, then there is no change in the results for the case of a large number of regions. In this case, a small amount of decentralization is desirable, implying that the local taxes on capital are small for coalition members who do not receive transfers.



provided public goods can be increased by a dollar at a cost of a dollar reduction in its transfers. For this reason, the first-best rule for efficient public good provision holds for all insider regions:

$$u'(g_m) = u'(g_a) = 1. \quad (12)$$

We will show that despite the efficiency result, some decentralization of public good provision remains desirable.

One implication of (12) is that in the case of many regions, no coalition member will top off its centrally-provided public good provision with its own locally-financed provision. The reason is that terms-of-trade effects are not present to potentially lower the marginal cost of public goods provision below one. More generally, we again assume that these terms-of-trade effects are sufficiently weak to keep this marginal cost below one, implying that there is no topping off. Then both the agenda setter and other insider regions finance the same number of goods outside of the set  $C$  of centrally-provided goods. It follows that they choose the same local tax rates.<sup>13</sup> This result enables us to use much of the previous analysis. Note, in particular, that insider regions will choose lower local taxes than outsider regions, since the latter must fund all of the public goods they receive. This tax discrepancy causes capital to flow from the outsider regions to the insider regions. Thus, all insider regions are capital importers:  $K > K^*$ . Equation (7) continues to describe their optimal levels of locally-provided public goods.

We are now in a position to show that Proposition 1 carries over to the agenda-setter model; that is, *there is a level of decentralization that raises expected utility*. In fact, the proof is largely unchanged. First, we can again use (7) to choose a level of decentralization so that the locally-provided public goods are supplied at their first-best levels. Unlike Proposition 1, replacing centralized provision with this local provision does not by itself represent an efficiency improvement, since we have found that central provision is efficient when income transfers are available. But there remain the two other efficiency improvements. The rise in the insider regions' tax rates to finance the new locally-provided public goods causes capital to flow to the higher-tax outsider regions, representing the first efficiency improvement. As we previously demonstrated, this flow of capital increases public good provision in the outsider regions, representing the second efficiency improvement.

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<sup>13</sup> Given the assumption of quasi-linear preferences, differences in the levels of public goods in  $C$  do not affect the chosen levels of goods outside of  $C$ .

Thus, Proposition 1 extends to a large number of regions, including the case where an agenda setter controls the distribution of public goods across the minimum winning coalition. It is straightforward to show that Proposition 2 also extends in a similar matter.

## 5. Concluding Remarks

This paper has investigated conditions under which a multi-tier government structure is desirable when lower-level governments are characterized by tax competition. Our approach is to exploit the tradeoff between the cost of decentralization (underprovision of public goods due to fiscal externalities) and the cost of centralization (exclusion of regions not in the MWC and oversupply of public goods to regions in the MWC). Our main results suggest that some decentralization is always desirable, in contrast to the more ambiguous results presented in the literature when public good spillover effects replace the fiscal externalities associated with tax competition. But some or no centralization may be optimal, as in the spillover case. Our results hold for both a 2-region model and a many-region model with an agenda setter.

To examine the robustness of our results, our model could be extended in a number of ways. For example, we work with a utility function that is quasi-linear and separable, so that the demand for a public good does not depend on income or the price of other public goods. In this case, central provision of some public goods does not affect the regional demands for other public goods, except in cases where it results in changes in the effective marginal costs of these other public goods. More general demand structures would provide other avenues through which central provision alters the behavior of lower-level governments.

Three other assumptions seem noteworthy. First, our modeling of centralization assumes that the legislative majority needed to pass a fiscal package is the smallest number consistent with a majority in the legislature. Yet political systems in modern economies often require more than a simple majority to pass particular types of legislation. We suspect that such a higher threshold level or supermajority requirement would make centralization relatively more attractive. Our reasoning follows from the observation that when the supermajority includes every region, centralization is first-best efficient. However, this extension would not upset the reasoning behind our main propositions.

Second, we assume that regional governments act in the interest of their representative citizen. But for the same reason that central government is inefficient, we expect that further decentralization of regional decisions to even lower levels of government would be beneficial. It would be interesting to examine under what conditions the typical three-tier government

structure, consisting of federal, regional and local governments, emerges as an optimal response to the trade-off between the benefits and costs of decentralization.

A third critical assumption is the use of minimum winning coalition concept. The MWC concept can be criticised because it assumes that decision making under centralization is noncooperative, and this may be unrealistic in a context with few decision makers where bargaining costs are assumed to be small. It is not clear to us whether bargaining costs are sufficiently small in national legislatures with several hundred legislators (such as in the House of Representatives in the U.S. or the Bundestag in Germany) to make a cooperative approach the only reasonable assumption. Even if we think that the basic trade off between centralization and decentralization remains. Besley and Coate (2003) and others such as Lorz and Willmann (2005) and Dur and Roelfsma (2005) show that even under cooperative legislative behaviour, centralization is typically not efficient in the presence of spillovers, as regions use strategic delegation to manipulate the outcome of the bargaining process.

Finally, future research should more thoroughly examine the implications of different federal structures for the distribution of income. The welfare criteria used throughout our analysis has been the sum of utilities across regions. Given our assumption of a quasi-linear utility function, along with our assumption that regions are identical ex ante, the analysis effectively ignores income distribution issues. We have observed, however, that centralization helps regions inside the minimum winning coalition at the expense of outsiders. Thus, the analysis suggests that centralization has the potential to worsen the distribution of income. In contrast, a theme of the local public economics literature is that distributional policies should be centralized, given the limitations that factor mobility places on the ability of lower-level governments to redistribute income. While these limitations are certainly important, the type of model considered here highlights the potential for bad politics at the central level to lead to capricious changes in the distribution of income.

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