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# Matching grants and Ricardian Equivalence

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**Abstract**

This paper investigates the effectiveness of matching grants to correct for interjurisdictional spillovers in the light of Bernheim general neutrality result. Indeed this result suggests that the usual argument that matching grants are needed to internalize the externality arising from the existence of interjuridictional spillovers is an artifact of the assumption that jurisdictions neglect the impact that their decisions have on the federal budget. Relaxing this assumption and using a classical model where the arbitrage resulting from labor mobility implies that redistribution has the properties of a public good, we find that matching grants are relevant although somewhat less effective. We also find that optimal matching rates are independent of the number of jurisdictions and their strategic variables contrarily to the case where jurisdictions ignore the impact of their decisions on the federal budget.
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# 1 Introduction

Redistributive programmes are the largest component of public expenditures in most industrialised countries.[1] With the ongoing process of integration and the simultaneous devolution of tax and spending responsibilities to lower level governments, many countries have become concerned about the sustainability of redistributive programmes. Increasing labour mobility makes redistribution more difficult as each state seeks to limit immigration of the poor and out-migration of the rich by setting low level of redistribution and taxation.[2]

The present paper stands at the intersection of two lines of research. In the fiscal federalism literature (as in [13]) and textbook treatment (as in [11]) one argument for intergovernmental transfers is to internalise the externality arising from the existence of interjurisdictional spillovers either through public good provision or labour mobility. To restore the Pareto-optimal outcome, a system of matching grants from the federal government to lower levels of governments is needed. It means that local states determine their expenditure levels and the federal government pays a fraction of the costs.[3]

However a different strand of literature on Ricardian equivalence as exemplified by [3] is very pessimistic about the capacity of a central government to correct that kind of externalities and in particular to restore the optimal provision of public good through tax-subsidy policies.[4] One critical assumption is whether agents take the central government tax-subsidy policy as parametric or not when optimising. Tax-subsidy are effective when

[1]For the European Community in 1998 the average GDP share of all transfer spending to individuals was 21.6 percent (see [2]). It is not always clear what is the overall redistributive effect of such spending.

[2]An excellent survey of the empirical studies of welfare migration is provided in [6]. See also [15] for a presentation of the redistribution and mobility issues in the European context.

[3]Evidence on the importance of intergovernmental transfers in some federal countries are provided in [7]. In the US, the federal government could bear 50-80 percent of the cost of the AFDC (Aid to Families with Dependent Children) expenditures undertaken by states. In 1996, the AFDC was replaced by a block grant programme (i.e., TANF), but the food stamp programme and the Medicaid programme continued under a matching system.

[4]The word *Ricardian Equivalence* was coined by Barro [1], who argued that debt and finance are equivalent because intergenerational transfers could be offset by private voluntary transfers. This argument was indeed already presented by Ricardo who also expressed scepticism about its empirical relevance.

agents select their policy to maximise their welfare, taking as given the policy of the central government. This implies that they ignore the requirement that the budget of the central government be balanced. The presumption is that there are enough agents for each to ignore the effects of its policy on the government budget. With many agents, like individual taxpayers, this is a reasonable assumption. However when there are few agents, like regional jurisdictions in a federal system, then it is less legitimate to assume that each has a negligible impact on government revenue. Then a simple inference from Bernheim's equivalence result suggests that tax-subsidy policy becomes ineffective. This result has been established formally by [4] in a fiscal federalism context of public good provision without mobility. They showed that matching grants are ineffective when jurisdictions *see through* the federal budget and take into account the impact of their decision on it.

In this paper we use the classic model of [13] to investigate the effect of the so-called see through assumption on the effectiveness of matching grants in the context of redistribution with mobility. Regional social welfare functions reflect some (unexplained) motive for redistribution. Redistribution is similar to a public good since when labour is mobile, by arbitrage all states will end up with the same equilibrium "welfare of the poor". A distinguishing feature of this framework is that redistribution interacts directly with the working of the labour market as it affects the allocation of factors across states, the economic rent and the amount of output available.

A first result is that in this model of redistribution as a public good, *matching grants are not irrelevant* even with see-through, although they are somewhat less effective. The reason why matching grants are not neutral is that acting to offset the federal policy change is distortionary. Offsetting changes in the states' redistributive policies distort the allocation of labour and affects the labour supply of each state. By contrast in [3] labour supply precedes contributions to the public goods (or in [4] is simultaneous) so that offsetting changes in contributions are not distortionary at all. To put it differently, redistribution with mobility has also an impact on the labour market which creates a second spillover between states through its effects on labour allocation which is not present in Bernheim's neutrality result where agents care about their contributions only insofar as these contributions affect the aggregate provision of public good.

Another finding is that with see-through *optimal matching grants are independent of the states'choice of policy variable.*[5] This is a rather unex-

[5]We mean here the choice of an instrument rather than the conjecture regarding this choice.

pected result since it is well known from the tax competition literature (see e.g. [8]), that different decision variables lead to different outcomes.[6] Indeed we show that when states ignore the impact of their decision on the federal budget (taking the federal policy as given) then tax competition requires higher matching grants than benefit (expenditure) competition to restore the first-best outcome. So it turns out that with see through this sensitivity of the optimal matching grant completely disappears. We also obtain the surprising result that under see-through the number of states is irrelevant for the optimal matching rate: increasing the number of states has a benefit diffusion effect that is exactly offset by a opposite cost diffusion effect.

We develop our analysis in a set up where states are assumed to be identical, and only symmetric Nash equilibria (among the states) are considered. This of course, rules out one key role of intergovernmental transfers which is to correct for differences in fiscal capacities or needs across states. Our purpose in adopting this simplication is to ensure that matching grants result solely from the need to internalise the externality arising from the existence of interjurisdictional spillovers (i.e efficiency role of matching grants).We also abstract from the risk sharing role of matching grants as in [10] by assuming away uncertainty.

The rest of the paper proceeds as follows. In section 2 we describe the basic framework. In section 3, we derive the Pareto optimal outcome as a benchmark for the rest of the analysis. In section 4 we analyse the effect of the see-through assumption on the optimal matching grants when states compete in benefit levels. In section 5, it is assumed instead that states compete in taxes. The concluding section summarises the results and discusses possible implications.

## 2 The framework

The presentation of the model will be brief.[7] A federation is composed of $k$ states indexed by $i$. In each state there is one representative rich resident who is immobile; there are also $l_i$ poor that are mobile. Let $\bar{l}$ denote the the number of poor initially located in each state. Hence, the total number of poor in the economy is $k\bar{l}$ and the amount of migration into state i is $l_i - \bar{l}$ with

$$\sum_i l_i = k\bar{l}. \tag{1}$$

[6] This is analogue to the usual distinction in industrial organisation between Cournot and Bertrand competition.

[7] More details can be found in [12] or [13].

States produce a private consumption good with a ricardian technology $f(l_i)$, which is increasing and concave ($f'(l_i) > 0$ and $f''(l_i) < 0$). Workers are paid their marginal product: wages in state $i$ are $w(l_i) = f'(l_i)$. Note that wages in state $i$ decrease with the number of poor in that state: $w'(l_i) = f''(l_i) < 0$.

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

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

which generates an allocation of labor $l_i = l_i(\mathbf{z})$ across states.[8]

The rich resident captures the return to the fixed factors of production. So the (gross) income of the rich in state $i$ is

$$y(l_i(\mathbf{z})) = f(l_i(\mathbf{z})) - f'(l_i(\mathbf{z}))l_i(\mathbf{z}). \tag{3}$$

This income is used to consume private good $x_i$ and to pay the tax $\tau_i$ so that $x_i = y(l_i(\mathbf{z})) - \tau_i$.

All states exhibit an identical social welfare function $W$ defined over the consumption $x_i$ of their rich resident and the income $c$ of their poor residents, reflecting some (unexplained) motives for redistribution. The function $W(x_i, c)$ is assumed to be quasiconcave and its (positive) partial derivatives are denoted $W_1$ and $W_2$.

Fiscal revenue in each state $\tau_i$ serves to finance the welfare benefits to its poor residents $(1-s)l_i(\mathbf{z})z_i$, (net of the federal subsidies $sl_i(\mathbf{z})z_i$) plus the federal tax $T$. Given our symmetric framework it is assumed that states are all facing the same matching rate $s \in [0, 1[$ and pay the same federal contribution $T$. Hence, the state budget constraints are:

$$\tau_i = (1-s)\, l_i\,(\mathbf{z})z_i + T\,, \quad i = 1, ..., k \tag{4}$$

and the federal budget constraint is:

$$\sum_{i=1}^{k} s\, l_i(\mathbf{z})\, z_i = kT. \tag{5}$$

[8] The $k$ equations (2) together with equation (1) produce a system of $k+1$ equations to solve for $c(\mathbf{z})$ and $l_i(\mathbf{z})$ (with $i = 1, ..., k$).

# 3 Conditions for Pareto optimality

In this model any Pareto optimal allocation of labour has to maximise the total output $\sum f(l_i)$ which given identical technologies across states requires workers to be evenly distributed ( i.e. $l_i = \bar{l}$, so that $f'(l_i) = f'(\bar{l})$ for all $i$). Using this productive efficiency condition, Pareto optimal allocation must also involve a level of income of the poor $c$ that solves

$$\max_{c \geq 0} \sum_{i=1}^{k} W(f(\bar{l}) - \bar{l}c, c).$$

The necessary and sufficient first-order condition for the (interior) optimal level of $c$ is then

$$\sum_{i=1}^{k} \frac{W_2}{W_1} = k\bar{l}. \tag{6}$$

This condition is akin to the Samuelson condition for the efficient provision of public good. Given the public good property of the income of the poor, $c$, at an interior solution we must have that the sum of the marginal benefits from raising the income of the poor is equal to its marginal cost.

# 4 Matching grants under benefit competition

## 4.1 No see through

In [13] it is assumed that states take the federal policy $(T, s)$ as given and choose simultaneoulsy and non-cooperatively the benefit levels $z_i$ to their poor residents with the tax rates $\tau_i$ being residually determined by the resulting migrations to balance their budget (i.e., benefit competition). Formally, each state $i$ takes the benefit levels of other states $z_j$ $(j \neq i)$ and the federal policy $(T, s)$ as given and solves

$$\max_{z_i} W(y(l_i(\mathbf{z})) - \tau_i, c(\mathbf{z}))$$

where $\tau_i = (1 - s)\, l_i\, (\mathbf{z}) z_i + T$.

We derive the symmetric Nash equilibrium in which $(i)$ no poor wants to migrate, $(ii)$ no state wants to change its policy choice given the policy choices of other states and the federal policy, $(iii)$ the budget of every state is balanced, and $(iv)$ the federal budget is balanced.[9]

[9] In a symmetric equilibrium, mobility does not affect the allocation of population among states; that is not to say, however, that it is irrelevant to the states' choice of redistributive policies!

The migration effect of a change in $z_i$ holding constant $z_j$ (for all $j \neq i$) is obtained by totally differentiating (1) and (2) with respect to $z_i$, $l_i$, $l_j$ which evaluated at a symmetric equilibrium gives[10]

$$\frac{dl_i}{dz_i} = -\frac{k-1}{kw'(\bar{l})} > 0, \tag{7}$$

$$\frac{dl_j}{dz_i} = \frac{1}{kw'(\bar{l})} < 0 \quad \forall j \neq i. \tag{8}$$

Differentiating (2) with respect to $z_i$ , using (7) and symmetry, we obtain

$$\frac{dc}{dz_i} = \frac{1}{k} \tag{9}$$

So, the impact that each state may have on the income of its poor resisdents is decreasing with the number of states as any unilateral increase in the benefit level $z_i$ diffuses among more states (*benefit diffusion effect*).

Differentiating (4) with respect to $z_i$ , using (7) and symmetry gives[11]

$$\frac{\partial \tau_i}{\partial z_i} + \frac{\partial \tau_i}{\partial l_i}\frac{dl_i}{dz_i} = (1-s)(\bar{l} - \frac{k-1}{k}\frac{z}{w'(\bar{l})}). \tag{10}$$

We are now in a position to derive the optimal matching grants. The first-order condition for state $i$ is

$$W_1\left[y'(l_i)\frac{dl_i}{dz_i} - \left(\frac{\partial \tau_i}{\partial z_i} + \frac{\partial \tau_i}{\partial l_i}\frac{dl_i}{dz_i}\right)\right] + W_2\frac{dc}{dz_i} = 0 \tag{11}$$

where from (3), $y'(l_i) = -l_i f''(l_i)$. Plugging (7), (9) and (10) into (11) and rearranging, the first-order condition becomes,

$$\frac{W_2}{W_1} = (1-sk)\bar{l} - (1-s)(k-1)\frac{z}{w'(\bar{l})}.$$

Comparing this condition with (6), it is readily seen that it is possible to implement the first-best solution as a Nash equilibrium by setting the matching rate $s$ such that the right hand side of this condition equates $\bar{l}$. This requires the following optimal matching rate:[12]

[10] All the (implicit) differentiations are without surprise and the details are omitted to save space.

[11] Recall that with no see-through, states take the federal tax $T$ as given.

[12] Or alternatively $s_z^0 = \frac{|\varepsilon| z}{|\varepsilon| z + w} \in (0,1)$.

$$s_z^0 = \frac{1}{1 - \frac{k}{k-1}\frac{w}{z\varepsilon}} \in (0,1) \tag{12}$$

where $\varepsilon \equiv d\log l/d\log w = w/w'\bar{l} < 0$ is the labor-demand elasticity evaluated at the symmetric equilibrium. This is the classical matching grant as derived in [13] for identical states (see Proposition 4). Note that the optimal matching grant must increase with the number of states to outweight the fact that states have lower incentive to redistribute in a larger federation because of the benefit diffusion effect mentionned earlier. This result is obtained by assuming that states take the federal policy $(s,T)$ as given and so behave as if their policy choice had no influence on the federal budget.

Now we relax this assumption and assume as in [3] that states can see through the federal budget and take into account the effect of their policy choices on the federal tax $T$. Our purpose is to see how this see-through assumption affects the effectiveness of matching grants and, in particular, whether the general neutrality result of Bernheim applies in this model. We will also see that under see-through the number of states become irrelevant for the optimal matching grants.

## 4.2 See through

Substituting the federal budget constraint (5) for $T$ into every state $i$'s budget constraint (4),

$$\tau_i = (1 - \frac{k-1}{k}s)\, l_i(\mathbf{z})\, z_i + \frac{s}{k}\sum_{j\neq i} l_j(\mathbf{z})\, z_j. \tag{13}$$

State $i$'s problem is the same as before except that the condition (4) is replaced by (13). The general expression for the first-order condition for state $i$ is still given by (11) where $dl_i/dz_i$ and $dc/dz_i$ are unchanged (resp., (7) and (9)), but from (13) the total differentiation of $\tau_i$ with respect to $z_i$ evaluated at a symmetric equilibrium becomes

$$\begin{aligned}
\frac{\partial\tau_i}{\partial z_i} + \frac{\partial\tau_i}{\partial l_i}\frac{dl_i}{dz_i} &= (1 - \frac{k-1}{k}s)(\bar{l} + z\frac{dl_i}{dz_i}) + \frac{s}{k}\sum_{j\neq i} z\frac{dl_j}{dz_i} \\
&= (1 - \frac{k-1}{k}s)(\bar{l} - \frac{k-1}{k}\frac{z}{w'}) + \frac{k-1}{k}s\frac{z}{kw'} \\
&= (1 - sk)\bar{l} - (1-s)(k-1)\frac{z}{w'(\bar{l})} + \frac{s}{k}\bar{l} \qquad (14)
\end{aligned}$$

where the second equality follows from (7) and (8). Note that equation (14) is the same as (10) with the extra term $s\bar{l}/k$ representing the impact of $z_i$ on the federal tax $T$. It is worth noting that this impact is decreasing with the number of states. This is because an increase in $z_i$ is shared with a larger number $(k-1)$ of other states (*cost diffusion effect*). Using (7), (9) and (14), the first-order condition becomes after some manipulation

$$\begin{aligned} \frac{W_2}{W_1} &= (1-\frac{k-1}{k}s)k\bar{l} - (1-s)(k-1)\frac{z}{w'(\bar{l})} - (k-1)\bar{l} \\ &= (1-(k-1)s)\bar{l} - (1-s)(k-1)\frac{z}{w'(\bar{l})}. \end{aligned}$$

Since first best requires the right-hand side of this expression to be equal to $\bar{l}$, the optimal matching grant is

$$s_z^1 = \frac{1}{1-\frac{w}{z\varepsilon}} \in (0,1)$$

where $\varepsilon = w/w'\bar{l} < 0$ is used. Three conclusions emerge immediately. Firstly matching grants can restore the first-best even if agents see through the federal budget, so the neutrality result of Bernheim does not apply. Secondly a higher matching rate is required to correct the fiscal externality under the see-through assumption (i.e., $s_z^1 > s_z^0$). This is because states internalise the federal budget and understand that they will have to pay a fraction of what they receive. Thirdly, with see-through, the number of states is irrelevant to the choice of the optimal matching rate. This is a surprising result since having more states reduces the impact each one may have on the income of their poor residents and so should lower the incentive to redistribute. However it turns out that this benefit diffusion effect is completely offset by a opposite cost diffusion effect according to which, under see-through, states also understand that the cost of their redistributive policy will be shared among a larger number of states. To summarize.

**Proposition 1**: *For any (symmetric) Nash equilibrium of the benefit competition game between $k \geq 1$ states, matching grants can achieve the first-best also under the see-through assumption. It only takes a higher matching grant with see-through. Moreover the effect of see-through is to make the optimal matching rate independent of the number of competing states.*

In the next section we relax the assumption we have made so far that states compete through benefit levels and instead assume that the policy variable is the tax while the benefit levels are determined residually according to migration to maintain budget balance. Again our purpose is to show how the see through assumption affects the optimal matching rate and whether there is a possibility of neutrality. We will also compare the outcome between tax and benefit competition and show an important equivalence result between the two games with see-through.

# 5 Matching grants under Tax competition

## 5.1 No see through

State $i$ selects a tax $\tau_i$ taking the tax rates of other states $\tau_j$ $(j \neq i)$ and the federal policy $(T, s)$ as given so as to solve

$$\max_{\tau_i} W\left(y(l_i(\mathbf{z})) - \tau_i, c(\mathbf{z})\right)$$

where $\mathbf{z} = (z_1, ..., z_i, ..., z_k)$ satisfies

$$z_i = \frac{\tau_i - T}{(1-s)l_i(\mathbf{z})} \qquad \text{for all } i \tag{15}$$

$$z_j = \frac{\tau_j - T}{(1-s)l_j(\mathbf{z})} \qquad \text{for all } j \neq i \tag{16}$$

The migration effect of a change in $\tau_i$ holding constant $T$, $s$, and $\tau_j$ (with $j \neq i$) is obtained by totally differentiating (1) and (2) with respect to $\tau_i$, $l_i$, $l_j$ using (15)-(16), which then evaluated at a symmetric equilibrium gives

$$\frac{dl_i}{d\tau_i} = \frac{k-1}{k(1-s)(z - w'\bar{l})} > 0 \tag{17}$$

$$\frac{dl_j}{d\tau_i} = -\frac{1}{k(1-s)(z - w'\bar{l})} < 0 \quad \forall j \neq i \tag{18}$$

Unlike the benefit competition game, a key element underlying this migration effect is the fact that a unilateral tax increase in state $i$ attracts some poor away from other states inducing them for given tax rates to increase their benefit levels $z_j$. This is the reason why we obtain different migration effects between the two games. Note also that matching grants amplify the migration response to tax change whereas they had no effect on migration in the benefit competition game. Differentiating (2) with respect to $\tau_i$ , using (15), (17) and symmetry, we obtain

$$\frac{dc}{d\tau_i} = \frac{1}{(1-s)k\bar{l}}. \tag{19}$$

Observe again that, due to the benefit diffusion effect, the marginal impact on the income of the poor of a unilateral tax increase is decreasing with the number of states. We can now derive the first-order condition for state $i$ as

$$W_1 \left[ y'(l_i)\frac{dl_i}{d\tau_i} - 1 \right] + W_2 \frac{dc}{d\tau_i} = 0. \tag{20}$$

Plugging (17) and (19) into (20) and using the fact that $y' = -\bar{l}w'$ in a symmetric equilibrium, we get

$$\frac{W_2}{W_1} = [(1-s) + w'\bar{l}\frac{k-1}{k(z-w'\bar{l})}]k\bar{l}.$$

Comparing this condition with (6), restoring the first best solution requires to set the matching rate such that the right-hand-side of this condition is equal to $\bar{l}$. This leads to the following optimal matching rate,

$$s_\tau^0 = \frac{1}{\frac{k}{k-1}(1-\frac{w}{z\varepsilon})} \in (0,1)$$

Note that $s_\tau^0 < s_z^0$ which means that tax competition requires a lower matching rate than benefit competition to restore efficiency. The reason is that competition in taxes is less severe because increasing tax in one state holding the tax rates in other states constant, attracts some of the poor in that state enabling the other states to raise their benefit levels. So more redistribution in one state triggers more tranfer to the poor in other states. By contrast under benefit competition more redistribution in one state triggers less taxation at unchanged benefits in other states (see [8] and [14] for similar result). It is worth noting that as $k \to +\infty$ the two games require the same matching rate. In fact, from (9) and (19), $dc/dz_i = dc/d\tau_i \to 0$ as $k \to +\infty$ so that a unilateral tax change has the same negligible effect on the income of the poor as a unilateral benefit change when the number of states increases to infinity.[13] We thus have,

[13]See also [14] for a similar result in the context of capital mobility.

**Proposition 2**: *Without see-through, the matching grants required to attain the first-best differs between tax competition and benefit competition: competition in taxes requires lower matching grants than competition in benefits. In both cases optimal matching rates are increasing with the number of competing states and converge to the same matching rate* $s_z^1 = \frac{1}{1-\frac{w}{z\varepsilon}}$ *as* $k \to \infty$.

We now allow for see-through in this tax competition game.

## 5.2 See through

We first derive the expression for $z_i$ as a function of the vector of strategy $\boldsymbol{\tau} = (\tau_1, ..., \tau_i, ..., \tau_k)$ when states internalise the federal budget. Substituting (5) for $T$ into (4) ,

$$\tau_i = (1-s)\; l_i\, z_i + \frac{s}{k} \sum_{j=1}^{k} l_j\, z_j \quad \text{for all } i.$$

Summing these $k$ identities

$$\begin{aligned} \sum_{j=1}^{k} \tau_j &= (1-s) \sum_{j=1}^{k} l_j\, z_j + s \sum_{j=1}^{k} l_j\, z_j \\ &= \sum_{j=1}^{k} l_j\, z_j. \end{aligned} \tag{21}$$

Combining these two expressions

$$\tau_i = (1-s)\; l_i\, z_i + \frac{s}{k} \sum_{j=1}^{k} \tau_j \;\; \text{for all } i.$$

Solving this expression for $z_i$ one finds:

$$z_i = \frac{\left(1-\frac{s}{k}\right)\, \tau_i - \frac{s}{k} \sum_{j\neq i} \tau_j}{(1-s)\; l_i} \text{ for all } i. \tag{22}$$

The state's problem is the same as without see through except that the condition (15) is replaced by (22).

Totally differentiating (1) and (2) with respect to $\tau_i$, $l_i$, $l_j$ holding constant $s$ and $\tau_j$ (with $j \neq i$), using (22) and evaluating at a symmetric equilibrium gives

$$\frac{dl_i}{d\tau_i} = \frac{k-1}{k(1-s)(z-w'\bar{l})} > 0 \tag{23}$$

$$\frac{dl_j}{d\tau_i} = -\frac{1}{k(1-s)(z-w'\bar{l})} < 0 \quad \forall j \neq i. \tag{24}$$

Note that the see-through assumption does not affect the migration response to a unilateral tax change (see (17) and (18)). Differentiating (2) with respect to $\tau_i$, using (22),(23) and symmetry, we obtain

$$\begin{aligned} \frac{dc}{d\tau_i} &= \frac{\partial z_i}{\partial \tau_i} + (w' - \frac{z}{\bar{l}})\frac{dl_i}{d\tau_i} \\ &= \frac{1-s/k}{(1-s)l} - \frac{1-1/k}{(1-s)\bar{l}} \\ &= \frac{1}{k\bar{l}}. \end{aligned} \tag{25}$$

Note again that $dc/d\tau_i \to 0$ as the number of jurisdictions increases to infinity. Substituting (23) and (25) into the first order condition (20), using the fact that $y'(\bar{l}) = -\bar{l}w'$ and rearranging one obtains:

$$\frac{W_2}{W_1} = [1 + w'\bar{l}\frac{k-1}{k(1-s)(z-w'l)}]kl.$$

Restoring the first-best requires to choose $s$ such that the right-hand side of this expression equates $\bar{l}$. This yields the following matching grant,

$$s_\tau^1 = s_z^1 = \frac{1}{1-\frac{w}{z\varepsilon}}.$$

So with see-through, the optimal matching grant is the same whether states compete in taxes or in benefits. This was true with non-see-through only in the limiting case of an infinite number of states. Note that the optimal matching rate is also independent of the number of states. the reason is the same as for the benefit competition game: benefit and cost diffusion effects of larger federation cancel each other. Lastly simple comparison of the matching rates reveals that $s_\tau^1 = \frac{k}{k-1}s_\tau^0$ so that optimal matching rates under see-through may be at most twice the matching rate without see through. Therefore we have

**Proposition 3**: *With see-through the optimal matching grant is the same whether states compete in taxes or in benefit levels and is independent of the number of states. This matching grant is equal to* $\frac{k}{k-1} \geq 1$ *times the matching grant without see through.*

The key to the different results in the Bernheim model and ours, as outlined in the introduction, is that mobility invalidates one of the key assumption in Bernheim's theorem that agents care about their contributions only insofar as these contributions affect the aggregate level of public good. Indeed with mobility contributions also affect the allocation of labour and economic rent in each state. To understand the critical role of this distortion, suppose that states do not care about productive efficiency. It follows that states do not take into account the distortionary effect of their policy choices on the allocation of labour. This can be easily captured in our model by assuming that $y' = 0$. Plugging this value into the first-order condition (20) and using (23) and (25) give:

$$\frac{W_2}{W_1} = kl.$$

So, the first-order condition would be now independent of the matching rate $s$ and the neutrality result would follow with a suboptimal underprovision of public good (i.e., too little redistribution).

## 6 Conclusion

This paper has analysed the effectiveness of matching grants to correct for interjurisdictional spillovers due to mobility. We have used a classical model of welfare competition in which states seek to redistribute income but face a mobility constraint. The model shares the properties of private contribution to public good models since with mobility, by arbitrage all states end up with the same level of income for the poor. It follows that redistribution of income in each state is akin to the voluntary contribution of a public good (namely, the income of the poor). The Nash equilibrium involves too little redistribution and a subsidy policy like matching grants can be used to restore the Pareto optimal outcome. However, unlike the previous papers having investigated this issue, we have allowed for the (reasonable) possibility that states take into account the impact of their decisions on the federal budget (i.e., see- through assumption). Because states fully take into account the taxes they will have to pay as a result of the subsidies they receive, and because all states are linked through their voluntary contributions to a public good, it is natural to wonder whether Bernheim's general neutrality result, based on these two assumptions, would apply. Our analysis reveals that the answer is no. Matching grants are not neutral in our model although the see-through assumption make them less effective. So federal policy changes do not trigger offsetting changes from states. The reason is that, with mobility, offsetting change in states' contributions to public good also affects the allocation of labour and the economic rent in each state and not only the aggregate level of public good as in Bernheim. Hence, the key assumption in Bernheim theorem that agents (states) care about the magnitude of their contributions only insofar as these contributions affect the aggregate level of public good is no longer valid with mobility.

Our analysis has also revealed some intriguing results. In particular, we have shown that, contrary to conventional results, the states' choice of policy variable (i.e., whether they compete in taxes or in benefits) and the number of competing jurisdiction are irrelevant for the computation of optimal matching grants. Previous work rather suggests that competition increases with the number of jurisdictions and that benefit competition is more severe than tax competition, and so that higher matching grants are needed. The key to the different results is that we allow for states to take into account the impact of their decision on the federal budget which is a sensible assumption when there are only few states. Not too surprisingly, we have also found that this see-through assumption is becoming decreasingly relevant as the number of states increases.

Attention has been restricted in our analysis to identical jurisdictions and symmetric Nash equilibrium to ensure that any matching grants emerge solely from efficiency grounds. We have thus abstracted from the heterogeneity neutralising matching grants. Due to the mobility distortion reason already outlined we can expect the non neutrality result of matching grants to carry over in a more general model of heterogenous states. We have also abstracted from the possibility of reaching the optimal outcome through voluntary sharing rules rather than coercitive federal policy (see [9]) and the risk sharing issue under symmetry (e.g. i.i.d. shocks). These are two issues clearly worth investigating in future research.

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