Public Spending in Functional Jurisdictions: a Nash Bargaining Approach

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Abstract

In many federations local governments form functional jurisdictions in order to provide public goods. In contrast to standard literature, which assumes autonomous decisions of governments, the decision making process in co-operations is jointly. This paper models that difference using a Nash bargaining game. It is shown that a region with higher private income can enforce a higher level of public spending. Therefore local co-operations result in inefficiency.

Keywords: co-operation, public spending, local governments

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1 Introduction

This paper examines public spending in functional jurisdictions. Municipalities or residents form these districts or co-operations in order to secure the provision of a public good.[1] A central argument for local co-operation is the reduction of costs. Like a central government, local co-operations can bundle the public good production and enhance economies of scale. But since they are organized locally, they also derive the benefits of decentralization.

In many federations, co-operations play an important role on the local level. In the United States and Canada for example, residents can decide to form *special purpose districts* in order to provide several public goods. Many German municipalities choose a public good provision in administration unions (*kommunale Zweckverbände*). Since local public spending in functional jurisdictions has high relevance in many federations, this paper investigates the influence of a co-operative decision-making on the allocation. Public spending in functional jurisdictions is not an autonomous decision of a government or a legislature but instead a joint decision of different groups or representatives of municipalities. Therefore, this paper models local co-operation by a Nash bargaining game. Since regions choose co-operations freely, the

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[1]Frey and Eichenberger (2000) introduce with *Functional Overlapping Competing Jurisdictions* a related form of governments.

threat point, the situation in which functional jurisdictions are not established, must be taken into account. It turns out, that it has an important influence on the allocation. One can show, that functional jurisdictions limit redistribution of private income. With restricted policy instruments this can cause inefficiencies since there is a higher level of public spending in wealthy regions than in poor regions.

Previous research has already focused on bargaining in the context of public finance. Hickey (2007) analyzed requirements of a political system to federations. If it allows bicameral bargaining, small regions are more likely to join a federation because they have a better chance to influence the allocation of public spending. Persson and Tabellini (1996) analyze bargaining between regions about an insurance system. If two regions face different risks of suffering income shocks, the one with the better risk will prohibit redistribution to some extent and therefore limit the insurance payments. Fenge and von Weizsäcker (2001) emphasize the importance of the threat point in a similar model.

The paper is structured as follows. The next section introduces a simple model. Section 3 examines the allocations of a central planner and a functional jurisdiction within full fiscal instruments, while in section 4 these are

restricted. Section 5 concludes the paper.

2 The Model

A federal economy consists of two regions $i = 1, 2$. In each region, a represen-

tative resident earns a fixed income s_i. In addition to private consumption

c_i, she consumes a public good g_i, and thus the residents' utility function is

$$u_i = u(c_i, g_i) = c_i + b(g_i) \tag{1}$$

with $b'(g_i) > 0$ and $b''(g_i) < 0$. The public good g_i is offered either by a local,

or a central government. The cost function K of the public good is linear so

that

$$K = \alpha \cdot g_i + F, \tag{2}$$

$\alpha > 0$, where α represents the marginal costs and F are fix costs. To finance

g_i, a tax of the rate τ_i is levied on privat income s_i. The tax rate can

also be interpreted as a contribution rate on the tax base s_i.[2] The private

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[2]E.g., German administration unions finance public spending by a contribution on the tax base of municipalities.

consumption in region i is given by

$$c_i = s_i(1 - \tau_i). \tag{3}$$

In order to consider unequal allocations of private income, $s_1 > s_2$ is assumed throughout this paper. Therefore region $i = 1$ is called the *rich region* , region $i = 2$ is called the *poor region*.

As a benchmark case for local co-operations a central government is analyzed. The central government determines the taxation of the regions as well as the allocation of the public good. In a decentralized federation regions can either offer a public good on their own or form a functional jurisdiction. For a co-operation the local partners have to agree to a cost apportionment and to an allocation of the public good. If the local governments do not agree to a bargaining solution, they offer the public good on their own. The regions then maximize their residents' utility $\overline{u_i}$ subject to the local budget constraint $\tau_i s_i = \alpha g_i + F$. The utility in the threat point is

$$\overline{u_i} = s_i - \alpha \cdot g_i - F + b(g_i). \tag{4}$$

From the first order condition one can show that $g_i = g^*$ satisfies $b'(g^*) = \alpha$. It is assumed that $b'(\frac{s_i - F}{\alpha}) \leq \alpha \leq b'(0)$, so the public good is offered and

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private consumption is positive in both institutional settings.

The budget of the central government and the functional jurisdiction is

$$\tau_1 s_1 + \tau_2 s_2 = \alpha(g_1 + g_2) + F. \tag{5}$$

Central and local policy makers can set g_i independent of the share of generated tax revenue in the regions. The public good is a local one with no spillovers to the other region.

While by a utilitarian maximization, regions have no influence on allocations chosen by the central government, the partners of a functional jurisdiction are free to accept an outcome of a bargaining process. Considering utility maximization of local players there is always a bargaining solution. The benefit of common public spending is the sharing of fix costs and with it decreasing costs per unit of the public good.

3   The Optimum

As a benchmark case the central government maximizes the sum of the utilities $w = u_1 + u_2$ over the tax rates τ_i and the public good allocation g_i

subject to the common budget (5):

$$\max_{\tau_i, g_i} \quad s_1(1 - \tau_1) + b(g_1) + s_2(1 - \tau_2) + b(g_2) \tag{6}$$

$$s.t.$$

$$\tau_1 s_1 + \tau_2 s_2 = \alpha(g_1 + g_2) + F.$$

From the first order conditions it follows that the public spending is uniform in the regions, so $b'(g_1) = b'(g_2) = \alpha$. Therefore the optimal level of the public good g^* is offered in both regions. In order to finance public spending the tax revenue must equal

$$\tau_1 s_1 + \tau_2 s_2 = 2\alpha \cdot g^* + F. \tag{7}$$

The central government is indifferent to all possible allocations of private consumption, so there is a set W_1 of solutions. All of them have to satisfy equation (7).

In a functional jurisdiction, local governments maximize the Nash product

$n = (u_1 - \overline{u_1})(u_2 - \overline{u_2})$ subject to the common budget:[3]

$$\max_{\tau_i, g_i} \ (s_1(1 - \tau_1) + b(g_1) - \overline{u_1})(s_2(1 - \tau_2) + b(g_2) - \overline{u_2}) \qquad (8)$$

$$s.t.$$

$$\tau_1 s_1 + \tau_2 s_2 = \alpha(g_1 + g_2) + F.$$

Using the first order conditions it can be shown that $b'(g_1) = b'(g_2) = \alpha$ holds again. Public spending is therefore first best efficient. But instead of a set of first best efficient allocations, the bargaining process defines a unique outcome N_1. From the first order conditions it follows $u_1 - \overline{u_1} = u_2 - \overline{u_2}$. Since g^* is equal in the threat point and in N_1 one can show, that

$$\tau_1 s_1 = \tau_2 s_2. \qquad (9)$$

The bargaining solution N_1 is contained in the solution of the central planner W_1. The allocation of public goods and private consumption is unique. With $s_1 > s_2$, it follows that $\tau_1 < \tau_2$. While the payments are equal in both regions, the tax rate in the rich region is smaller.

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[3]Equal bargaining power is assumed for both regions.

Proposition 1 *The bargaining solution N_1 of a functional jurisdiction is an allocation with uniform public spending in the regions. While the tax rate of the rich region is smaller than the one of the poor region, the payments of both partners are equal in absolute terms. N_1 is an element of W_1 and therefore first best efficient.*

4   Restricted fiscal instruments

Some federations encourage local co-operations, but they dictate that regions should be treated equally.[4] The political economy provides an argument for uniformity: Wrede (2006) argues it protects small regions against a central government. Being forced to treat all regions equally gives a central government no possibility to form a minimum winning coalition and regions can not be played off against each other. This can justify a restriction of fiscal instruments .

Regions can still decide freely on the public good allocation but they have to agree on a uniform tax rate τ. The restriction of instruments decreases the set of possible allocations. To find all Pareto efficient allocations, it is

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[4]For example, the German States Bavaria, Baden-Württemberg and Mecklenburg-Vorpommern dictate their administration unions to set uniform contribution rates.

necessary to maximize the utility of one region subject to a given utility $\hat{u}_i$ of the other region and the budget of the regional co-operation:

$$\max_{\tau, g_i} \quad s_2(1 - \tau) + b'(g_2) \tag{10}$$

$$s.t.$$

$$s_1(1 - \tau) + b'(g_1) = \hat{u}_1$$

$$and$$

$$\tau(s_1 + s_2) = \alpha(g_1 + g_2) + F.$$

To solve this problem the envelope theorem is used. The result is the sum of all Pareto efficient allocations. It can be shown that the slope of the Pareto frontier P is always

$$-\mu = -b'(g_2)/b'(g_1) \tag{11}$$

with μ as the Lagrange operator of the first side condition. So the gradient

of P is only determined by the allocation of g_i. Furthermore

$$\frac{d\vartheta}{du_1} = 0 \tag{12}$$

holds. Therefore the sum of public goods does not vary along the Pareto frontier and there exists exactly one welfare maximizing τ^*. All Pareto efficient solutions of the bargaining game will differ only in the allocation of public spending but not in the sum of payments of the regions. These two results imply a strictly concave Pareto frontier.

Proposition 2 *In a setting with restricted fiscal instruments, such as a uniform tax rate, both a central government and a functional jurisdiction will choose exactly one τ^*. The total amount of public spending in the federation is thus constant and independent of the institutional setting.*

The utilitarist maximizes w over a uniform tax rate and the public good provision:

$$\max_{\tau, g_i} \quad s_1(1 - \tau) + b(g_1) + s_2(1 - \tau) + b(g_2) \tag{13}$$

s.t.

$$\tau(s_1 + s_2) = \alpha(g_1 + g_2) + F.$$

Looking at the first order conditions $b'(g_1) = b'(g_2) = \alpha$ holds again. But

due to the uniform τ, the tax rate of each region i is fixed to

$$\tau = \frac{2\alpha \cdot g^* + F}{s_1 + s_2}. \tag{14}$$

The allocation W_2 is contained in W_1 and from there it is first best efficient.

Furthermore it is unique. Since $b'(g_1) = b'(g_2)$, the gradient of the Pareto

frontier in W_2 is $-\mu = -1$.

In the case of regional co-operation, the local partners maximize the Nash

product n over a uniform tax rate τ and g_i, subject to the budget of the

functional jurisdiction:

$$\max_{\tau, g_i} \ (s_1(1 - \tau) + b(g_1) - \overline{u_1})(s_2(1 - \tau) + b(g_2) - \overline{u_2}) \tag{15}$$

$$s.t.$$

$$\tau(s_1 + s_2) = \alpha(g_1 + g_2) + F.$$

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Using the first order conditions one can show

$$b'(g_2)[s_1(1 - \tau) + b(g_1) - \overline{u_1}] = b'(g_1)[s_2(1 - \tau) + b(g_2) - \overline{u_2}]. \qquad (16)$$

With an unequal allocation of private income, $s_1 > s_2$, it follows $g_1 > g_2$ in the bargaining solution N_2. Since the sum of public spending is constant $2 \cdot g^*$ along the Pareto frontier, the same tax rates are chosen in N_2 as in W_2. Hence the private consumptions $s_i(1 - \tau)$ in a centralized and a decentralized federation are equal. The allocation N_2 differs from the first best solution. The reason for non-uniform public spending is the limitation of fiscal instruments. While the tax rate is now equal for both regions, the absolute payment of the rich region is higher. A central government ignores the effect on the private consumption and therefore redistributes welfare to some extent. But in order to find a compromise in a functional jurisdiction, the rich region needs to be compensated. Since there is no possibility to reimburse with a lower tax rate, the compensation is paid in terms of public goods. Therefore $g_1 > g_2$ must be satisfied, even though inefficiency in public spending arises.

Figure 1 pictures all solutions. The straight line $\overline{AB}$ is the set of first best efficient allocations W_1 a central government will choose assuming varying
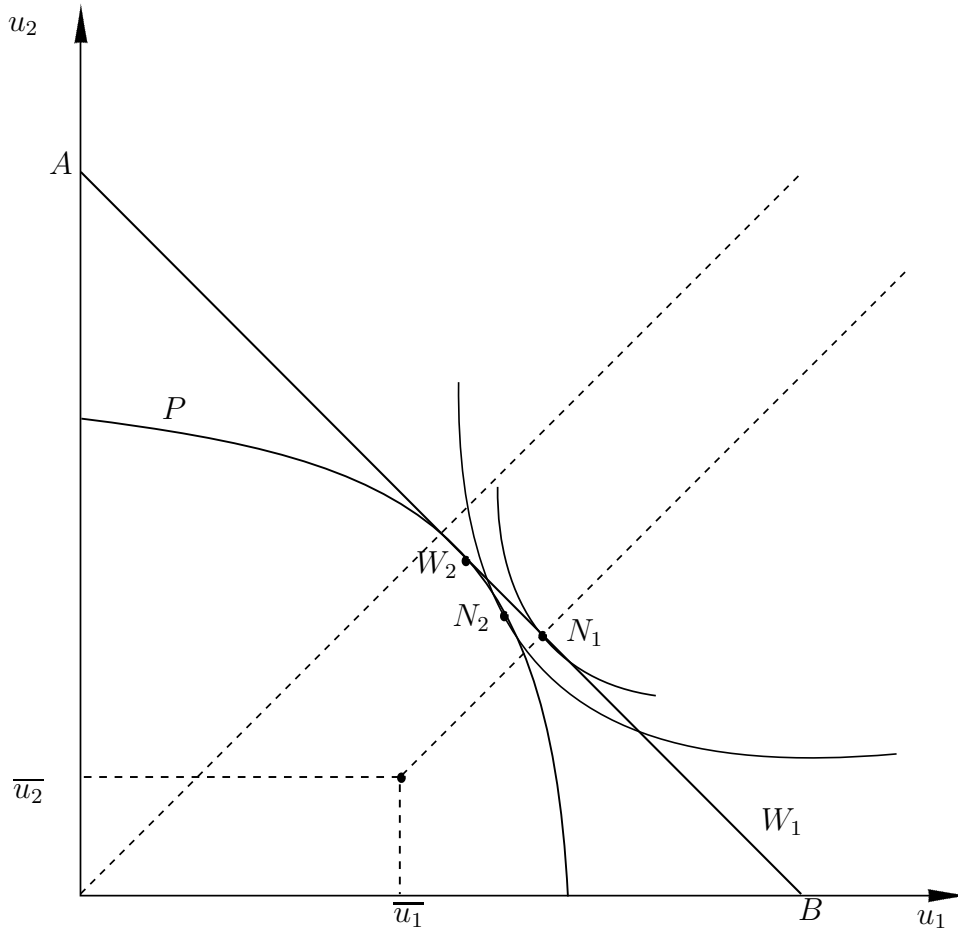
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Fig. 1: Allocations in different institutional settings

tax rates and public good provision. The Nash bargaining solution in the same setting is N_1. Obviously N_1 is a point on the straight line $\overline{AB}$ and is therefore contained in W_1. The curve P is the Pareto frontier for the settings with a uniform tax rate. W_2 is the allocation a central government will choose with limited fiscal instruments. Since $\tau < 1$, W_2 is below the intersection of the Pareto frontier P and the 45° line through origin. Therefore the utility

between the regions has not been totally equalized, but the differences have been reduced. Even though N_2 is efficient in sense of a bargaining solution, the aggregated surplus is smaller than in N_1 or W_2.

Proposition 3 *In a functional jurisdiction with uniform tax rates the rich region can enforce a higher level of public spending than the poor region ($g_1 > g_2$). A result of local co-operation is inefficiency in public spending.*

Comparing residents' utility, the institutional settings 'centralization' and 'functional jurisdiction' can be evaluated. Restrictions of fiscal instruments must be taken into account. Only the situation, in which a federation is centralized and fully instrumented, can not be evaluated because it is not unique. $U_i^{W_2}$ is the utility of the resident in region i under a central government regime with a uniform tax rate. $U_i^{N_1}$ is the utility for a resident settled in a functional jurisdiction with unequal tax rates and $U_i^{N_2}$ is the utility for residents in a functional jurisdiction with restricted fiscal instruments. Comparing residents' utility it turns out that

$$U_1^{N_1} > U_1^{N_2} > U_1^{W_2} \tag{17}$$

$$U_2^{N_1} < U_2^{N_2} < U_2^{W_2}.$$

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Generally, the situation of the region with higher utility in the threat point is better off in a functional jurisdiction than under a central government. The reason can be seen in the need to consider a better fallback position in a bargaining solution while the central government pays no attention to it. In a co-operation the better threat point of the rich region results either in a lower tax rate or a higher level of the public spending. The direct way of compensation is a lower tax rate because it influences the private consumption and does not lead to inefficiencies in the public sector. Compensation through higher public spending is not effective because inefficiencies arise. Hence the first best allocation cannot be reached anymore.

5 Conclusion

While the standard assumption in literature is either a central or a local government deciding autonomously on public spending, this paper analyzes a different approach: regions are free to form a functional jurisdiction in order to attain economies of scale in the provision of public goods. Therefore local governments need to decide jointly on tax rates as well as on the allocation of public goods. While in a setting with full fiscal instruments first best efficiency can be achieved by both institutional arrangements, a functional

jurisdiction can only achieve second best efficiency when fiscal instruments are restricted. The bargaining process considers the situation of each region in its threat point. The possibilities to reallocate private consumption are restricted and either the tax rate of the rich region is smaller or public spending is higher.

Since different forms of functional jurisdiction exist in federations, the policy implication might be, that these must be able to set their design of co-operation freely. While many national and sub-national governments promote local co-operations, they often fail to permit a high degree of freedom in terms of fiscal instruments.

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