Voluntary Matching Grants Can Forestall Social Dumping

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Abstract

The European economic integration leads to increasing mobility of factors, thereby threatening the stability of social transfer programs. This paper investigates the possibility to achieve by means of voluntary matching grants both the optimal allocation of factors and the optimal level of redistribution in the presence of factor mobility. We use a fiscal competition model a la Wildasin (1991) in which states differ in their technologies and preferences for redistribution. We first investigate a simple process in which the regulatory authority progressively raises the matching grants to the district choosing the lowest transfer and all districts respond optimally to the resulting change in transfers all around. This process is shown to increase total production and the level of reditribution. However it does not guarantee that all districts gain, nor that an efficient level of redistribution is attained. Assuming complete information among districts, we first derive the willingness of each district to match the contribution of other districts and we show that the aggregate willingness to pay for matching rates converges to zero when both the efficient level of redistribution and the efficient allocation of factors are achieved. We then describe the ajustment process for the matching rates that will lead districts to the efficient outcome and guarantee that everyone will gain.
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1 Introduction

The problem we address in this paper is the income protection of workers in a market that is increasingly integrated. In Europe, wage subsidies have been advocated for low-skilled workers and partly implemented in some countries (France, Belgium, the Netherlands) in the form of reduced rates of employers' contributions to social security at low wages. The additional employment due to the wage subsidies in France is estimated by Crépon and Deplatz (2002) at 470.000 persons; that is about 3% of total employment in the private sector.

With the recent enlargement of the European Union, we need to address the income protection of workers in a context where there is no legal barriers to migration so that a migration externality is at work. According to Hans-Werner Sinn (1990): "Any country that tries to establish an insurance state would be driven to bankruptcy because it would face emigration of the lucky who are suppose to give and immigration of the unlucky who are supposed to receive."

This prediction of a "race to the bottom" is too extreme; it rests on limited theoretical and empircial support. This is probably due to the presence of significant costs and barriers to migration. (Welfare shopping has been discouraged in Europe by limiting portability across member states and subjecting, for eligibility, to previous employment in the country). However we believe that underprovision of income protection in an integrated labour market is an issue that cannot be ignored in the EU. Even if it has not been a pressing issue to date, fiscal competition for capital and labour factors is already there. And with the enlargement, this issue will become more pressing, as extensively discussed in Wildasin (2004).

The objective of this paper is to clarify the role of the EU in the provision of income protection to workers in the context of market integration. Our proposal is EU co-financing of national transfers to workers through a system of matching grants, with special attention to implementation.[1]The key questions are: could a programme of matching grants, possibly at differentiated rates, be adopted unanimously? Could it be so defined that all member states gain regardless of their differences? Could it be implemented

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paper is an extension of earlier versions presented at the TAPES conference of the NBER and CESIfo on "fiscal federalism" held in Munich (20-22 May 2004). Thanks are due to our two discussants there Alex Plekhanov and Jacob L. Vigdor. We also thank seminar participants at Bern, Bonn, Cologne, and Toulouse for their comments and suggestions.

[1]This proposal was first developed by Jacques H. Drèze (2002) in a Tinbergen Lecture.

voluntarily by member states (henceforth "districts") instead of being imposed by a perfectly informed and powerful central planner as suggested in the existing literature (see Wildasin , 1991).

The motivation is enhanced efficiency rather than redistribution across districts.The existing literature does not quite answer these questions: it only provides an existence result for efficient matching rates, assuming (implicitely) that the net gains could be redistributed in a lump sum fashion so that everyone benefits, and that there exists a regulator with all the relevant information to implement the efficient solution.The more interesting question is whether the efficient policy could emerge from a negociation process which simultaneously guarantees that an efficient outcome is reached and that every member state gains.

To clarify the issues, we start with a simple model proposed by Wildasin (1991) in his paper "Income Redistribution in a Common Labour Market". That model does not predict a race to the bottom but only too little redistribution to the workers and inefficient allocation of workers across districts. Also, Wildasin (1991) shows that when labor is mobile and each district seeks to redistribute income to workers through transfers it is possible to achieve the efficient allocation of labour and at the same time the optimal level of redistribution by means of differentiated matching grants. Districts with lower preference for redistribution should get higher matching grants to equate transfer levels and achieve the efficient allocation of labour.

The main problem with this analysis is that local preferences for redistribution are not observable to the federal authority; even worse, the federal authority required to operate these matching grants may not exist or have the power to impose them to local authorities. In fact if such discretionary power existed, the federal authority possessing all the relevant information could directly implement the optimal solution by imposing a uniform transfer in all districts. But this solution is hardly feasible in the European context where redistribution policies are a competence of the states. The purpose of this paper is to investigate the possibility of *voluntary* matching grants among districts based on reciprocal matching; more precisely, we investigate whether there exists some adjustment process based on each state's decisions that can bring about the optimal matching rates.[2]

It should be emphasized that our solution requires the participants to be informed about the technology and tastes of the other participants. This is because voluntary matching of the other participants' contributions requires

[2] Another interesting approach that does not require the existence of a strong central authority is the immigration controls as suggested in Wilson (2006).

to know how they would respond to such matching. This is, of course, more restrictive than one would like. Therefore as a complement to this process, we propose another process that does not require complete information to implement the optimal matching rates. The central idea is that the regulatory authority can correct inefficient Nash equilibrium by raising the matching rate of the district choosing the lowest transfer. This will induce all other states to adjust their tansfer levels. These adjustments all around will increase total production and the level of redistribution. This process is budget-balanced but it does not guarantee that every district will gain, nor that an efficient level of redistribution is attained.

We use the same model as Wildasin (1991) modulo the fact that districts take into account that they will have to pay their share of the additional cost of matching grants. In Wildasin, the presumption is that there are enough districts for each to ignore the effects of its policy on their contribution to the financing of matching grants. We develop our analysis in a general set up of heterogenous districts that differ both with respect to their preferences and to their technologies.[3]

The paper is organized as follows. Section 2 presents the framework. Pareto optimal allocations for this economy are characterized in Section 3. Section 4 proposes a simple process implementing efficient matching grants without assuming complete information among districts. Section 5 studies the willingness of districts to match contributions of other districts under complete information. Section 6 uses these findings to investigate a progressive adjustment process of matching rates so as to converge to the efficient solution, with the property that every state is made better-off along the way. Section 7 concludes.

2 The framework

A federation is composed of $k \geq 2$ districts indexed by i. In each district there is a large group of immobile residents; there are also l_i workers that are mobile. Let L denote the the total number of workers in the economy. Thus

$$\sum_i l_i = L. \tag{1}$$

[3]The problem we address is related to, but more general than, the voluntary matching models of Guttman (1978) or Varian (1994) who deal with pure public goods. They propose a simple multistage mechanism and use the refinement of subgame perfection à la Moore-Repullo to implement an efficient outcome.

Each district produces a private consumption good with a specific ricardian technology $f_i(l_i)$, which is increasing and concave ($f_i'(l_i) > 0$ and $f_i''(l_i) < 0$). Workers are paid their marginal product: wage in district i is $w_i(l_i) = f_i'(l_i)$ which is decreasing with the number of workers in that district: ($w_i'(l_i) = f_i''(l_i) < 0$).

The per capita transfer that accrues to the workers in district i is denoted z_i. The total income of a worker in district i is thus $w(l_i) + z_i$.[4] Workers can migrate costlessly from one district to another, hence necessarily for any vector of transfers $\mathbf{z} = (z_1, ..., z_i, ..., z_k)$:

$$w(l_i) + z_i = w(l_j) + z_j \equiv c(\mathbf{z}) \quad \forall j, i. \tag{2}$$

This generates an allocation of labor $\mathbf{l}(\mathbf{z}) = (l_1, ..., l_i, ..., l_k)$ across districts and a uniform income for the workers $c = c(\mathbf{z})$. The labour demand function in district i is $l_i(w_i) = l_i(c - z_i)$ with $l_i'(c - z_i) = f_i''(l_i)^{-1} < 0$. From Wildasin (1991) :

$$\frac{dc}{dz_i} = \frac{l_i'}{\sum_j l_j'} \equiv \sigma_i \in (0, 1); \tag{3}$$

and the general-equilibrium effect of a change in the transfer level z_i on the allocation of labour across districts is

$$\frac{dl_i}{dz_i} = -(1 - \sigma_i) l_i' > 0 \tag{4}$$

$$\frac{dl_j}{dz_i} = \sigma_i l_j' < 0. \tag{5}$$

Each district i receives the matching grants $s_i z_i l_i$ from the federation (with $0 \leq s_i \leq 1$) and contributes $\varphi_i \sum_j s_j z_j l_j$ to balance the federal budget, (with $0 \leq \varphi_i \leq 1$ and $\sum_i \varphi_i = 1$). Both subsidy rates s_i and contribution rates φ_i are common knowledge. The districts represented by their immobile residents member capture the return to the fixed factors of production. Hence the net income of the immobile residents in district i is

[4] Alex Plekhanov pointed out that if the firms were paying the transfer, they would equal marginal product of labor to the wage plus the transfer, $f_i'(l_i) = w_i + z_i$. This alternative modelling is not interesting for our purpose since there will be no migration externality associated with such transfers.

$$y_i = f_i(l_i) - f_i'(l_i)l_i - (1-s_i)z_il_i - \varphi_i \sum_j s_jz_jl_j$$
$$= f_i(l_i) - f_i'(l_i)l_i - (1-(1-\varphi_i)s_i)z_il_i - \varphi_i \sum_{j\neq i} s_jz_jl_j. \quad (6)$$

The social welfare in each district i is an increasing function of the income of its immobile residents and the income of its mobile workers,

$$W^i(y_i, c) = y_i + U^i(c). \quad (7)$$

It is assumed to be quasi-linear with partial derivatives $U^i_{cc} < 0 < U^i_c$. Thus, $U^i_c \geq 0$ denotes district i's marginal willingness to redistribute income to workers.[5] Note that the objective function is independent of the number of residents of either type;with free migration, l_i is endogeneous to the policy choices.[6]

Districts choose their transfer level taking as given the transfer levels of other districts so as to attain a Nash equilibrium such that for each district i

$$\frac{dW^i}{dz_i} = (U^i_c - l_i)\sigma_i + (1-\varphi_i)s_il_i + (1-(1-\varphi_i)s_i)(1-\sigma_i)z_il_i' - \varphi_i \sum_{j\neq i} s_jz_j\frac{dl_j}{dz_i} = 0 \quad (8)$$

[5]With a large number of immobile residents $y_i = \sum_h y_i^h$ and $dy_i = \sum_h dy_i^h$. If $u^h(y_i^h)$ then $u^h(y_i^h + dy_i^h) - u^h(y_i^h) \simeq \frac{\partial u^h}{\partial y_i^h}\left(dy_i^h - \frac{\left(dy_i^h\right)^2}{y_i^h}R_R^h\right)$,where R_R^h is a coefficient of relative risk aversion. The quasi-linearity assumption amounts to ignoring the second-order terms proportional to $\left(dy_i^h\right)^2/y_i^h$.

[6]This assumption of exogenous social welfare is again more restrictive than what one would like. However allowing for a welfare function that depends on the relative number of each group would make the analysis of the Nash equilibrium much more complex. Roberts (1999) provides a first step in this direction by examining the process and outcomes of majority voting over public good in a club whose preferences and policy choices relate to its membership; and in turn its policy choices determine its membership. See also Drèze and Greenberg (1980) for a cooperative game approach where players's preferences are directly related to the composition of the coalition to which they belong (i.e; hedonic coalition). They showed that efficiency requires transfers across coalitions and stability requires penalties for leaving a coalition. It is also fair to say that there is no agreement in social choice theory about how to make social welfare evaluation with variable population. In particular using the utilitarian criterion with a variable population leads to the so-called "repugnent" solution of an infinitely large population with infinitely low per capita utility.

where σ_i is the change in the net income of the workers c resulting from an increasin in z_i, and $-(1-\sigma_i)l_i'$ is the change in the number of workers resulting from this increase in z_i.

3 Pareto optimality with lump-sum taxes

In this model any Pareto optimal allocation solves

$$\max_{l_i,y_i,c} \Lambda = \sum_i \lambda_i \left(y_i + U^i(c)\right) + \mu \left[\sum_i y_i + c\sum_i l_i - \sum_i f_i(l_i)\right] + \upsilon \left[\sum_i l_i - L\right]. \tag{9}$$

where $\lambda = (\lambda_1, ..., \lambda_i, ..., \lambda_k)$ is an arbitrary weighting system with $\lambda_i > 0$ and $\sum_i \lambda_i = 1$. The necessary first-order conditions are,

$$\frac{\partial \Lambda}{\partial l_i} = \mu(c - f_i'(l_i)) + \upsilon = 0$$

$$\frac{\partial \Lambda}{\partial y_i} = \lambda_i + \mu = 0$$

$$\frac{\partial \Lambda}{\partial c} = \sum_i \lambda_i U_c^i + \mu \sum_i l_i = 0 = \mu \sum_i \left(U_c^i - l_i\right).$$

The condition $f_i'(l_i) = c + \frac{\upsilon}{\mu}$ is the productive efficiency condition (equalization of the marginal productivities of labour across districts). The condition $\sum_i \left(U_c^i - l_i\right) = 0$ may be interpreted as the Bowen-Lindahl-Samuelson condition for the efficient level of redistribution c which is akin to a public good. $\sum_i \left(U_c^i - l_i\right) > 0$ means *underprovision* and conversely.[7] Given λ^*, the pareto optimal solution is denoted l_i^*, y_i^*, c^*.

Wildasin (1991) shows that without matching grants, the Nash equilibrium among districts will not be efficient due to the migration externality. Anticipating correctly the migration flows and taking the transfer levels of other districts as given, each district acting independently settles for a level of redistribution that is too low (as expected from voluntary contributions

[7] Note that the Bowen-Lindahl-Samuelson condition does not preclude contributions to differ from willingness-to-pay for some individuals $\frac{W_2^i}{W_1^i} - l_i \lesseqgtr 0$ provided that on average the differences cancel out.

to a public good); also, wages are not equalised across districts resulting in inefficient allocation of labour. Wildasin (1991) proposes a solution involving the intervention of a central regulator who can impose Pigovian corrections in the form of matching grants. This existence result leaves open the question of implementation. In particular how could such differentiated matching grants be designed , when the regulator does not have access to all the relevant information about technology and preferences required to implement the efficient outcome.

In Section 4, we investigate a simple budget-balanced process that will implement the efficient allocation even if the agents involved do not know the relevant information about all other agents. This process only requires the regulatory authority to observe the transfer levels.

4 Implementing Matching grants

.The federal government is controlling the matching rates and each district i is adjusting optimally its own z_i to any change in its own matching rate s_i and in the common income of the workers c. With quasi-linearity of welfare functions, there are no income effects on the first order conditions ($dW^i_{z_i}/dy_i = 0$). Production functions are approximated quadratically so that σ_i and l'_i are treated as constants.

The process rests on a very simple intuition: observing a Nash equilibrium with an inefficient allocation of labor and an inefficient level of redistribution, efforts need to be made to reduce the dispersion of the transfers while at the same time increasing (decreasing) the level of redistribution. For a desired increase (which holds for sufficiently low matching rates), this is possible by raising the matching rate to the district choosing the lowest transfer. More precisely, let current equilibrium choices be such that $z_i < z_j < ...$, all j; assuming too little redistribution ($\sum_i \left(U^i_c - l_i\right) > 0$), set $ds_i > 0$, $ds_j = 0\ \forall j \neq i$ (the same reasoning applies under reversed signs). This change ds_i will induce district i to adjust its own transfer by $dz_i \neq 0$ to remain on its first-order condition. This leads to an effect $dc = \frac{dc}{dz_i} dz_i$ on c and to migration $dl_j = \frac{dl_j}{dc}$, $\forall j \neq i$. Then all districts will respond optimally to the resulting change in level of redistribution by $dz_j/dc \neq 0$. Each district j will have to pay its share φ_j of the additional cost of the higher s_i and the changes of z_k's all around. So the process is budget-balanced. From (8) the first-order conditions are

$$F_i = (U^i_c - l_i)\sigma_i + (1-\varphi_i)s_i l_i + (1-(1-\varphi_i)s_i)(1-\sigma_i)z_i l'_i - \varphi_i \sum_{j\neq i} s_j z_j \frac{dl_j}{dz_i} = 0$$

so that

$$\begin{aligned}
\frac{\partial F_i}{\partial c} &= \sigma_i U^i_{cc} < 0 \\
\frac{\partial F_i}{\partial z_i} &= (1-(1-\varphi_i)s_i)(1-\sigma_i)l_i' < 0 \\
\frac{\partial F_i}{\partial s_i} &= (1-\varphi_i)\left(l_i-(1-\sigma_i)z_i l_i'\right) > 0 \\
\frac{\partial F_i}{\partial l_i} &= (1-\varphi_i)s_i-\sigma_i
\end{aligned}$$

Therefore

$$\begin{aligned}
\left.\frac{dz_i}{ds_i}\right|_{z_j} &= \frac{-\frac{\partial F_i}{\partial s_i}}{\left[\frac{\partial F_i}{\partial z_i}+\frac{\partial F_i}{\partial l_i}\frac{dl_i}{dz_i}+\frac{\partial F_i}{\partial c}\frac{dc}{dz_i}\right]} \\
&= \frac{(1-\varphi_i)\left(l_i-(1-\sigma_i)z_i l_i'\right)}{\sigma_i^2\left|U^i_{cc}\right|+|l_i'|\left[(1-(1-\varphi_i)s_i)^2-(\sigma_i-(1-\varphi_i)s_i)^2\right]} > 0 \qquad (10)
\end{aligned}$$

$$\begin{aligned}
\left.\frac{dz_i}{dc}\right|_{z_j} &= \frac{-\left[\frac{\partial F_i}{\partial c}+\frac{\partial F_i}{\partial l_i}\left.\frac{dl_i}{dc}\right|_{z_i}\right]}{\frac{\partial F_i}{\partial z_i}+\frac{\partial F_i}{\partial l_i}\left.\frac{dl_i}{dz_i}\right|_{c}} \\
&= -\frac{\sigma_i\left|U^i_{cc}\right|+((1-\varphi_i)s_i-\sigma_i)\,|l_i'|}{\left[1-(1-\varphi_i)s_i(2-\sigma_i)\right]|l_i'|} < 0 \ \text{ for } \sigma_i < (1-\varphi_i)s_i < \frac{1}{2} \qquad (11)
\end{aligned}$$

This condition is not unreasonable since $\sigma_i < (1-\varphi_i)s_i$ holds with many districts and $(1-\varphi_i)s_i < \frac{1}{2}$ holds when starting from sufficiently low matching rates. All other districts will respond to the change in c. Therefore given the initial $ds_i > 0$, there obtain $\frac{dz_i}{ds_i}ds_i > 0$, $\left.\frac{dc}{ds_i}\right|_{z_j} = \sigma_i\frac{dz_i}{ds_i}ds_i$ and

$$\begin{aligned}
dc &= \sigma_i\frac{dz_i}{ds_i}ds_i+\sum_j \sigma_j\frac{dz_j}{dc}dc \\
&= \frac{\sigma_i\frac{dz_i}{ds_i}ds_i}{1-\sum_j\sigma_j\frac{dz_j}{dc}} > 0
\end{aligned}$$

with $dz_j = \frac{dz_j}{dc}dc < 0$. To evaluate the welfare effect of this change ds_i, define "total welfare" as[8]

$$\Lambda = \sum_k U^k(c) + \sum_k f_k(l_k) - cL$$

$$d\Lambda = \sum_k \left(U_c^k - l_k\right) dc + \sum_k \left(f_k'(l_k) - c\right) dl_k$$

In this expresssion, the term $\sum_k cdl_k$ cancels out since $\sum_k dl_k = 0$. So

$$d\Lambda = \sum_k \left(U_c^k - l_k\right) dc + \sum_k f_k' dl_k \tag{12}$$

where

$$\begin{aligned}\sum_k f_k' dl_k &= \sum_{k\neq i} f_k' dl_k + f_i' dl_i\ , \\ &= \sum_{k\neq i} f_k' dl_k + f_i' \left(-\sum_{k\neq i} dl_k\right)\ , \\ &= \sum_{k\neq i} \left(f_k' - f_i'\right) dl_k\ . \end{aligned} \tag{13}$$

For all $k \neq i$, $dw_k = dc - dz_k > 0$, implying $dl_k < 0$. Also, because $z_i < z_k\ \forall k \neq i$ one can deduce from the equilibrium migration condition that

$$f_k' - f_i' = z_i - z_k < 0\ .$$

Therefore from (13)

$$\sum_{k\neq i} f_k' dl_k > 0.$$

which together with $\sum_k \left(U_c^k - l_k\right) dc > 0$, establishes from (12) that $d\Lambda > 0$. Thus there has been a progress towards pareto-efficiency.

We can repeat the process by selecting again the district with the lowest transfer and raising its matching rate. The previous analysis indicates that it will induce higher c and better allocation of labour causing a "total welfare"

[8] This definition relies on $\lambda_i = \lambda_j\ \forall i, j$ in (9), thus an increase in "total welfare" implies progress towards Pareto-efficiency.

gain. The process will stop when $z_i \simeq z_j$, $\forall i, j$, which is the productive efficiency condition. Therefore we have demonstrated the following result.

Proposition 1. *Starting from an equilibrium with too little redistribution and inefficient allocation of labour, consider the mechanism that, at each point in time, increases the matching rate to the district choosing the lowest transfer. When all other districts respond optimally, the total production, the level of redistribution and total welfare are increasing over time. Hence, every limit point of the process yields production efficiency but not necessarily the efficient level of redistribution.*

That is our mechanism achieves an efficient allocation of labour across districts but not necessarily the efficient level of redistribution. Moreover, there is no guarantee that all districts gain along the process. Therefore we now look for a mechanism which yields aPareto-efficient level of redistribution and along which all districts gain, thus making the mechanism acceptable to every agent. The mechanism is based on *voluntary* matching grants across agents. In this approach agents set simultaneously their own transfer levels and the rate at which they will match other agents' transfers. In contrast to the above mechanism we assume complete information among agents.

5 Voluntary Matching grants

To investigate the voluntary provision of matching grants, we start by deriving the willingness-to-pay π_{ij} of district i for a matching rate s_j to district j. District i understands that: (i) district j will benefit from a higher s_j on the transfers z_j it pays to its workers and will accordingly be induced to increase its own z_j; (ii) the other districts $k \neq j$ (including district i) may do the same and to different extent (under asymmetry); and (iii) district i will have to pay its share of the additional cost of the matching grants resulting from the higher s_j and the higher z_k's all around.

$$
\begin{aligned}
\frac{dW^i}{ds_j} &= \frac{\partial W^i}{\partial s_j} + \sum_k \frac{\partial W^i}{\partial z_k}\frac{dz_k}{ds_j} \\
&= \left.\frac{\partial y_i}{\partial s_j}\right|_z + \sum_k \left(\frac{\partial y_i}{\partial z_k} + U_c^i \frac{\partial c}{\partial z_k}\right)\frac{dz_k}{ds_j}
\end{aligned}
$$

where $\left.\frac{\partial y_i}{\partial s_j}\right|_z = (\jmath_{i=j} - \varphi_i) z_j l_j$ with $\jmath_{i=j} = 1$ if $i = j$ and $\jmath_{i=j} = 0$ otherwise. Therefore, using $\partial c / \partial z_k = \sigma_k$

$$
\begin{aligned}
\pi_{ij} &= \frac{dW^i}{ds_j} \\
&= (\jmath_{i=j} - \varphi_i) z_j l_j + U_c^i \sum_k \sigma_k \frac{dz_k}{ds_j} + \sum_k \frac{\partial y_i}{\partial z_k} \frac{dz_k}{ds_j}. \qquad (14)
\end{aligned}
$$

This expression denotes the willingness of district i to pay for s_j taking into account the impact of s_j on district i's contribution $\varphi_i \sum_k s_k z_k l_k$. Adding up (14) over all districts the aggregate willingness-to-pay for s_j gives

$$
\begin{aligned}
\pi_j &= \sum_i \pi_{ij} \\
&= \left(\sum_i \jmath_{i=j} - \sum_i \varphi_i \right) z_j l_j + \sum_i \frac{W_2^i}{W_1^i} \sum_k \sigma_k \frac{dz_k}{ds_j} + \sum_i \sum_k \frac{\partial y_i}{\partial z_k} \frac{dz_k}{ds_j} \\
&= \sum_i U_c^i \sum_k \sigma_k \frac{dz_k}{ds_j} + \sum_i \underbrace{\frac{\partial y_i}{\partial z_i} \frac{dz_i}{ds_j}}_{\text{own effect}} + \sum_i \sum_{k \neq i} \underbrace{\frac{\partial y_i}{\partial z_k} \frac{dz_k}{ds_j}}_{\text{cross effect}} \qquad (15)
\end{aligned}
$$

where the third equality follows from the fact that $\sum_i \jmath_{i=j} = \sum_i \varphi_i = 1$.

- The decomposition of the cross effect in (15) gives for $i \neq k$

$$
\begin{aligned}
M_{ik} &\equiv \frac{\partial y_i}{\partial z_k} = \left. \frac{\partial y^i}{\partial z_k} \right|_l + \left. \frac{\partial y^i}{\partial l_i} \right|_z \frac{dl_i}{dz_k} + \sum_{h \neq i} \left. \frac{\partial y^i}{\partial l_h} \right|_z \frac{dl_h}{dz_k} \\
&= -\varphi_i s_k l_k + \left[-f_i^{''} l_i - (1 - s_i(1 - \varphi_i)) z_i \right] \sigma_k l_i^{'} \\
&\quad + \sum_{h \neq i; h \neq k} (-\varphi_i s_h z_h) \sigma_k l_h^{'} + \varphi_i s_k z_k (1 - \sigma_k) l_k^{'} \\
&= -\varphi_i s_k l_k - \sigma_k l_i - (1 - s_i) z_i l_i^{'} \sigma_k - \varphi_i \sigma_k \sum_h s_h z_h l_h^{'} + \varphi_i s_k z_k l_k^{'} \qquad (16)
\end{aligned}
$$

where the second equality follows from (4)-(5) and we have used the fact that $l_i^{'}(c - z_i) = f_i^{''}(l_i)^{-1}$in the last equation.

- The decomposition of the own effect in (15) yields for $i = k$,

$$
\frac{\partial y_k}{\partial z_k} = M_{kk} + s_k l_k + (1 - s_k) z_k l_k^{'}. \qquad (17)
$$

Therefore combining (16) and (17) gives the aggregate effect,

$$\begin{aligned}
\sum_i \sum_k \frac{\partial y_i}{\partial z_k}\frac{dz_k}{ds_j} &= \sum_i \sum_k M_{ik}\frac{dz_k}{ds_j} + \sum_k \left(s_k l_k + (1-s_k) z_k l_k^{'}\right)\frac{dz_k}{ds_j} \\
&= -\sum_k s_k (l_k - z_k l_k^{'})\frac{dz_k}{ds_j} - \sum_i \left(l_i + (1-s_i) z_i l_i^{'}\right)\sum_k \sigma_k \frac{dz_k}{ds_j} \\
&\quad -\sum_h s_h z_h l_h^{'} \sum_k \sigma_k \frac{dz_k}{ds_j} + \sum_k \left(s_k l_k + (1-s_k) z_k l_k^{'}\right)\frac{dz_k}{ds_j} \\
&= -\sum_i l_i \sum_k \sigma_k \frac{dz_k}{ds_j} + \sum_k z_k l_k^{'}\left(\frac{dz_k}{ds_j} - \sum_h \sigma_h \frac{dz_h}{ds_j}\right). \quad (18)
\end{aligned}$$

Substituting (18) into (15) yields

$$\pi_j = \sum_i \left(\frac{W_2^i}{W_1^i} - l_i\right)\sum_k \sigma_k \frac{dz_k}{ds_j} + \sum_k z_k l_k^{'}\left[\frac{dz_k}{ds_j} - \sum_h \sigma_h \frac{dz_h}{ds_j}\right]. \quad (19)$$

The second term in (19) is the covariance across districts between $z_k l_k'$ and dz_k/ds_j. Using $\sigma_k = l_k^{'}/\sum_h l_h^{'}$, this covariance can be written

$$\begin{aligned}
cov(zl', \frac{dz}{ds_j}) &\equiv \sum_k z_k l_k^{'}\left[\frac{dz_k}{ds_j} - \sum_h \sigma_h \frac{dz_h}{ds_j}\right] \\
&= \sum_k z_k \left[\sigma_k \frac{dz_k}{ds_j} - \sigma_k \sum_h \sigma_h \frac{dz_h}{ds_j}\right]\sum_h l_h^{'} \\
&= \sum_k z_k \left[\Delta_{kj}\right]\sum_h l_h^{'},
\end{aligned}$$

where $\sum_k \Delta_{kj} = 0$ for all j. Letting $\overline{z} = \sum_h \sigma_h z_h$ and rearranging we have

$$\begin{aligned}
cov(zl', \frac{dz}{ds_j}) &= \sum_h l_h^{'} \sum_k (z_k - \overline{z})\sigma_k \left[\frac{dz_k}{ds_j} - \sum_h \sigma_h \frac{dz_h}{ds_j}\right] \\
&= \sum_h l_h^{'} \sum_k (z_k - \overline{z})\sigma_k \frac{dz_k}{ds_j}, \quad (20)
\end{aligned}$$

where the second equality follows from $\sum_k (z_k - \overline{z})\sigma_k = 0$. Substituting (20) into (19) and using again $\sigma_k = l_k^{'}/\sum_h l_h^{'}$,

$$\pi_j = \underbrace{\sum_i \left(U_c^i - l_i\right) \sum_k \sigma_k \frac{dz_k}{ds_j}}_{\text{public good efficiency}} + \underbrace{(\overline{z} - z_j) \left|l_j'\right| \frac{dz_j}{ds_j} + \sum_{k \neq j} (\overline{z} - z_k) \left|l_k'\right| \frac{dz_k}{ds_j}}_{\text{production efficiency}} . \tag{21}$$

Therefore, the total willingness to pay (net of the cost) for the matching rate s_j corresponds to the two efficiency considerations. The public good efficiency term is positive if a higher matching rate to district j can bring public good provision closer to its optimal level. Indeed since $\sum_k \sigma_k \frac{dz_k}{ds_j} = dc/ds_j$, this term is positive in the case of underprovision when $dc/ds_j > 0$ and in the case of overprovision when $dc/ds_j < 0$. The productive efficiency term is positive if subsidizing more district j can induce a more efficient allocation of labour. The first component is the own-productivity effect of s_j and the second one is the cross-productivity effect of s_j. The own productivity effect is positive if $(\overline{z} - z_j)\frac{dz_j}{ds_j} > 0$ so that a higher s_j induces district j to set z_j closer to the mean, implying less distortion in the allocation of labour. In addition, a higher s_j also induces a change in the choice of z_k by all other districts $k \neq j$ with an overall reduction of the distortion in the allocation of labour if on average it reduces the spread of z_k so that $\sum_{k \neq j}(\overline{z} - z_k)\left|l_k'\right| \frac{dz_k}{ds_j} > 0$. To sum up,

Proposition 2: *(a) Under productive efficiency (i.e., $z_k = \overline{z}$ $\forall k$) and $\sum_k \sigma_k \frac{dz_k}{ds_j} > 0$, the aggregate willingness-to-pay for s_j is positive if and only if there is inefficiently low level of redistribution. (b) Under efficient level of redistribution, the aggregate willingness-to-pay for s_j is positive if it produces a more efficient allocation of labour (i.e., reallocating labour from over-employment district k where $z_k > \overline{z}$ to under-employment district h where $z_h < \overline{z}$).*

This proposition suggests the possibility of reaching the efficient level of redistribution and the efficient allocation of labour through some adjustment process based upon voluntary contributions. In Section 6 we will explore an extension of the so-called MDP adjustment process for pure public goods.[9]

[9] This procedure has been proposed independently by Malinvaud (1972) and Drèze and De la Vallee Poussin (1971).

6 Adjustment process

To achieve productive efficiency, matching rates s_j must be differentiated to induce districts to choose uniform transfer level. To insure that every district gains, one must introduce k possibly different cost shares φ_j in the funding of the programme. So there are altogether $2k$ decision variables to be selected so as to satisfy three conditions:

(i) productive efficiency: calling for identical wages and transfers across districts;

(ii) efficient level of redistribution as required by the Bowen-Lindahl-Samuelson condition;

(iii) individual rationality: such that every district benefits from the programme.

In principle there are enough decision variables to satisfy the three conditions simultaneously through some adjustment process based on voluntary contributions. There is a natural adjustment process for the matching rates and cost shares that will lead agents to the efficient outcome.

Suppose at each point in time districts announce their marginal willingness to pay for matching rates and the procedure that begins at time $t = 0$ (with $s_j(0) = 0\ \forall j$) revises the matching rates and private consumption of each district according to the following system of differential equations:[10]

$$\begin{cases} \dot{s_j} = \pi_j = \sum_i \pi_{ij} & \text{for all } j \\ \dot{y_i} = -\sum_j \pi_{ij}\ \dot{s_j} + \delta_i \left[\sum_j \pi_j\ \dot{s_j}\right] & \text{for all } i. \end{cases}$$

That is, at each point in time: (i) the matching rate to each district j is adjusted by an amount equal to the aggregate willingness to pay for this matching rate; and (ii) each district i pays for this adjustment in matching rates an amount equal to its own willingness to pay and receives a share $\delta_i > 0$ (with $\sum_i \delta_i = 1$) of the total surplus resulting from the adjustement in matching rates, $\sum_j \pi_j\ \dot{s_j} = \sum_j \pi_j^2 > 0$. This procedure has several desirable properties under truthful revelation of the π_{ij}'s. First, it is making every district better off at each point in time.[11] Indeed letting $V^i(y_i, \mathbf{s})$ denote the (quasi-linear indirect) utility function of each district i as a function of its net income and of the matching rates,

[10] The adjustments in net incomes $\dot{y_i}$ can be obtained through adjustments in the cost shares.

[11] The restriction to a quasi-linear objective function is needed to prevent the (Nash) equilibrium choice of z_i to be affected by the redistribution of the surplus resulting from the adjustment process. With quasi-linearity we have $\partial z_i / \partial y^i = 0$ which implies non-distortionary redistribution of the surplus.

$$\begin{aligned}\frac{dV^i}{dt}(y^i, \mathbf{s}) &= \dot{y_i} + \sum_j \pi_{ij}\ \dot{s_j} \\ &= \delta_i \sum_j \pi_j\ \dot{s_j} \\ &= \delta_i \sum_j \pi_j^2 > 0 \quad \text{for } \delta_i > 0.\end{aligned}$$

Second, every limit point of the process is a Pareto optimum, since then $\dot{s_j} = \pi_j = 0$ for all j. The monotonicity of the utilities implies the (weak) convergence of the process; taking the sum of utilities as the Lyapunov function,

$$L(t) = \sum_i V^i(t)$$

which is monotonically increasing with derivative equal to zero only at a stationary point. The strict concavity of V^i implies the global convergence of the process to a unique stationary point.Therefore we have proven the following result.

Proposition 3. *Under complete information of the districts and truthful revelation, consider the process that, at each point in time, increases the matching rate to each district by an amount equal to the aggregate willingness to pay for this matching rate and adjusts the cost shares so that each district pays for this adjusmtent in matching rates an amount equal to its own willingness to pay while receiving a share of the total surplus produced. This process is making every district better off at each point in time. The process converges to a stationary solution which is a Pareto optimum.*

This still leaves open a crucial question however. Why should the regions submit their true preferences and technologies? Might it not sometimes pay to misrepresent one's preference and technology? The answer is that it could. Indeed each district could gain from misrepresenting its willingness to pay so as to manipulate the adjusment process to his onw advantage (e.g. by claiming low tastes for redistribution to receive higher matching grants). This issue has been addressed in the litterature for a pure public good problem where agents announce their willingness to pay and the regulatory authority provides directly the public good. For instance, Drèze and De la Vallee Poussin (1971) have shown that truthful revelation at each point in time is a maximin strategy (i.e., the best response to the most unfavourable strategies of the other players). Revelation in dominant strategy is more problematic (See Laffont, 1988, chapter 5). The main result here is that truthful revelation is a dominant strategy at a stationary point (see Drèze and De la Vallée Poussin, 1971). Even if participants misrepresent their preference, Roberts (1979) has shown that the MDP process still generates Pareto optimal outcomes: the effect of preference manipulation is simply to slow down the adjusment process.

7 Conclusion

The European enlargment is the largest single expansion that the European Union has ever experienced, with ten countries and 73 million people joining the club. It is not just the largest EU expansion, but also the most diversifying; the gap in the living standards between existing EU nations and those that are joining is far wider than in previous enlargments. One of the great benefits of EU membership for citizens from the new countries is the right to live and work in the rest of the EU. Although East European economies have been growing rapidly in the past ten years, average wages are still only 12 percent of those of Britain. Granting immediate employment and full access to the welfare state could produce ample migration. Some economists have argued that open-border immigration policy is incompatible with a welfare state and will trigger a race to the bottom. Other pro-immigration economists argue that it will attract workers who are needed in key sectors and so will not be a burden on the public budget. For employers, mobility enables recruitment from a wider pool of workers and helps to alleviate regional skills shortages. It will attract skills and boost the economy.

In this context, we have examined a fiscal competition game in which the contribution by one state to support the income of its workers may affect other states through the induced migration. Due to this migration externality the Nash equilibrium is typically inefficient: there is too little redistribution to low-skilled workers due to the fear of immigration; and different districts will choose different redistributive policies so that wages are not equalised resulting in inefficient allocation of labour across the federation. To achieve the efficient allocation, each district must face the correct "price" for its choice. Wildasin (1991) proposes a solution involving differentiated matching grants. He shows that there exist levels of these matching grants inducing an efficient Nash equilibrium in spite of district differences in production possibilities and preferences for redistribution. The problem is how to determine the correct matching rates so that all districts would benefit:

the regulator may not have access to the information (about technology and preferences) needed to implement an efficient outcome.

Our purpose has been to design a decentralized process that will implement an efficient allocation, when each district possesses the relevant information about preferences and technology in the other districts. In addition to implementing efficient outcomes, the process should be acceptable to every agent. Our process is based on *voluntary* matching grants by the districts themselves. This is a process where districts choose their own transfers and announce the rates at which they will match the transfers in other districts. We have examined some adjusment process capable of producing an efficient solution. Under this process the matching rates are progressively adjusted based on what agents are willing to pay and costs are shared so that every district gains. We have also proposed a simpler mechanism more parcimonious in information in which the central authority increases matching rate of the district choosing the lowest transfer and all the districts simply adjust their own transfer to the new level of redistribution. We have shown that this process increases total production and the level of redistribution so that total welfare is increasing over time. However, in contrast to the above mechanism, all districts may not gain, and the process may stop before attaining the efficient level of redistribution.

References

[1] Bean, C., S. Bentolila, G. Bertola and J. Dolado, 1998, *Social Europe:One for all?* London:CEPR.

[2] Brown, C. and W. Oates, 1987, Assistance to the poor in a federal system, *Journal of Public Economics* 32(3), 307-330.

[3] Brueckner, J.K., 2000, Welfare Reform and the Race to the Bottom: Theory and Evidence, *Southern Economic Journal* 66(3), 505-525.

[4] Crépon, B. and R. Deplatz, 2002, Une nouvelle évaluations des effets des allégements de charges sociales sur les bas salaires, *Economie et Statistiques* 348.

[5] Costello, D., 1993, Intergovernmental grants: what role for the European Community?, *European Economy*, no 5.

[6] Drèze, J.H., and D. De la Vallee Poussin, 1971, A tatonnement process for public goods, *Review of Economic Studies*, 38, 133-50.

[7] Drèze, J.H., and J. Greenberg, 1980, Hedonic coalitions: optimality and stability, *Econometrica* 48, 4, 987-1003.

[8] Drèze, J.H., 2002, Economic and social security: the role of the EU, *De Economist* 150, 1-18.

[9] Figuières, C. and J. Hindriks, 2002, Matching grants and ricardian equivalence, *Journal of Urban Economics*,52, 177-91

[10] Figuières, C., J. Hindriks and G. Myles, 2004, Revenue sharing vs expenditure sharing in a federal system, *International Tax and Public Finance* 11, 155-74.

[11] Guttman, J. 1978, Understanding collective action: matching behavior, *American Economic Review (Papers and Proceedings)*, 68, 251-55.

[12] Hindriks, J., 1999, The consequences of labour mobility for redistribution:tax versus transfer competition, *Journal of Public Economics* 74, 215-34.

[13] Hindriks, J., and G.D. Myles, 2003, Strategic inter-regional transfers, *Journal of Public Economic Theory* 5, 229-48.

[14] Laffont, J.-J, 1988, Fondements de l'economie publique, (Coll. Economie et Statistiques avancees), Economica.

[15] Malinvaud, E., 1972, Prices for individual consumption, quantity indicators for collective consumption, *Review of Economic Studies*, 39, 385-405.

[16] Oates, W.E., 1972, *Fiscal federalism*, Harcourt Brace Jovanovich: New York.

[17] Pfingsten A. and A. Wagener, 1997, Centralized vs. Decentralized Redistribution: A case for Interregional Transfer Mechanisms, *International Tax and Public Finance* 4, 429-451.

[18] Roberts, J., 1979, Incentives in planning procedures for the provision of public goods, *Review of Economic Studies*, 46, 283-92.

[19] Roberts, K., 1999, Dynamic voting in clubs, LSE discussion paper No. TE/99/367.

[20] Sinn, H.-V., 1990, Tax harmonization and tax competition in Europe, *European Economic Review* 34, 489-504.

[21] Sinn, H.-V., 2003, *The New Systems Competition*, Yrjö Jahnsson Lectures, Blackwell Publishing: Oxford.

[22] Varian, H.R., 1994, A solution to the problem of externalities when agents are well-informed, *American Economic Review* 84, 1278-93.

[23] Wildasin, D.E., 1991, Income redistribution in a common labor market, *American Economic Review* 81, 757-74.

[24] Wildasin, D.E., 1988, Nash equilibria in models of fiscal competition, *Journal of Public Economics* 35, 229-240.

[25] Wildasin, D.E., 2000, Factor mobility and fiscal policy in the EU: policy issues and analytical approaches, *Economic Policy*, October, 339-78.

[26] Wilson, J.D., 2006, Protecting the welfare state from international migration, mimeo, Michigan State University.