Chapter 2

FISCAL CAPACITY EQUALIZATION AND ECONOMIC EFFICIENCY: THE CASE OF AUSTRALIA[1]

JEFFREY D. PETCHEY AND SOPHIA LEVTCHENKOVA
School of Economics and Finance, Curtin University, Australia

1. INTRODUCTION

Central governments in many countries including Canada, Germany, Switzerland, Japan, India, the UK and Australia use fiscal equalization models when distributing grants to sub-national governments. The models used vary somewhat in their precise structure but also share general features. Some, for example the Australian model, estimate the revenue and expenditure needs of sub-national governments in generating the distribution of grant funds while others, such as that used in Canada, estimate only the revenue needs of regions.

Cost disabilities may also be incorporated into schemes that take account of expenditure needs. The logic here is that a high cost region needs more grant funds than a lower cost region simply to provide the same level of service. The additional funds are required in order to compensate for the relatively higher costs. An instance here is Switzerland where differences in the cost of providing services in mountainous areas are taken into account in calculating expenditure needs for equalization - one disability proxy measures the relative significance of agricultural land above 800 meters. The Swiss also have proxies for population density in their allocation model (based on the idea that it is relatively more expensive to provide services to a geographically dispersed population). In Japan too, cost disabilities are included in the scheme that allocates equalization grants to local governments. The types of disabilities accounted for include population density, population growth, climate, area and geography, degree of urbanization, and industrial diversification. The UK also takes account of cost disabilities when allocating grants from the national government to local jurisdictions. These disabilities are constructed using a cross-section regression analysis.

Equalization in practice is almost always motivated by equity concerns with the basic idea being to ensure equality of access to public services regardless of where a citizen lives. This is usually attempted by designing a system that attempts to equalize "fiscal capacities" across regions. The idea is illustrated from the following official statement of the aims of Australian equalization:

> "States should receive funding from the Commonwealth such that, if each made the same effort to raise revenue from its own tax bases and operated at the same level of efficiency, each would have the capacity to provide services at the same standard" (Commonwealth Budget Paper No. 3)[2].

By equalizing fiscal capacities through inter-State transfers, it is thought that citizens of a federation with the same preferences and incomes can enjoy the same standard of State-provided public services with identical tax burdens, regardless of where they live. A federation with equalized State fiscal capacities is one that, in principle, replicates the equity of a unitary system while at the same time providing the benefits of decentralization, namely, the ability to have different packages of local public goods and taxes in accordance with local preferences.

Fiscal capacity equalization results in inter-regional income transfers. Such transfers can be quite substantial, as Table 1 shows for Australia. Column 1 in Table 1 shows how the pool of grant funds directed to the States is allocated using fiscal capacity equalization. Column 2 shows how the funds would be distributed on a simple equal per capita basis, while the last column shows the difference between the two allocation methods. One can see that New South Wales, Victoria and Western Australia are "losers' while the remaining States and Territories are "winners".

Economic efficiency arguments for such inter-regional transfers have appeared in the fiscal federalism literature. One, the 'efficiency in migration case', argues that local public goods create region-specific fiscal externalities, and that fixed factors of production create region-specific economic rents. The location decisions of mobile capital, and labor, are affected by these externalities and rents. The result is that, in equilibrium, these factors of production will be located inefficiently across regions. In short, 'too many' mobile factors locate in regions relatively rich in fiscal externalities and rents (e.g. resource rich regions). It is argued that there is an optimal inter-State transfer that corrects for the distorting effects of externalities and rents, and establishes an optimal spatial distribution of

Table 1. Equalization, Australia, 2002-03. Distribution Using CGC Model, Equal Per Capita Distribution

	\$m (1)	%	\$m (2)	%	Difference (1) - (2)
New South Wales	7723.9	29.0	8967.4	33.6	-1243.6
Victoria	5552.9	20.8	6650.7	24.9	-1097.8
Queensland	5236.9	19.6	5029.5	18.9	207.4
Western Australia	2447.8	9.2	2633.2	9.9	-185.3
South Australia	2641.6	9.9	2045.0	7.7	596.7
Tasmania	1118.6	4.2	637.8	2.4	480.8
ACT	519.6	1.9	429.3	1.6	90.3
NT	1423.6	5.4	272.1	1.0	1151.5
Total (Pool)	6664.9	100.0	26664.9	100.0	0.0

Source: Commonwealth Budget Paper No. 3, "Federal Financial Relations, 2002-2003".

mobile factors. Of course, the existence of an optimal transfer does not justify any of the schemes that we see in operation since none actually implement the optimal transfer[3].

Fiscal capacity equalization has also been criticized on efficiency grounds. Swan and Garvey (1991) attempt to show that equalization grants induce strategic behavior by regions, or gaming against the distribution formula. The result is sub-optimal provision of local public goods by regions. It has also been argued that equalization creates 'transfer dependency' (an issue for the Atlantic Provinces in Canada[4]) making regions reluctant to pursue economic development objectives. Equalization may also slow down economic adjustments that would otherwise take place to facilitate inter-State income convergence, such as changes in relative wages between regions, or migration from low to high-income regions.

Therefore, though often justified by policy-makers on equity grounds, equalization and inter-State transfers have been both supported and criticized on economic efficiency grounds. There seems to be no consensus on the efficiency debate, with conclusions depending on particular lines of argument taken, assumptions made and modeling structures adopted.

This paper attempts to provide some cohesion to the debate. It does this by bringing together, within one model, the major efficiency rationale for inter-regional transfers - the presence of regional externalities and rents - together with one of the major efficiency arguments against equalization: the potential for strategic behavior by regions and sub-optimal provision of local public goods. The advantage of this approach is that it enables us to examine exactly how equalization affects efficiency in a world in which regions act strategically, and where externalities and rents affect location decisions. We are also able to draw conclusions about the efficiency (and welfare) implications of equalization in such a world.

The model adopted is novel in the sense that it integrates a real world fiscal equalization scheme into a standard model of a decentralized (e.g. federal) economy, with optimizing regional governments and factor mobility. Each region chooses the provision of a local public good to maximize the utility of a representative resident, while taking account of the migration responses to its decisions (regions are non-myopic with regard to migration responses). The central government collects taxes in each region and distributes the revenue raised to the regions through an equalization formula that estimates regional revenue and expenditure needs. The equalization formula used in the model is the Australian one. This is because Australian equalization is, arguably, the most comprehensive in the world: it equalizes for revenue and expenditure needs, and incorporates cost disabilities. As will be shown, many schemes used in other countries are special cases of the Australian approach.

The efficiency properties of a Nash equilibrium are then explored and the results are as follows. The first is that equalization distorts State decisions over public policy, mainly because (at least in Australia's scheme) the standards used to assess whether a State has expenditure and/or revenue needs are dependent on state policy choices. Therefore, States, through their choice of public policy, are able to influence these standards, and hence the grant they receive. This gives them an incentive to distort their public policies away from what might otherwise be optimal.

The second result relates to the efficiency of location choices made in a decentralized economy with equalization. As noted, some have argued that in economies with free mobility, location choices are inefficient because of region-specific rents and fiscal externalities. This necessitates an optimal transfer. What we show is that in the equilibrium in our model, there will be an inter-regional transfer, but it is not the one required for efficiency in the spatial allocation of mobile factors.

The paper outline is as follows. Section 2 develops the model of a decentralized economy with optimizing sub-national governments, factor mobility and a fiscal equalization system implemented by a central government. Section 3 examines public policy choices made by the sub-national governments, while Section 4 examines the efficiency implications of those decisions in the presence of equalization. Section 5 concludes with suggested policy implications.

2. MODEL

Suppose that we have a decentralized economy with N citizens who have identical incomes and preferences. For convenience we will think of this as a federal economy with i = 1,2 States. State i has n_i residents who each supply one unit of labor. The national population (labor supply) is therefore

$$N = n_1 + n_2 . \quad (1)$$

The production process in each State is simple. There are two inputs, the first, immobile and in fixed supply, can be thought of as land, fixed physical capital, or natural resources. We denote the supply of this factor in State i as L_i. The second factor is labor. Since each citizen supplies one unit of labor, n_i is State i's labor supply. As shown below, labor is perfectly mobile between States and its supply can vary from the perspective of each State. The two factors are combined using a production technology based on constant returns to scale to produce a numeraire good whose price is set at one. The value y_i of a State's production of the numeraire (the value of aggregate State output) is represented by the production function

$$y_i = f_i(n_i, L_i), \quad i = 1,2 . \quad (2)$$

Since the immobile factor is in fixed supply in each State, from now on we define the aggregate output of State i as $y_i = f_i(n_i)$ and suppose the following: $f_i'(n_i) > 0,\ f_i''(n_i) < 0$. Though States have the same production technologies, we allow them to have different endowments of the fixed factor.

Competitive factor markets are also assumed, implying that each person in a State receives a wage, w_i, equal to their marginal product. Since citizens of a State are identical, each receives the same wage, but because State specific supplies of land may differ, inter-State wage rates may not be the same. The residents of a State own equal portions of that State's fixed factor[5] and each receives an equal per capita share of the State's fixed factor income, or economic rent. Since we have assumed constant returns to scale, and hence that output is exhausted by factor payments, the income of a representative citizen in State i is the State's average product

$$\frac{f_i(n_i)}{n_i}, \qquad i = 1,2 . \quad (3)$$

Part of the numeraire output in each State is transformed, by a State government, into a pure local public good denoted as q_i, with no inter-State spillovers, and the rest is consumed directly by State citizens. Per capita consumption of the numeraire is denoted as x_i. From now on we think of this as private good consumption. There is implicitly a transformation frontier defined between private and public good consumption that is assumed to be linear. The (constant) slope of the frontier is the marginal rate of transformation between the two goods that is equal to the marginal cost of x_i over the marginal cost of q_i. Under the assumption of perfect competition it is also equal to the price of the numeraire (one) over the price of the public good[6].

Each citizen has a quasi-concave, continuous and differentiable utility function,

$$u(x_i, q_i), \qquad i = 1,2. \tag{4}$$

As noted, citizens are also assumed to be perfectly mobile across States so that, in equilibrium

$$u(x_1, q_1) = u(x_2, q_2). \quad \textit{(Equal utility condition)} \tag{5}$$

The equal utility condition can be thought of as a social welfare function; $W = u_1 = u_2$. Since citizens of a State receive location-specific fixed factor rents, and because of the presence of local public goods which generate fiscal externalities, in this model labor will, in general, be allocated inefficiently between States. This is a well-known feature of federalism models with the underlying regional structure developed here.

2.1 Fiscal Capacity Equalization

In practice, the size of the pool of funds to be distributed among the States is determined by tax and spending assignment between the national and sub-national governments, which commonly leads to a fiscal gap (an excess of revenue relative to expenditure) at the federal level. This gap is then distributed back to the States on the basis of various distribution formulas. We abstract from the complexities of how the pool is created and concentrate on the gaming behavior of States over the distribution of the pool. It is the efficiency effects of how the pool is distributed, rather than any distortions related to the creation of the pool, which are of primary focus here.

Therefore, it is supposed that some pool G is created by a federal government using a per capita lump sum tax on citizens, denoted as s. In addition, we do not model central government provision of public goods (national public goods). Rather, the only role given to the central government is one of creating a revenue pool that is then distributed to the States using an equalization methodology. This is clearly a major abstraction and simplification of central government behavior, but again, it is one that allows us to focus on the issue at hand: the distortions created by gaming over the allocation of a given pool.

For simplicity we also assume that s is given[7]. It represents a quantity of the numeraire that is surrendered by a citizen to the national government. Since the numeraire produced in each State is the same, the quantity collected by the national government can be aggregated to create a single 'pool' of the numeraire, denoted as G = sN. Since s and N are fixed, G is a parameter.

2.2 The State - Specific Grant

As noted, we have chosen to model equalization using the Australian approach. The grant pool in Australia is allocated between the States using the Commonwealth Grants Commission (CGC) equalization formula[8]. We integrate the key components of this formula into the federal model, and in doing so, abstract from the inessential parts. Though the formula applies in a federation of multiple States, we also suppose there are only two States, i = 1,2, consistent with our model. The CGC's formula defines the per capita grant, g_i, to State i as:

$$g_i = \frac{G}{N} + \frac{E}{N}(\gamma_i - 1) + \frac{T}{N}(1 - \rho_i) + c, \quad i = 1,2. \tag{6}$$

G and N are the total grant pool and national population (as previously defined) and so G/N = s is the per capita amount of funds available for distribution to the States.

The variable E is defined by the CGC as total expenditure by the States on the services included in the model (for example, education, health, transport, welfare). Here, there is only one service, a local public good, so that the following holds: $E = p_1 q_1 + p_2 q_2$. Therefore, E/N is the per capita average expenditure on the local public good across both States. The CGC calls this 'standard expenditure'. As will be shown below, it is the expenditure that is used as a benchmark to assess a State's 'expenditure need'.

The variable T is defined by the CGC as the total (own-source) revenue raised by all States to fund their public expenditures. Assuming balanced State budgets, this is equal to total expenditure by all the States, less what they receive as grants from the federal government, G. Therefore, own-source revenue can be defined as T = E − G, or alternatively, $T = p_1q_1 + p_2q_2 - G$. Furthermore, T/N is the per capita average own-source revenue raised by all States, known as 'standard' revenue in CGC terminology. Again, this name is given to the term T/N because, as will be seen, it is the benchmark used to assess whether a State has a 'revenue need.'

2.3 Cost and Revenue Disabilities

Another part of (6) is the cost disability, γ_i. It captures the cost of providing each service in State i, relative to the average cost for all States. The CGC calculates a set of cost disabilities for each service provided by the States. The calculations are complex and since we have only one service we have only one cost disability for each State (for the local public good).

A State may have a cost disability in the provision of a particular service for a variety of reasons. For example, it may have a geographically dispersed population and have to provide schools in remote locations. This means that a unit of education service may have a higher cost than the average across all States. Other factors contributing to cost disabilities include the age/sex profile of the population, ethnicity and the presence of groups with special health/educational requirements, and economies of scale. Australian equalization is unique in the sense that it puts a great deal of effort into estimating such cost disabilities and then allowing them to determine the distribution of the grant pool, G.

We adopt a simplified definition of a cost disability that, of necessity, abstracts from this complexity but captures the essence of the idea. Namely, we define the cost disability for State i as

$$\gamma_i = \frac{2p_i}{p_1 + p_2}, \ i = 1, 2. \tag{7}$$

So defined, if $\gamma_i > 1$, then State i is a relatively high cost provider of the public good (has a cost disability) and if $\gamma_i < 1$, it is a relatively low cost provider. Thus, the cost disability variable is normalized around the number one. The prices of the public good are exogenous so the disability is treated as exogenously given by the States.

The CGC also estimates a State specific 'revenue disability' for each State tax base. In Australia's case, such disabilities are estimated individually for each of the State taxes, including payroll tax, the major State tax, and mineral royalties. Again, we abstract from this complexity and suppose that a State has only one revenue disability, ρ_i, which is greater than one if the

State has a relatively strong tax base, and less than one if the State has a relatively weak tax base. As with the cost disability, we assume that States take the revenue disability as determined exogenously by the CGC.

2.4 Expenditure and Revenue Needs

The term $(E/N)(\gamma_i - 1)$ in equation (6) is the expenditure need of State i. If we multiply E/N through the brackets we can see that the need has two parts. The first, $(E/N)\cdot\gamma_i$, is the standardized expenditure of State i. This is the expenditure that State i would have to undertake, taking account of its cost disability, to achieve the per capita standard, E/N. State i's standardized expenditure is greater than or less than the standard, depending on the magnitude of its cost disability. The second term, E/N, is just the standard expenditure of all States. Thus, the expenditure need of the State is equal to its standardized expenditure less standard expenditure. If the State's cost disability is greater than one, the State has a positive expenditure need. Otherwise, it is negative.

Similarly, $(T/N)(1-\rho_i)$ is the revenue need of State i. Multiplying through the brackets one can see that it also has two parts. The first is just T/N, or standard own-source revenue. The second term, $(T/N)\cdot\rho_i$, is the standardized own-source revenue of State i. This is the revenue that State i would raise if it applied the average tax effort to its own tax base. If the State's revenue disability is greater than one, then its standardized revenue will be higher than the standard, and its revenue need will be negative. Alternatively, if the State's revenue disability is less than one, its standardized revenue will be less than the standard, and the State will have a positive revenue need.

Thus, under Australian equalization, a State receives an equal per capita share of the pool, G/N, adjusted by the expenditure and revenue need terms. A State will receive more than its equal per capita share of the grant pool if the sum of its needs is positive; and less than its equal per capita share if the sum of its needs is negative. Finally, if the expenditure and revenue needs cancel each other exactly, the State will simply receive its equal per capita share, G/N.

Note also here that, due to the differences in their definition, the disabilities are applied differently in equation (6). Namely, for the expenditure disability, standard expenditure is multiplied by $(\gamma_i - 1)$ where $\gamma_i > 1$ implies that the State has relatively high costs, while for the revenue disability standard revenue is multiplied by $(1-\rho_i)$ where $\rho_i > 1$ denotes a State with a relatively rich tax base[9].

2.5 Summary

Each endogenous variable in the model is a function of the exogenous variables and parameters. For later discussion, it is useful to explore this in more detail for one of the endogenous variables, for example the grant to State i. In this regard, one can define from (6) the per capita grant to a State as

$$g_i(F, P, CGC, S) \tag{11}$$

where $F = [s\ N]$ is a vector of variables determined by the federal government, $P = [p_1\ p_2]$ is a vector of the local public good prices, $CGC = [\gamma_i\ \rho_i\ c]$ is a vector of variables determined by the CGC and $S = [q_1\ q_2]$ is the strategy set of the two States. Within F, the variable s is determined by the federal government. The total federal population N is determined by things such as the birth and death rate, but also by international migration and hence, to some extent, the population policy of the federal government. Within the vector CGC, the variables γ_i, ρ_i, c are all determined by the CGC, while the public good provision levels within S are determined by the States.

As discussed below, we assume that each State perceives s, N, public good prices and the CGC variables (except the adjustment term c) to be exogenously given. This is reasonable since in practice the States have no impact on s and only a marginal impact on the CGC variables. It is true that the States rent-seek over the cost and revenue disabilities but, in reality, this meets with limited success. As also discussed below, we assume that each State adopts Nash conjectures with regard to the level of provision of the public good in the other State. For example, when optimizing, State 1 perceives q_2 to be given, and similarly for State 2. Thus, each State perceives its grant to be a function of its own public good provision. The adjustment variable c is also among the variables contained in the vector CGC. Given the previous discussion, we know that States also view c as a function of their joint policy choices.

The general function (11), which links State policies and equalization variables to the State specific grant, will hold in any federation with equalization, though the specific variables to be included will vary depending on the particular structure of the equalization formula used. Thus, one can think of (11) as a general function defining the State specific grant, and equation (6) as the specific function for the Australian model.

3. STATE POLICY CHOICES

Taking into account private good consumption, provision of the public good, the national government tax and the equalization grant, the aggregate budget constraint in State i is:

$$n_i x_i + p_i q_i + n_i s = f_i(n_i) + n_i g_i \,, \tag{12}$$

Suppose that the government of each State is benevolent and perfectly represents the preferences of its citizens. The implication is that State and citizen interests are synonymous: a State will choose its level of provision of the public good to maximize per capita utility within its jurisdiction (recall that all residents within a State have the same income and preferences). In making its choice, a State is assumed to take account of the equal utility condition and the equation defining the total supply of labor. Thus, States are non-myopic with regard to the migration effects of their public policy choices. It is also assumed that States take account of the grant response to any changes in public good provision, through the equalization formula. This implies that each State's choice of public good provision will affect the welfare of citizens in the neighboring State, both through the migration condition and the equalization formula.

Such policy interdependence means that States can act strategically. One can, therefore, think of the problem as a two-player simultaneous move game in continuous pure strategies, in which the States are players and the payoffs are the per capita utilities in each State. The strategy set for the game, defined previously, is $S = (q_1, q_2)$. Nash conjectures are assumed so each State chooses its public good provision taking provision in the other State as given. However, it is supposed that States have sufficient foresight to take account of the impact of their choice on migration and the equalization grant. Given this, each State will choose its provision of the public good to maximize within-State per capita utility subject to the State-specific budget constraint, the national labor supply condition, the equal utility condition and the equalization formulas.

For convenience, from now on we conduct the analysis from the perspective of State 1. Rewriting the aggregate budget constraint for State 1 in terms of per capita private good consumption and substituting the result into the per capita utility function, the problem of State 1 can then be written as

$$\underset{(q_1)}{\mathrm{Max}} \; u\left(\frac{f_1(n_1) - p_1 q_1}{n_1} - s + g_1, q_1 \right) \tag{13}$$

Subject to:

Migration and Labor Supply Constraints

$$\text{(i) } u\left(\frac{f_1(n_1)-p_1q_1}{n_1}-s+g_1,q_1\right)=u\left(\frac{f_2(n_2)-p_2q_2}{n_2}-s+g_2,q_2\right)$$

$$\text{(ii) } n_1+n_2=N$$

Fiscal Capacity Equalization Constraints

$$\text{(iii) } g_1=\frac{G}{N}+\frac{E}{N}(\gamma_1-1)+\frac{T}{N}(1-\rho_1)+c$$

$$\text{(iv) } g_2=\frac{G}{N}+\frac{E}{N}(\gamma_2-1)+\frac{T}{N}(1-\rho_2)+c$$

$$\text{(v) } c=\frac{G}{N}-\frac{E}{N}(n_1\gamma_1+n_2\gamma_2)+\frac{T}{N}(n_1\rho_1+n_2\rho_2)$$

$$\text{(vi) } E=p_1q_1+p_2q_2.$$

$$\text{(vii) } T=E-G.$$

From State 1's perspective, the exogenous variables are s, N, p_1,p_2, G (defined as $G=sN$), γ_1,γ_2 (defined by (7)) and ρ_1, ρ_2. These are the variables determined by the federal government and the CGC, and perceived to be exogenous by the States. With Nash conjectures, State 1 will also treat q_2 as given. The endogenous variables are, therefore, q_1, n_1,n_2, g_1,g_2, E, T and c, which is an endogenous function of both exogenous and endogenous variables. The constraint set has seven equations. There are 8 unknowns and hence one free dimension to maximize over. Also, we do not use G = sN in constraints (iii) and (iv) because we want these constraints to reflect the way that the CGC formulates its model. Of course, if we do use G = sN in constraints (iii) and (iv) then G/N simply becomes s, the per capita tax levied by the federal government[10]. State 2 solves an analogous problem with identical exogenous variables and with Nash conjectures it takes q_1 as given when it chooses q_2.

The necessary condition for provision of the local public good is found by differentiating the objective function in (13) with respect to q_1, for given q_2 under Nash conjectures, and fixed values of s, N, the CGC variables (except adjustment factor c) and public good prices. This yields

$$n_1 MRS^1_{xq} = p_1 - \left(b_1 \cdot \frac{\partial n_1}{\partial q_1} + n_1 \frac{\partial g_1}{\partial q_1} \right), \tag{14}$$

where $MRS^1_{xq} = u_{q_1} / u_{x_1}$ is the marginal rate of substitution between the local public good and the private good in State 1 (or the marginal benefit of extra units of the public good). The remaining parts of (14) are explained below.

The term b_1 is the net benefit of an additional migrant in State 1 and is defined as

$$b_1 = (w_1 - x_1) - (s - g_1), \tag{15}$$

where $(w_1 - x_1)$ is the difference between a migrant's marginal product (wage) and their per capita consumption, and $(s - g_1)$ is the difference between the federal tax they pay (output foregone by State 1) and the per capita equalization grant the migrant attracts to the State. The net benefit of an extra migrant for a State is more complex than in traditional federal models because we have to account for the grant and equalization consequences of migration into a State[11].

The term $\partial g_1 / \partial q_1$ in (14) is the change in State 1's equalization grant in response to a small increase in the State's public good provision. The expression for this is found by differentiating constraint (iii) with respect to q_1, for given q_2, and fixed values of the exogenous variables. This yields

$$\frac{\partial g_1}{\partial q_1} = \frac{p_1}{N}(\gamma_1 - 1) + \frac{p_1}{N}(1 - \rho_1) + \frac{\partial c}{\partial q_1}. \tag{16}$$

The first term on the right side, $(p_1 / N)(\gamma_1 - 1)$, is the change in the expenditure need of State 1 resulting from a small change in its provision of the local public good. The expenditure need changes because a variation in the provision of the local public good changes standard expenditure, which is in turn used by the CGC in its per capita grant formula to determine the standardized expenditure of each State, and hence the State specific expenditure needs. Similarly, the term $(p_1 / N)(1 - \rho_1)$ is the change in the revenue need of State 1 resulting from a small change in its revenue raising. Again, the revenue need changes because, as discussed previously, standard revenue, T/N, is a function of the revenue choices of the States. The third term, $\partial c / \partial q_1$, is the change in the balanced budget condition adjustment c.

The total change in the grant is just the sum of the changes in the expenditure and revenue needs, and the balanced budget adjustment. The sign and magnitude of the changes in the two types of need, and the adjustment, will determine the sign and magnitude of the own-grant response term. The sum of these changes can also be expressed simply as $(p_1 / N)(\gamma_1 - \rho_1) + \partial c / \partial q_1$.

The term $\partial n_1 / \partial q_1$ in the public good necessary condition is the change in State 1's population resulting from a small increase in its provision of the local public good. An expression for this has been derived but at this level of generality it cannot be signed and is available from the authors on request. Similarly, an expression for the change in the adjustment term in response to a small increase in State 1's public good expenditure has been derived, cannot be signed, and is available on request.

4. EFFICIENCY

The inefficiency of provision of the local public good in State 1 is illustrated in Figure 1. Efficient provision is at q_1^* where the marginal cost of the public good ($mc_q = p_1$) is equal to the marginal rate of substitution between q and x (marginal benefit of the public good). Provision with equalization is at a point such as q_1 where the marginal cost, adjusted by the migration, grant and adjustment factor responses, is equal to the marginal benefit. Figure 1 illustrates a case of over-provision of the local public good, but as noted above, we might also have under-provision depending on the sign of the own-migration and grant responses (which are in general indeterminate)[12].

The other interesting question from an efficiency perspective is whether the mobile population will be distributed optimally across States in equilibrium. This issue can be assessed by examining the first-best Pareto optimal outcome in a federation that has the same regional structure as our model. The Pareto optimal outcome is characterized by supposing that it is governed by a benevolent central planner who chooses the private and public good provision in either of the States to maximize per capita utility in that State. At the same time, the utility of a representative citizen in the other State is held fixed at some predetermined level. The central planner also takes into account the national feasibility and labor supply constraints[13]. The solution (not presented here but available on request) highlights that there are two conditions that must be satisfied in a Pareto optimum. One is that the Samuelson rule must hold in each State (as shown above, this is not the case in our model). The second is that in equilibrium the mobile population must

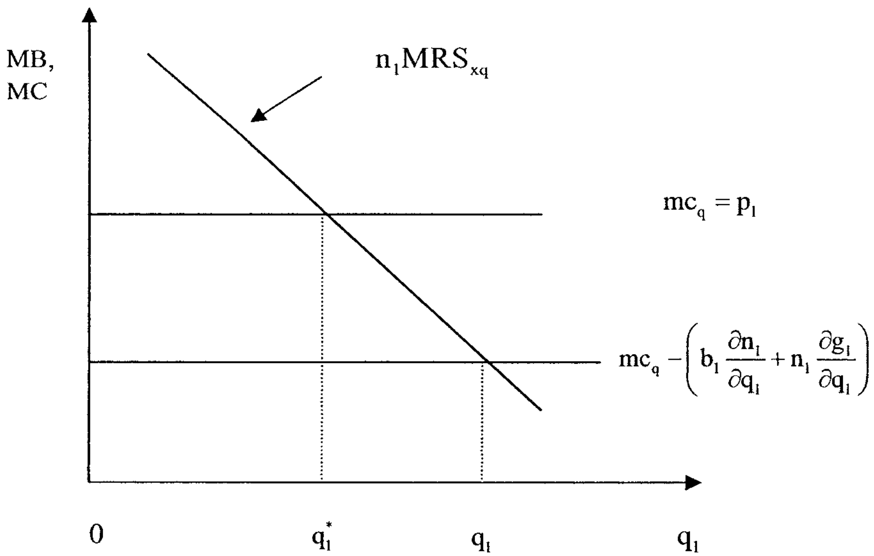

Figure 1. Sub-Optimal Public Good Provision

be distributed between States such that the following 'equating at the margin rule' is satisfied, $(w_1 - x_1) = (w_2 - x_2)$. It is well known that this condition will, in general, not be satisfied because of the presence of fiscal externalities and location specific economic rents that distort migration decisions. Moreover, there is an efficient transfer from State 1 to State 2 that corrects for this distortion and establishes an optimal distribution of the mobile population consistent with the equating at the margin rule. This transfer is found by solving for t from $(w_1 - x_1 - t/n_1) = (w_2 - x_2 + t/n_2)$ to yield[14]

$$t^{opt} = \frac{n_1 n_2}{N} \cdot \left((w_1 - x_1) - (w_2 - x_2)\right) \quad \textit{(Efficient Transfer)} \qquad (17)$$

For the mobile population to be allocated efficiently across States in our model, the inter-State transfer that results from the equalization process would have to be consistent with this efficient transfer. We know that $\sum_i g_i n_i = s \sum_i n_i$ must hold in equilibrium because the CGC is assumed to be setting the adjustment parameter in each State's per capita grant formula to ensure that the condition is satisfied. This implies that the equilibrium inter-State transfer under equalization, denoted by t^E, is

$$t^E = n_1(s - g_1) = n_2(s - g_2). \textit{ (Transfer with Equalization)} \quad (18)$$

Since g_1, g_2, n_1 and n_2 are functions of State policies, for given values of the federal government variables, public good prices and CGC variables, t^E is a function of collective State policies. Thus, through the equalization formula, the inter-State transfer is determined by the collective policies of the States. But there is no reason why the transfer under equalization should be the same as the transfer required for efficiency: hence, $t^E \neq t^{opt}$ and the distribution of labor is inefficient.

5. CONCLUSION AND POLICY IMPLICATIONS

We develop a model that integrates a real world fiscal capacity equalization scheme, namely the Australian one, into a standard model of a decentralized (e.g. federal) economy with optimizing regional governments and factor mobility. This allows us to examine the efficiency of an equilibrium where States are linked together through capacity equalization and where factors of production make location choices while taking into account region-specific rents and externalities.

The key result is that the modeled equilibrium with fiscal capacity equalization is inefficient for two reasons. The first is that it distorts State decisions over expenditure on local public goods. Second, the inter-State transfer that results under fiscal capacity equalization is not consistent with the inter-State transfer required for global efficiency. Thus, in the outcome with fiscal capacity equalization, the spatial allocation of mobile factors is inefficient.

What are the implications for the design of systems of fiscal equalization, given that Australia is seen as having a benchmark model? The first is that standards need to be exogenously set. In the Australian model they are endogenous (see equation (6) where E - a function of States' policies - is an element in the grant function for State i), and this is the source of the inefficiency due to strategic behavior. This raises the question of where standards should come from if they are not to be made a function of what States do on average. Second, capacity equalization yields an inefficient spatial allocation of mobile factors because it is based on factors such as expenditure and revenue needs rather than fiscal externalities and rent sharing (important for efficiency). Regardless of what design changes are made, this source of inefficiency will remain.

An option is to shift from equalization based on fiscal capacity to equalization based on economic efficiency. This would require that countries implement an inter-regional transfer scheme consistent with (17) where the transfer is determined by variables that matter from an efficiency rather than equity point of view. In a world of perfect mobility, such a reform would be unambiguously welfare enhancing as it would make the residents of all States better-off.

Notes

1. The background research for this paper was undertaken under the auspices of an Australian Research Council (ARC) Large Grant. The authors would like to thank the ARC for its support.
2. The "Commonwealth" here refers to the Australian national government.
3. Papers that analyze this idea include Boadway and Flatters (1982), Myers (1990) and Petchey and Shapiro (2000, 2002).
4. See Courchene (1984).
5. This rules out the possibility that people may be 'absentee landlords' (i.e. live in one State and own some of the fixed factor in another). The assumption also implies that as a person migrates from, say, State 1 to State 2, they immediately forfeit their right to fixed factor ownership in State 1, and gain a share of the fixed factor in State 2 upon entry to that State.
6. Defining p_i as the price of the public good, the marginal rate of transformation is simply $1/p_i$. With a linear frontier this ratio is unchanged as we adopt different combinations of x_i and the public good. Therefore, p_i is treated as a parameter. Since it can differ across States, the ratio $1/p_i$ can also vary across States. Thus, generally, States will have differently sloped frontiers.
7. The determination of s could be made endogenous by explicitly modeling national government optimizing behavior. If States took account of the impact of their policy decisions on s, then additional distortions, not directly related to equalization, would be introduced. We abstract from these considerations by supposing that States treat s as given.
8. See CGC (1999).
9. There is no reason, a priori, for the sum of the aggregate grants across all States to exactly exhaust the available grant pool, G. Therefore, one must introduce an adjustment to the per capita needs-based grant estimated for each State to ensure that a 'balanced grant pool condition' is satisfied, i.e. that the sum of the aggregate grants exactly exhausts the pool. The last term, c, in (6) is included to do just that. An explicit expression for c is derived in Annex A.
10. A State also perceives its population size to be a function of its own policy choice. To see this, note that for given $q_1, q_2, p_1, p_2, s, g_1$ and g_2, constraints (i) and (ii) determine n_1 and n_2. We know that g_1 and g_2 are functions of s, N, public good prices, CGC variables and joint State policies. Therefore, for State 1, $n_1(F, P, CGC, S)$ where F, P, CGC and S are as previously defined. State 1, when optimizing according to (13) with Nash conjectures, will perceive everything to be fixed, except its own level of provision

of the public good. Hence, it perceives its population to be a function of its own policy choices.

11. In standard models where States are not linked through an equalization model, the net benefit of a migrant is just $b_1 = (w_1 - x_1)$.
12. In general, the curves in Fig 1 would be non-linear. They are drawn as linear for convenience.
13. For example, see Flatters, Henderson, and Mieszkowski (1974) and Myers (1990) who solve analogous central planner problems.
14. See also Boadway and Flatters (1982) and Boadway, Cuff and Marchand (2003). We can write the optimal transfer alternatively as a function of State specific rents and fiscal externalities (see Petchey (1993)).

References

Boadway, R.W. 2004. The theory and practice of fiscal equalization. *CESifo Economic Studies*, 50(1): 211-54.

Boadway, R.W., Cuff, K., and M. Marchand. 2003. Equalization and the decentralization of revenue-raising in a federation. *Journal of Public Economic Theory*, 5(2): 201-28

Boadway, R.W., and F. Flatters. 1982. Efficiency and equalization payments in a federal system of government: A synthesis and extension of recent results. *Canadian Journal of Economics*, 15: 613-33.

Buchanan, J.M and C.J. Goetz. 1972. Efficiency limits of fiscal mobility: An assessment of the Tiebout model. *Journal of Public Economics*, 1: 25-43.

Commonwealth Grants Commission. 1999. Report on general revenue grant relativities, Vol. II: Methods, assessments and analysis. Canberra: Common wealth of Australia.

Courchene, T. 1984. Equalization payments; past, present and future. *Ontario Economic Council*, Toronto.

Flatters, F., Henderson, V, and P. Mieszkowski. 1974. Public goods, efficiency and regional fiscal equalization. *Journal of Public Economics*, 3: 99-112.

Mansoorian, A., and G.M. Myers. 1993. Attachment to home and efficient purchases of population in a fiscal externality economy. *Journal of Public Economics*, 52: 117-132.

Myers, G.M. 1990. Optimality, free mobility and the regional authority in a federation. *Journal of Public Economics*, 43:107-21.

Petchey, J.D. 1993. Equalization in a federal economy with inter-state migration. *Australian Economic Papers* December: 336-54.

Petchey, J.D. and P. Shapiro. 2000. The efficiency of state taxes on mobile labor income *The Economic Record*, 76:234; 285-96.

Petchey, J.D. and P. Shapiro. 2002. State tax and policy competition for mobile capital. *The Economic Record*, 78:241; 218-28.

Swan, P. and G. Garvey. 1991. The equity and efficiency implications of fiscal equalization. *Mimeograph*. Swan Consultants Pty Ltd.

Tiebout, C.M. 1956. A pure theory of local expenditures. *Journal of Political Economy*, 64(5): 416-24.