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Vertical transfers to local governments and horizontal redistribution

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Abstract

This paper develops a political economy framework with three levels of government: central, regional and local or municipalities. Central government transfers revenues to regional governments, which must coordinate the sharing of these transfers among local governments. The aim is to study the efficiency of centralized transfers to municipalities. Destination constraints, which are usually imposed by the central government to drive the horizontal redistribution, affect the shadow prices that municipalities are willing to pay for the provision of local public goods. Results show that the efficiency of the horizontal redistribution does not depend on the imposition of destination constraints by the central government.

Key words: fiscal federalism, intergovernmental relations, transfers, bargaining.

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1 Introduction

Consider an economy with three levels of government: central, regional and local. Local governments or municipalities are in charge of providing a set of local public services. The central government levies an income tax and redistributes tax-revenues to regions according to some (politically desirable) macroeconomic criteria and/or some easily observable parameters such as, for example, population number, sex, age, education and region size. We assume that only municipalities know the distribution and characteristics of local preferences or simply that the central government does not want to deal with the numerous local differences and characteristics. Thus, the central government transfers resources to the local governments in order to finance local public services. The central government, however, does not leave local governments totally free to decide how to allocate the money, as it imposes some constraints on the amount of resources spent in each public service. These constraints are at the regional level. The central government decides the total amount of money that should go to each service in any region and then leaves municipalities in each region the possibility to freely share these resources, under the aggregate destination constraint.

In this situation, municipalities can negotiate with other municipalities in the same region the preferred mix of local public goods and service they want to provide, under the understanding that in case of disagreement the mix is decided according to some general criteria set by the central government. We consider two institutional scenarios:

1. the agreement must be unanimous among all municipalities;
2. partial agreements may form.

In order to simplify the analysis we consider the decision over two policies such as nursing and culture activities, which we shall call policy A and policy B. The central government decides the amount of resources to devote to these two policies in each region. In this setting regions do not have an active role, it only represents the level at which the constrain on the destination of the central government transfers is imposed. Although the amount of resources transferred to each region maybe different, here we are only interested on how these resources are shared inside the region, thus we just consider a generic region, R, with local policies denoted with R_A and R_B.

2 Unanimous agreement

Let $i = 1, \ldots, m$ be the set of municipalities in the region. Each municipality differs with respect to the preference over the mix of the two public goods. The payoff function of the representative of a generic municipality i is

$$u_i = \lambda_i u(r_i^A) + (1 - \lambda_i) u(r_i^B) \tag{1}$$

where $\lambda_i \in (0,1)$ is the preference for policy A relative to B, and r_i^A, r_i^B is the amount of resources for policy A and B, respectively. We assume that the function u is increasing and strictly quasi-concave in r_i^A and r_i^B. Municipalities may differ with respect to their preference for the mix of public policies. This setting does not require municipalities to be identical on other characteristics, indeed, they may differ in population or geographical size or income, but it does not affect the relative preference for the mix of public goods.

The central government imposes a regional constraint on the destination of the resources, so that the sum of all resources destined to policy A must be

$$r_1^A + r_2^A + ... + r_i^A + \ldots + r_m^A \leq R^A, \tag{2}$$

where r_i^A is the resources that go to municipality i. The same must hold for policy B; that is

$$r_1^B + r_2^B + ... + r_i^B + \ldots + r_m^B \leq R^B. \tag{3}$$

Moreover, the central government imposes a default sharing rule $\rho : X \rightarrow \mathbb{R}^m$, in case municipalities do not reach a common agreement. The set X represents the characteristics that the central government uses in order to define a default sharing rule, for instance demographic size and income.

Let $\bar{r}_i = \{\bar{r}_i^A, \bar{r}_i^B\}$ be the default mix of resources, such that

$$\sum_{i=1}^{m} \bar{r}_i^A = R_A \text{ and } \sum_{i=1}^{m} \bar{r}_i^B = R_B. \tag{4}$$

Municipalities can negotiate a different mix of resources with other municipalities inside the same region. The negotiation process is characterised by the following two constraints:

1. if no general agreement is reached each municipality receives the mix $\bar{r}_i$;
2. the mix of resources must satisfy $\sum_{i=1}^{m} r_i^A = R_A$ and $\sum_{i=1}^{m} r_i^B = R_B$.

We can study the Nash-Bargaining solution to this negotiation problem, where $\bar{u} = \{\bar{u}_1, \ldots, \bar{u}_m\}$ is the vector of disagreement payoffs in which

$$\bar{u}_i = \lambda_i u(\bar{r}_i^A) + (1 - \lambda_i) u(\bar{r}_i^B) \tag{5}$$

The set of possible agreements is defined by

$$S = \left\{ u(r_i^A, r_i^B) : \sum_{i=1}^{m} r_i^A = R_A \text{ and } \sum_{i=1}^{m} r_i^B = R_B \text{ and } u_i \geq \bar{u}_i \text{ for all } i \right\}$$

This is a standard problem of bargaining with many players, where the possible solutions (i.e., agreements) are limited by the destination constrain at the regional level. We can define the net gains from bargaining as

$$\phi_i = u_i - \bar{u}_i \tag{6}$$

given the set S, cooperation implies that $\phi_i \geq 0$ for all i. The Nash-Bargaining solution is defined by

$$(r_i^A, r_i^B)_{i=1}^m = \arg\max \prod_{i=1}^m \phi_i$$

$$s.t. \sum_{i=1}^m r_i^A = R_A, \sum_{i=1}^m r_i^B = R_B$$

where the solution is the value of transfers for policy A and B, in each municipality. Let μ and h be the Lagrangian multipliers for the two constraints, the Nash-bargaining solution must satisfy,

$$L = \prod_{i=1}^m \phi_i + \mu(R_A - \sum r_i^A) + h(R_B - \sum r_i^B). \tag{7}$$

The first order conditions are

$$\frac{\partial L}{\partial r_i^A} : \prod_{j \neq i} \phi_j \frac{\partial \phi_i}{\partial r_i^A} = \mu \qquad \text{for all } i, \tag{8}$$

$$\frac{\partial L}{\partial r_i^B} : \prod_{j \neq i} \phi_j \frac{\partial \phi_i}{\partial r_i^b} = h \qquad \text{for all } i, \tag{9}$$

$$\frac{\partial L}{\partial \mu} : R_A = \sum r_i^A = \sum \bar{r}_i^A, \tag{10}$$

$$\frac{\partial L}{\partial \mu} : R_B = \sum r_i^B = \sum \bar{r}_i^B.$$

Dividing condition (8) and (9), we get

$$MRS_i^{A,B} = \frac{\frac{\partial \phi_i}{\partial r_i^A}}{\frac{\partial \phi_i}{\partial r_i^B}} = \frac{\mu}{h} \qquad \text{for all } i \tag{11}$$

which implies that the bargaining solution must satisfy the equality between all municipalities marginal rates of substitution. In fact,

$$\frac{\partial \phi_i}{\partial r_i^A} = \frac{\partial u_i}{\partial r_i^A} = \lambda_i \frac{\partial u}{\partial r_i^A}$$

hence the marginal rate of substitution between policy A and B for municipality i is

$$MRS_i = \frac{\lambda_i}{1 - \lambda_i} \frac{\frac{\partial u}{\partial r_i^A}}{\frac{\partial u}{\partial r_i^B}} \qquad \text{for all } i \tag{12}$$

Notice that $\frac{\frac{\partial u}{\partial r_i^A}}{\frac{\partial u}{\partial r_i^b}} = f(r_i^A, r_i^B)$ where the function f is the same for all municipalities. Therefore, we can write

$$MRS_i = \frac{\lambda_i}{1-\lambda_i} f(r_i^A, r_i^B) \tag{13}$$

Furthermore, the Nash Bargaining solution must satisfy $MRS_i = MRS_j$, that is

$$\frac{\lambda_i(1-\lambda_j)}{\lambda_j(1-\lambda_i)} = \frac{f(r_j^A, r_j^B)}{f(r_i^A, r_i^B)} \qquad \text{for all } i, j \tag{14}$$

This shows that if $\lambda_i = \lambda_j$ then $f(r_j^A, r_j^B) = f(r_i^A, r_i^B)$.

Note that equation (11) shows that the MRS must be equal to the ratios between the shadow prices, μ/h, in equilibrium.

3 The social optimum

Now, assume that the regional government acts as a central planner willing to maximize social welfare. The social optimum will be given by the solution to the following maximization problem:

$$\left(r_i^{A^e}, r_i^{B^e}\right) = \arg\max \sum_{i=1}^{m} \left(\lambda_i u(r_i^A) + (1-\lambda_i) u(r_i^B)\right)$$

$$s.t. \sum_{i=1}^{m} r_i^A = R_A, \ \sum_{i=1}^{m} r_i^B = R_B. \tag{15}$$

Let μ and h be the Lagrangian multipliers for the two constraints the municipal demand must satisfy,

$$L = \sum_{i=1}^{m} \left(\lambda_i u(r_i^A) + (1-\lambda_i) u(r_i^B)\right) + \mu \left(R_A - \sum_{i=1}^{m} r_i^A\right) + h \left(R_B - \sum_{i=1}^{m} r_i^B\right).$$

The first order conditions are

$$\frac{\partial L}{\partial r_i^A} : \lambda_i \frac{\partial u(r_i^{A^e})}{\partial r_i^{A^e}} = \mu \qquad \text{for all } i, \tag{16}$$

$$\frac{\partial L}{\partial r_i^B} : (1-\lambda_i) \frac{\partial u\left(r_i^{B^e}\right)}{\partial r_i^B} = h \qquad \text{for all } i, \tag{17}$$

$$\frac{\partial L}{\partial \eta} : R_A = \sum r_i^A = \sum \bar{r}_i^A, \tag{18}$$

$$\frac{\partial L}{\partial \zeta} : R_B = \sum r_i^B = \sum \bar{r}_i^B. \tag{19}$$

After dividing equations (16) and (17) we get

$$MRS_i^{A^e,B^e} = \frac{\lambda_i}{1-\lambda_i} \frac{\frac{\partial u(r_i^{A^e})}{\partial r_i^{A^e}}}{\frac{\partial u\left(r_i^{B^e}\right)}{\partial r_i^{B}}} = \frac{\mu}{h} \qquad \text{for all } i. \tag{20}$$

As in the bargaining model, the social optimum solution implies that the MRS of all municipality must be the same, in equilibrium, given the budget constrains imposed by the central government. This, in turn, proves that the bargaining outcome is also efficient.

4 A model with a compensation room

Assume that the region, which receives the transfers from the central government, has the neutral role to coordinate the exchange of the default quotas assigned to each municipality according to the criteria established by the central government. Therefore, the representatives of the municipalities go to the regional compensation room where the default quotas, $\bar{r}_i^A$ and $\bar{r}_i^B$, become their initial endowment that they can exchange in order to increase welfare. Thus, in the compensation room, the total supply of public good A is given by[1]

$$\sum_{i=1}^{m} \bar{r}_i^A = R^A, \tag{21}$$

and the total supply of public good B is given by

$$\sum_{i=1}^{m} \bar{r}_i^B = R^B. \tag{22}$$

After exchanging $\bar{r}_i^A$ and $\bar{r}_i^B$ all municipalities will be better-off in equilibrium. However, the relation, $r_i^A + r_i^B \lesseqqgtr \bar{r}_i^A + \bar{r}_i^B$, will be true; that is, some municipalities must face a trade-off between receiving less money for a better mix of local public goods provision. Off-course, this relation is going to depend on the relative prices at which it is possible to exchange r_i^A with r_i^B in the compensation room, which works as an Edgeworth Box with m players. In the regional exchange room, municipalities trade the two "goods" to maximize their utility subject to their budget constraints, which are given by their initial endowments.

In order to describe the Pareto efficient allocations, let us pick $\sum_{j\neq i} \overline{u}_j$ as the sum of utility levels of all municipalities j, with $j \neq i$, and see how we can make

[1]Note that total constrains are $\sum_{i=1}^{m} \bar{r}_i^A \leq R^A$ and $\sum_{i=1}^{m} \bar{r}_i^B \leq R^B$ if there are transaction costs; that is, the regional government asks a price for their intermediation (This is a suggestion by Alberto Cassone).

municipality i as well as possible (See Varian (2006, 7th ed., pp. 589-90). The maximization problem is

$$\max_{r_i^A, r_i^B} \left[\left(\lambda_i u(r_i^A) + (1-\lambda_i) u(r_i^B) \right) \right]$$

$$\text{such that } \sum_{j \neq i} \left[\lambda_j u(r_j^A) + (1-\lambda_j) u(r_j^B) \right] = \sum_{j \neq i} \overline{u}_j,$$

$$r_1^A + ... + r_i^A + ... + r_m^A = R^A$$

and

$$r_1^B + ... + r_i^B + ... + r_m^B = R^B.$$

Here $R^A = r_1^A + ... + r_i^A + ... + r_m^A$ is the total amount of good A available and $R^B = r_1^B + ... + r_i^B + ... + r_m^B$ is the total amount of good B available. Basically, we need to find the allocation r_i^A, r_i^B, with $i = 1, ...m$, that maximizes the utility of municipality i given a fixed level for all the other municipalities and given the total amount of each good used is equal to the amount available.

We can write the Lagrangian for this problem as

$$\begin{aligned} L = & \left(\lambda_i u(r_i^A) + (1-\lambda_i) u(r_i^B) \right) + \mu \left[R^A - \left(r_1^A + ... + r_i^A + ... + r_m^A \right) \right] + \\ & + h \left[R^B - \left(r_1^B + ... + r_i^B + ... + r_m^B \right) \right] + \eta \left\{ \sum_{j \neq i} \overline{u}_j - \sum_{j \neq i} \left[\lambda_j u(r_j^A) + (1-\lambda_j) u(r_j^B) \right] \right\}. \end{aligned}$$

The first order conditions are

$$\frac{\partial L}{\partial r_i^A} : \lambda_i \frac{\partial u(r_i^A)}{\partial r_i^A} = \mu \qquad \text{for all } i \tag{23}$$

$$\frac{\partial L}{\partial r_i^B} : (1-\lambda_i) \frac{\partial u\left(r_i^B\right)}{\partial r_i^B} = h \qquad \text{for all } i \tag{24}$$

$$\frac{\partial L}{\partial \mu} : r_1^A + ... + r_i^A + ... + r_m^A = R^A \tag{25}$$

$$\frac{\partial L}{\partial h} : r_1^B + ... + r_i^B + ... + r_m^B = R^B \tag{26}$$

$$\frac{\partial L}{\partial \eta} : \sum_{j \neq i} \left[\lambda_j u(r_j^A) + (1-\lambda_j) u(r_j^B) \right] = \sum_{j \neq i} \overline{u}_j \tag{27}$$

If we divide the first equation by the second we have

$$MRS_i = \frac{\lambda_i}{1-\lambda_i} \frac{\frac{\partial u(r_i^A)}{\partial r_i^A}}{\frac{\partial u\left(r_i^B\right)}{\partial r_i^B}}, \qquad \text{for all } i = 1, ...m.$$

Now, if municipality i is maximizing utility subject to its budget constraint, and all municipality face the same price for the two goods, than it must be

$$MRS_i = \frac{\lambda_i}{1-\lambda_i} \frac{\frac{\partial u(r_i^A)}{\partial r_i^A}}{\frac{\partial u\left(r_i^B\right)}{\partial r_i^B}} = \frac{p^A}{p^B}, \tag{28}$$

where p^A and p^B are the prices for good A and B and μ and h are the shadow prices or efficiency prices.

So far, according to this analysis, the mechanism of transfers to municipalities designed by the Italian law leads to an efficient allocation of resources, as the second theorem of welfare economics also predicts.

5 Do we need the destination constraints?

The mechanisms of vertical transfers and horizontal sharing analysed in the previous sections incorporate two types of constraints. The first type is given by the destination constraints (2) and (3). The second type is given by the default constraint (4). An interesting question in the Italian debate is whether the central government should maintain the constraints or cancel them. In this section, we look at how the removal of the destination constraints affects the efficiency of the horizontal redistribution mechanism.

It is easy to verify that the default constraint (4) can be relaxed without any consequence on the efficient allocations of public funding represented by conditions (11), (20) and (28). This can be seen by setting $\bar{r}_i^A = \bar{r}_i^B = 0$ for any $i = 1, ..., m$. However, even if the default constraint is not needed to achieve efficiency, the central government may have other good reasons to impose it. One reason, for instance, is to make sure that, in the case of horizontal disagreement among municipalities, public funding are assigned to local governments. Besides, there may be numerous other strategic or equity reasons to impose it.

More relevant is the case of the regional destination constraints (2) and (3) imposed by the central government to each region. Basically, municipality would certainly prefer to share the regional amount, $R_A + R_B$, freely. Thus, ther regional budget constraint becomes

$$\sum_{i=1}^{m} r_i^A + \sum_{i=1}^{m} r_i^B = R_A + R_B = R. \tag{29}$$

Without any destination and default constraint, the Nash bargaining solution solves the following maximization problem:

$$(r_i^A, r_i^B)_{i=1}^m = \arg\max \prod_{i=1}^{m} u_i$$

$$s.t. \sum_{i=1}^{m} r_i^A + \sum_{i=1}^{m} r_i^B = R$$

Let μ be the Lagrangian multipliers for the constrain the Nash-bargaining solution must satisfy,

$$L = \prod_{i=1}^{m} u_i + \mu(R - \sum r_i^A - \sum_{i=1}^{m} r_i^B). \tag{30}$$

The first order conditions are

$$\frac{\partial L}{\partial r_i^A} : \prod_{j \neq i} u_j \frac{\partial u_i}{\partial r_i^A} = \mu \qquad \text{for all } i, \tag{31}$$

$$\frac{\partial L}{\partial r_i^B} : \prod_{j \neq i} u_j \frac{\partial u_i}{\partial r_i^b} = \mu \qquad \text{for all } i, \tag{32}$$

$$\frac{\partial L}{\partial \mu} : R = \sum r_i^A + \sum r_i^B, \tag{33}$$

Dividing condition (31) and (32), we get

$$MRS_i^{A,B} = \frac{\lambda_i}{1 - \lambda_i} \frac{\frac{\partial u_i}{\partial r_i^A}}{\frac{\partial u_i}{\partial r_i^B}} = 1 \qquad \text{for all } i. \tag{34}$$

Without the destination constraint the marginal rate of substitution is one; that is, municipalities exchange one euro for the provision of good A with one euro for the provision of good B.

Clearly, only municipal preferences or tastes, λ_i, play a role. Instead, when the central Government imposes regional destination constraints, they change the shadow prices ratio, μ/h in condition (11), which reflects the policy preferences of the central government.

Furtermore, it is straightforward to verify that condition (34) is also the solution of the central planner without destination constraints. This result may be developed further to show that social welfare must be lower when the centralized destination constraints are imposed on municipalities.

Similarly, the same condition (34) can be found in the model with the compensation room.

6 Concluding remarks

This paper has developed a political economy framework with three levels of government: central, regional and local. Central government transfers revenues to regional governments, which must coordinate the negotiation on the sharing of these revenues among local governments or municipalities. The aim is to study the efficiency of centralized transfers to local governments coupled with a mechanism of horizontal bargaining. We have seen that either a cooperative bargaining approach among municipalities or a system with a regional exchange room of municipal quotas leads to an efficient allocation of recourses. Furthermore, destination constraints, which are usually imposed by the central government to drive horizontal redistribution, affect the shadow prices that municipalities are willing to pay for the provision of local public goods. Results show that the efficiency of the horizontal redistribution does not depend on the enforcement of destination constraints by the central government.

This paper provides a political economic framework that may be useful for several future developments. We have analyzed three possible ways of horizontal sharing of vertical transfers, which lead to the same efficient equilibrium. In all the three cases the regional tier of government plays no active role in allocating resources across different municipalities. However, in the international scenario several countries, especially large and with federal structure, include an intermediate level of goverment (variously referred as States, Regions, Counties, etc.) endowed with relevant taxing powers and autonomous expenditures responsibilities. In some cases (e.g. Belgium, Canada, Germany and Switzerland) the intermediate level of goverment raises taxes and receives transfers from the central government and successively assignes those resources to local goverments by assuming in this way a prominent role in the funding system of Municipalities (see Blöchlinger H. and King D. (2006)). As a consequence in those federal countries the intermediate level of government provides the overwhelming part of grants to local governments according to rules that are parly established at the regional level. A more active role of Regions in local goverment financing is at least partially recognized by the law recently passed by the Italian parliament providing for the reform of the financing system of sub-national levels of goverment.

Along this perspective, one can model on the theoretical ground the way in which the regional government proposes how to share revenues among municipalities. In this case, the sharing rule must be approved by the majority of the regional municipalities. This would allow us to study the conditions under which a coalition compounded of the majority of municipal representatives is stable and the resulting policy implications.

The analysis can also be extended to investigate the reasons why the mechanism of horizontal negotiation can fail or lead to inefficient allocation of resources. The sharing mechanism, for instance, can fail because there are high transaction costs, free-riding incentives and asymmetric information.

Furthermore, municipal representatives may be interested in the total amount of "money" they receive rather then in the total utility produced by the mix of local public goods they provide. A reason may be because they extract private rent from public money. When rent sicking becomes a problem for the efficiency of the sharing system, the imposition of centralized destination constraints may increase social welfare. In this case, the destination constraints prevent local representatives from investing all the money in the provision of public goods that give them larger rents.

Rent seeking may also be prevented by imposing to the municipalities a joint-participation to the financ ing of local expenditure. The joint-participation should be increasing in the amount of centralized transfers to local governments.

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