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Interjurisdictional Capital Mobility: Fiscal Externality and a Corrective Subsidy

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Recent studies emphasize that local property taxation may result in inefficiently small amounts of local public spending. This paper shows that the inefficiency can be traced to a fiscal externality: when one jurisdiction increases its taxes, it causes a flow of capital to other jurisdictions that increases their tax revenues. The inefficiency can be corrected with a subsidy that internalizes the externality. Key empirical parameters determining the magnitude of the externality are identified. Illustrative calculations indicate that subsidy rates on the order of 40% might be required to achieve efficiency.

I. INTRODUCTION

Recent studies have emphasized that local property taxation may result in inefficiently small levels of local public spending. The essential reason for this result is that interjurisdictional mobility of capital results in infinitely elastic capital supplies to individual localities, even if capital is inelastically supplied to all localities taken together. The property tax therefore appears to be highly distortionary at the local level, whereas, at least in simple models, it may generate a zero or small excess burden for society as a whole. This idea is summarized in somewhat greater detail in the next section of this paper, and has been developed and elaborated by Zodrow and Mieszkowski [35] and Wilson [34] among others.[1]

The contributions of this paper are threefold: first, to develop some better intuition about the source of potential efficiency losses caused by tax competition; second, to discuss possible policy correctives for this inefficiency; and third, to develop a rough assessment of the possible quantitative importance of tax competition.

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[1]Wilson [34] emphasizes that although tax competition leads to underspending when an increase in local taxes drives capital out of the locality, this condition need not always be met —as, for example, when local public production is highly capital intensive. Such possibilities are ignored here. For related analyses, see also Arnott and Grieson [1] and Beck [3]. A survey and additional references can be found in Wildasin [32]; see Oates [14] for early discussion of tax competition.

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Section II begins by showing that the inefficiency associated with tax competition can be understood as a kind of externality. This externality occurs because an increase in the tax rate in one jurisdiction causes a flow of capital to other jurisdictions that increases their tax revenues. The discrepancy between the perceived and true social marginal cost of local public spending is precisely equal to this induced change in tax revenue in other jurisdictions.

Once the inefficiency of tax competition is shown to arise from an external benefit, a remedy for the inefficiency immediately suggests itself, namely, an appropriate subsidy. Section III discusses the subsidy program (presumably administered by a higher level government) that would internalize this externality.

The externality analysis in Sections II and III provides a useful way of thinking about the tax competition effect on local public spending and about ways to remedy it but also prompts a further question: is the externality likely to be important enough quantitatively to justify such subsidy programs? After all, a system of subsidies to local governments would be a complicated and perhaps costly policy to administer, and one would not want to introduce it if it were of negligible importance. Section IV, therefore, attempts to assess the potential practical relevance of tax competition inefficiencies, and of subsidies designed to overcome them. The first objective is to derive expressions for subsidy rates, efficiency losses, etc., that are stated in terms of recognizable empirical parameters. Several such measures are derived. These are then calculated numerically, based on a range of assumptions about the values for the critical parameters. For example, a range of estimates is provided for the marginal subsidy rate that would internalize the property tax externality. It appears that subsidy rates as high as 40% might be called for, in the absence of any other federal and state aid to local governments. Given the current high level of intergovernmental transfers, however, substantially smaller subsidies would be justified by fiscal externality considerations. It is also possible to estimate the allocative inefficiency caused by inadequate local government spending if one knows the elasticity of demand for public goods. At the margin, this could amount to 20% of local government spending, or about 0.2% of GNP.

Section V reviews some of the most important simplifying assumptions on which the analysis is based, and, in some cases, the implications of relaxing them. This discussion shows that the applicability of the analysis in the present paper depends, among other things, on certain unresolved empirical issues, and it identifies problems for future research.

II. TAX COMPETITION AS AN EXTERNALITY

Let us begin by clearly identifying the nature of the problem. Suppose the economy contains a fixed stock $\bar{K}$ of perfectly mobile capital. For the

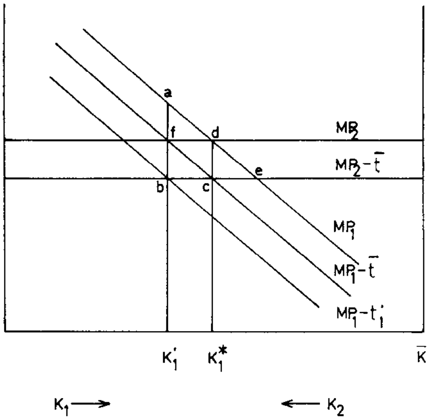

FIGURE 1

sake of diagrammatic exposition, it is convenient to divide the economy into two parts, a single small jurisdiction 1 and a large jurisdiction 2 representing all other jurisdictions. Each jurisdiction uses only a per unit tax on mobile capital, at rate t_i, to finance its public expenditure. Capital is employed in each jurisdiction to produce a homogeneous private good, and MP_i represents the marginal product of capital in i. Since we are concerned with the incentives facing locality 1, and since this locality is small, assume that jurisdiction 2's marginal product of capital is essentially constant over the relevant range. In Fig. 1, capital in jurisdiction 1, K_1, is measured on the horizontal axis in the positive direction. Then the amount of capital in jurisdiction 2, K_2, is $\bar{K} - K_1$ and diminishes as one moves to the right. MP_1 is diminishing in K_1, but MP_2 is unaffected by K_1 over the range in question.

An efficient allocation of capital requires equal marginal products, and occurs at $K_1 = K_1^*$. This can of course be achieved as a competitive equilibrium in a taxless world. It can also be achieved in a world of equal taxes: if the (per unit) tax rates in each locality, t_1 and t_2, are equal to a common rate $\bar{t}$, the equilibrium would occur where $MP_1 - t_1$ and $MP_2 - t_2$ intersect, i.e., at K_1^* once again.

Now, starting from the equal tax rate situation with $t_1 = t_2 = \bar{t}$, suppose locality 1 considers increasing t_1 to t_1', resulting in a new equilibrium at K_1' (assuming 1's policy change does not affect the tax policy of other jurisdictions). As seen from locality 1, which takes the net return on capital as fixed at $MP_2 - \bar{t}$, the tax rate $\bar{t}$ causes an excess burden of *cde*, and the new tax results in an excess burden of *abe*. Hence, the tax increase generates an incremental excess burden of *abcd*.[2] This excess burden, plus the incremental tax revenue itself, is the cost to the locality of the extra spending that an increase in t_1 to t_1' would finance, and that must be traded off against the benefit of that spending. The true loss of output to society resulting from this incremental tax is only *afd*, however, and only this should be added to incremental tax revenue to determine the incremental social cost of the extra revenue. The difference, *fbcd*, is perceived as an incremental excess burden by locality 1, but actually corresponds to an increase in tax revenue to jurisdiction 2. This is the result of an increase in tax base in jurisdiction 2, taxed at rate $\bar{t}$, that offsets the loss of tax base in jurisdiction 1. Thus, since there is a local loss from taxation that does not correspond to a social loss, the cost of local public goods is overstated and jurisdictions will tend to underspend on local public goods. Note that the social loss from an increase in t_1 from $\bar{t}$ to t_1' is equal to $1/2\ (t_1' - \bar{t}')(K_1^* - K_1') = -1/2\, \Delta t\, \Delta K$, while the local loss that represents a simple transfer of tax revenue to other jurisdictions is $fbcd = -\bar{t}\,\Delta K$. For small changes, this social loss vanishes to a first approximation, while the transfer does not. In short, starting from an initial equal tax rate situation, the true social cost of raising spending by \$1 in locality 1 is just \$1. The jurisdiction perceives a cost of greater than \$1, however. In the language of externality theory, local taxation generates an external benefit to other jurisdictions. Too little of the externality-generating activity tends to occur in equilibrium.

Strictly speaking, this analysis applies only to the case where all jurisdictions other than 1 impose a common rate of taxation on capital of $t_2 = \bar{t}$. It is intuitively clear, however, that the extension to the many-jurisdiction case involves no new theoretical principles. The only difference is that a decrease in K_1 increases the capital stock in many jurisdictions $j = 2, \ldots,$ each of which may impose a different tax rate t_j. The part of the local marginal excess burden that corresponds to a transfer to other localities rather than to a true social loss is thus $\Sigma_{j \neq 1} t_j\, \Delta K_j$. This of course reduces to the simple 2-jurisdiction case if $t_j = \bar{t}$ all $j \neq 1$.

III. A PIGOVIAN REMEDY

The preceding section has identified a revenue spillover associated with the capital outflow from any jurisdiction that raises its taxes. As a consequence, each locality has an incentive to undertax capital, or, equivalently, to underspend on local public goods. To remedy this problem, standard

[2] Implicit in this excess burden analysis, and in the analysis in the rest of this paper, is the concept of a real income change for a locality. This approach is justified if each locality contains a single household or many identical households, if the locality is small so that the prices of all traded goods and factors are treated as exogenous, and if all immobile factors located in the jurisdiction are locally owned. Under these assumptions, welfare analysis for a locality is identical to that for a single consumer.

externality arguments suggest that a subsidy should be paid to each jurisdiction i that is equal, at the margin, to the tax revenue that flows into other jurisdictions as a result of an increase in its taxes or spending. Thus, if S_i is the total subsidy paid to i, it should satisfy

$$\frac{dS_i}{dt_i} = \sum_{j \neq 1} t_j \frac{dK_j}{dt_i}, \tag{1}$$

where dK_j/dt_i shows how the equilibrium capital stock in j varies with t_i.

To see how such a subsidy would change the local incentive to spend on public services, let us evaluate and compare the marginal cost to a locality of a dollar's worth of public spending, with and without the subsidy program described in (1).

First, consider the local marginal cost of public spending without a subsidy. If locality i treats the net return to capital as exogenous, an increase in t_i by dt_i entails an equal increase in the gross cost of capital to locality i. The loss of real income to the locality is thus $K_i\,dt_i$. Since the local tax base is mobile, however, local revenues do not increase by an equal amount. In fact, if dK_i/dt_i denotes the derivative of the equilibrium capital stock in i w.r.t. t_i, the change in revenue is $d(t_iK_i) = K_i\,dt_i + t_i(dK_i/dt_i)\,dt_i$. Thus, the loss of real income per dollar of extra tax revenue raised, i.e., the marginal cost to the locality of a \$1 increase in public spending, is

$$\mathrm{MC}_i = \frac{K_i}{K_i + t_i dK_i/dt_i} > 1, \tag{2}$$

where the inequality follows because $dK_i/dt_i < 0$.[3]

Now consider the cost to locality i of an increase in spending when the subsidy program (1) is in effect. An increase dt_i of the local tax rate still entails a loss of $K_i\,dt_i$ in real income to the locality. However, it now generates incremental revenue equal to

$$\begin{aligned}\left(\frac{d(t_iK_i)}{dt_i} + \frac{dS_i}{dt_i}\right) dt_i &= \left(K_i + t_i\frac{dK_i}{dt_i} + \sum_{j \neq i} t_j \frac{dK_j}{dt_i}\right) dt_i \\ &= K_i\,dt_i + \sum_{j \neq i} (t_j - t_i)\frac{dK_j}{dt_i}\,dt_i,\end{aligned} \tag{3}$$

[3] This formula is similar to those appearing in the literature on public expenditure with distortionary taxation. See Atkinson and Stern [2], Stuart [20], Topham [21, 22], Usher [26], and Wildasin [29].

using $dK_i/dt_i + \Sigma_{j \neq i} dK_j/dt_i = 0$. Thus, the perceived cost of raising revenue in i, given the subsidy program, is

$$MC_i^* = \frac{K_i}{K_i + \sum_{j \neq i} (t_j - t_i)(dK_j/dt_i)} \tag{4}$$

Comparing (2) and (4) establishes that $MC_i \geq MC_i^*$, given that $t_i \geq 0$ and $dK_j/dt_i \geq 0$. Indeed, if $t_j > 0$ and $dK_j/dt_i > 0$ for at least one j, the marginal subsidy to i given by (1) is strictly positive, so that $MC_i > MC_i^*$ (i.e., the inequality is strict). In the special case where all tax rates are initially equal, $t_j = t_i$ all j, $MC_i^* = 1$. This accords with the intuition developed in Section II: with all tax rates initially equal, there is no social marginal excess burden from local taxation, so the social cost of an extra dollar of local spending is just \$1.

When tax rates are unequal across jurisdictions, unambiguous results on the magnitude of MC_i^* can be obtained for the localities with the highest and lowest tax rates. If $t_i > t_j$ all j, then there is initially "too little" capital in i from the viewpoint of efficient resource allocation, and, from the social viewpoint, there is a positive marginal excess burden from the property tax in i. In accordance with this, (4) shows that $MC_i^* > 1$. (This assumes that $dK_j/dt_i > 0$, all $j \neq i$, as discussed formally below.) Conversely, if $t_i < t_j$ all j, there is initially "too much" capital in i, and, accordingly, (4) shows that $MC_i^* < 1$. Outside of these extreme cases, it is not possible to determine whether or not $MC_i^* > 1$ a priori. In any case, however, the marginal subsidy is definitely nonnegative.[4]

IV. THE MAGNITUDE OF THE EXTERNALITY, SUBSIDY RATE, AND WELFARE LOSS; ILLUSTRATIVE ESTIMATES

The analysis of Sections II and III has demonstrated the general proposition that local property taxation generates external benefits that might be internalized through a system of subsidies. It has not, however, demonstrated that these externalities are likely to be empirically important. This section presents illustrative calculations of key variables in order to show that property tax externalities can indeed be quite large.

Of course, this exercise presupposes some way of determining what constitutes a large externality. Several distinct but related measures are

[4]One might expect that $MC_i^* > 1$ if t_i is "large," but $MC_i < 1$ if t_i is "small." In the former case, the $t_j - t_i$ terms in (4) are negative for most values of j, so $\Sigma_{j \neq i}(t_j - t_i)(dK_j/dt_i)$ is likely to be negative, and conversely for the latter case. However, the weights dK_j/dt_i in this weighted sum depend on the nature of the demand for capital in each jurisdiction and need not be the same for all j. Thus, even if t_i is one of the highest tax rates in the system, it is theoretically possible to have $MC_i^* < 1$, and conversely for low tax rates.

employed here. One is the ratio MC^*_i/MC_i, that is, the ratio of the marginal cost of public spending with an optimal subsidy to the marginal cost without a subsidy. This ratio shows how much the cost of local public goods would be reduced by the optimal subsidies or, if one prefers, the ratio of the "social" to the "local" marginal cost of local public goods. A second measure, which will be denoted MS_i, is the additional subsidy that a jurisdiction optimally receives when it raises an extra dollar of own-source revenue. The third and fourth measures take into account the fact that the allocative impact of a subsidy scheme depends on the elasticity of demand for local public goods. Note that in the limiting case of perfectly inelastic demands, the fiscal externality of local property taxes causes no reduction at all in the level of local public good provision, and is of no allocative significance. Therefore, our third and fourth measures of the size of the externality are estimates of the marginal and total welfare gain from the introduction of subsidies to local spending, respectively. Finally, we estimate the increase in local public expenditure that would result from optimal subsidies. These last three measures directly reflect the allocative impact of the externality.

Before they can be estimated, these externality measures must be expressed in terms of recognizable parameters. In particular, since interjurisdictional capital flows are central to the fiscal externality created by local property taxation, it is necessary to specify the general equilibrium structure of the economy and to solve for the derivatives dK_j/dt_i.

First, let $f_i'(K_i)$ be the marginal productivity of capital in i, and let ρ denote the net return to capital. In equilibrium, capital earns ρ in all locations, so that

$$f_i'(K_i) - t_i - \rho = 0 \qquad \text{all } i. \tag{5}$$

This system of equations can be used to solve implicitly for $K_i(\rho + t_i)$, all i, with

$$K_1' = \frac{1}{f_i''} < 0, \tag{6}$$

provided of course that we assume $f_i'' < 0$. The equilibrium value of ρ is determined implicitly by the market-clearing condition

$$\bar{K} - \sum_j K_j(\rho + t_j) = 0. \tag{7}$$

from which one obtains

$$\frac{d\rho}{dt_i} = \frac{-K_i'}{\sum_j K_j'} < 0. \tag{8}$$

Now, defining the elasticity of demand for capital in locality j as $\varepsilon_j = \partial \log K_j / \partial \log(\rho + t_j)$, one obtains

$$\frac{dK_i}{dt_i} = K_i'\left(1 + \frac{d\rho}{dt_i}\right) = K_i'\left(\frac{\sum_{j \neq i} K_j'}{\sum_j K_j'}\right)$$

$$= \frac{\varepsilon_i K_i}{\rho + t_i} \frac{\sum_{j \neq i} \frac{\varepsilon_j K_j}{\rho + t_j}}{\sum_j \frac{\varepsilon_j K_j}{\rho + t_j}} < 0 \tag{9.1}$$

$$\frac{dK_j}{dt_i} = K_j' \frac{d\rho}{dt_i} = \frac{-K_j' K_i'}{\sum_j K_j'}$$

$$= -\frac{\frac{\varepsilon_j K_j}{\rho + t_j} \frac{\varepsilon_i K_i}{\rho + t_i}}{\sum_j \frac{\varepsilon_j K_j}{\rho + t_j}} > 0, \qquad j \neq i. \tag{9.2}$$

These results clearly show that the pattern of interjurisdictional capital flows that results from an increase in one locality's tax rate depends, among other things, on the demand elasticities for capital throughout the economy. A priori, these can vary widely. Note that $dK_i/dt_i \to 0$ as $\varepsilon_i \to 0$, and that $dK_j/dt_i \to 0$ as $\varepsilon_j \to 0$. If $\varepsilon_i \to 0$, both $\text{MC}_i \to 1$ and $\text{MC}_i^* \to 1$: since changes in t_i have little effect on the allocation of capital, excess burdens and fiscal externalities become negligible. If $\varepsilon_j \to 0$, MC_i^* and the marginal subsidy rate to locality i become independent of t_j: intuitively, when $|\varepsilon_j|$ is small, so little capital will flow between i and j in response to tax changes that they are virtually independent economies and their interaction can be ignored.

In principle, one might ascertain the value of the demand elasticity for every jurisdiction in the economy. This would be a large and costly undertaking, however, since the number of localities in any economy, especially a large economy such as the United States, is very large. Even the number of large cities is large. In practice, then, this elasticity could be obtained for only a small sample of jurisdictions at best. Recognizing this fact, let us assume throughout the remainder of this discussion that the demand elasticity for capital is the same in all jurisdictions, denoted by ε. Although interjurisdictional variation in this parameter might conceivably be large, the analysis of fiscal externalities based on the assumption of a uniform ε will not be seriously misleading unless variations in the demand elasticity are strongly correlated with tax rates and with the initial values of the capital stock in each locality (the K_j's).[5]

To express MC_i and MC_i^* in a form suitable for estimation, it is helpful to convert from per unit to ad valorem taxes. For a per unit tax of t_j, the equivalent ad valorem rate is $\tau_j = t_j/(\rho + t_j)$, so that $t_j = \tau_j\rho/(1 - \tau_j)$. Substituting into (9), using $\varepsilon_i = \varepsilon_j = \varepsilon$, defining $\sigma_j = K_j/\bar{K}$, and then substituting into (2) and (4) yields

$$MC_i^{-1} = 1 + \tau_i\varepsilon \frac{\sum_{j \neq i} (1 - \tau_j)\sigma_j}{\sum_j (1 - \tau_j)\sigma_j} \tag{10.1}$$

$$(MC_i^*)^{-1} = 1 + \frac{\sum_{j \neq i} \left(\frac{\tau_j}{1 - \tau_j} - \frac{\tau_i}{1 - \tau_i} \right)(-\varepsilon)(1 - \tau_j)(1 - \tau_i)\sigma_j}{\sum_j (1 - \tau_j)\sigma_j}. \tag{10.2}$$

From (10), it is simple to compute MC_i, MC_i^*, and, of course, their ratio.

If an optimal subsidy program satisfying (1) was in place, incremental dollars of local taxes would generate extra subsidies. The *marginal subsidy rate* for jurisdiction i, denoted MS_i, is defined to be the extra subsidy received per dollar of local revenue. Using (1) and (9), and assuming equal ε_j's,

$$MS_i = \frac{dS_i/dt_i}{d(t_iK_i)/dt_i} = \frac{\sum_{j \neq i} (-\varepsilon)\tau_j(1 - \tau_i)\sigma_j}{\sum_j \sigma_j(1 - \tau_j) + \tau_i\varepsilon \sum_{j \neq i} \sigma_j(1 - \tau_j)}. \tag{11}$$

Of course, MC_i, MC_i^*, and MS_i are all related. In fact, it is easily verified that

$$\frac{MC_i^*}{MC_i} = \frac{1}{1 + MS_i}. \tag{12}$$

Therefore, MC_i^* and MS_i are really the same measure of fiscal externality, in the sense that they contain the same information. They portray this information in somewhat different ways, however, so both are useful.

[5]It would be feasible to carry unequal ε_i's through in the remaining analysis, as the reader can verify. Few theoretical propositions can be established in the general case, however, as already discussed. Given the absence of jurisdiction-specific empirical estimates, consideration of the general case is not useful for empirical purposes either. It seems best, therefore, to focus on the special case.

To obtain a measure of the allocative inefficiency that results from the uninternalized external benefits of property taxation, assume that localities choose public spending levels to equate the marginal benefit of local public goods to their marginal cost to the locality.[6] If MB_i is the marginal benefit to jurisdiction i per dollar of local public expenditure, the level of public spending z_i that is chosen in the absence of any subsidy will satisfy

$$\mathrm{MB}_i = \mathrm{MC}_i. \tag{13}$$

With an optimal subsidy, jurisdictions would set $\mathrm{MB}_i = \mathrm{MC}_i^*$. The amount of locality i's underspending on local public goods in the unsubsidized equilibrium, in percentage terms, is approximately $-\eta_i(\mathrm{MC}_i - \mathrm{MC}_i^*)/\mathrm{MC}_i^*$, where η_i is the elasticity of demand for local public goods in i. The deadweight loss from this underspending is approximately

$$\mathrm{DWL}_i = -\frac{1}{2}(\mathrm{MB}_i - \mathrm{MC}_i^*)\eta_i \frac{\mathrm{MC}_i - \mathrm{MC}_i^*}{\mathrm{MC}_i^*}, \tag{14}$$

expressed as a percentage of total public expenditure in the locality. Substituting from (13) allows one to express DWL entirely in terms of MC_i and MC_i^*, or, using (10), in terms of ε, tax rates, and capital shares.[7]

Of course, while the total welfare loss DWL_i is a useful measure of the allocative impact of the property tax externality, it is also important to evaluate the impact of small movements toward an optimal policy. Consider, therefore, the effect of a subsidy to local governments equal to 1% of their spending on local public goods. This would lower the price of local public goods by 1%, increase provision of these goods in locality i by $-\eta_i$%, and generate a welfare gain of $-(\mathrm{MB}_i - \mathrm{MC}_i^*)\eta_i$% of local public spending. The cost of the subsidy would be 1% of local public spending.

[6]As discussed further below, the results of the welfare analysis could change substantially if one postulates a decision making mechanism for local public expenditure that departs significantly from this assumption.

[7]This expression for deadweight loss is approximate because it linearizes the demand curve for local public goods and because it is imprecise about whether ε is a compensated or uncompensated elasticity. (See Wildasin [30] for discussion of this issue, which is simply glossed over here.) It is also approximate because MC_i and MC_i^* actually vary as tax rates vary. The introduction of a subsidy scheme would change local spending in all jurisdictions, and would change the entire interjurisdictional pattern of property tax rates. Formula (14) makes no allowance for these interactions. Note, however, that in the important special case where all localities are identical, $\mathrm{MC}_i^* = 1$ for all i, both before and after the subsidy program is introduced. Most of the estimates below are in fact based on the assumption of identical jurisdictions, and the evaluation of MC_i^* in (14) presents no difficulties in this case. In other cases, MC_i^* is evaluated at its presubsidy or initial equilibrium value. The errors involved in such cases are likely to be quite small.

Therefore, the welfare gain per dollar of subsidy to locality i, or the marginal deadweight loss from not subsidizing local public spending, is

$$\text{MDWL}_i = -(\text{MB}_i - \text{MC}_i^*)\eta_i. \tag{15}$$

Let us now consider some estimates of these externality measures. To simplify the computations, assume that all jurisdictions initially contain equal amounts of capital, so that $\sigma_i = 1/n$, all i, where n is the number of jurisdictions.[8] Also, let us assume that all localities have identical elasticities of demand for local public goods, η.

A convenient benchmark case, Case 1, sets $|\varepsilon| = |\eta| = 1$, $n = 25$, and $\tau_i = 0.3$ for all i. The elasticity estimates are those that would be obtained for Cobb–Douglas preferences and technology for private and public goods and therefore make a useful reference point. The property tax rate of $\tau = 0.3$ is an estimate of what the rate of property taxation would be in the absence of any higher level government financial support for local governments, assuming that local government spending was held constant.[9]

The results for Case 1, presented in the first row of Table 1, show that the size of the external benefit from local property taxation can be substantial.

[8]The capital shares determine the weights to be applied to various tax rates. When all tax rates are identical, the values of the σ_j's are irrelevant for the calculations of our externality measures. When tax rates vary across jurisdictions, the effect of having large (or small) jurisdictions with high (or low) tax rates can be estimated approximately by assuming that there is a large (or small) number of "standard size" jurisdictions with high (or low) tax rates. Variations of our estimates along these lines could easily be computed, but there is little empirical basis for such a computation. We therefore confine attention to the simplest case here.

[9]Note that the 1982 "Census of Governments" (U.S. Department of Commerce [25, Table S]) finds a median effective property tax rate of 1.09% for all categories of property for selected localities in the United States (in some major cities, the rate is much higher—e.g., 1.73% for New York City, 1.42% in Cook County, Illinois, 1.97% in Baltimore, and 4.1% in Detroit (U.S. Department of Commerce [25, Table 22])). In 1981–1982, 37% of local government revenue was received from the federal and state governments, while 25% was derived from local property taxes (U.S. Department of Commerce [25, Table G]). If the localities had received no transfers from higher level governments, and had made up this revenue from the local property tax, property tax rates would have been about 148% higher (assuming a fixed tax base), or about 2.7% of the value of property. If gross rents are 10% of property value, the effective property tax rate on rents would then have been about 27% in the absence of transfers from higher level governments. Note, for comparison, that the median effective rate was 1.85% in 1967 (U.S. Department of Commerce [23, p. 15]), while revenue from higher level governments was 80% of local property tax revenues in 1966–1967 (U.S. Department of Commerce [24, Table 4]). Similar calculations to those given above yield an effective property tax rate in 1967 of 33% of rental value, again on the assumption of no transfers from federal and state to local governments. These calculations justify a value of $\tau_i = 0.3$ as a rough approximation to the property tax rates that would have been observed in recent decades in the United States in the absence of intergovernmental transfers.

TABLE 1

Case	n	$\|\varepsilon\|$	$\|\eta\|$	Tax rates	$\frac{MC^{*a}}{MC}$	MS	DWL	MDWL	% Quantity change
1	25	1	1	$\tau_j = .3$ (all j)	.712	.404	.082	.404	.404
2	25	1	0.5	$\tau_j = .3$ (all j)	.712	.404	.041	.202	.202
3	25	1	0.2	$\tau_j = .3$ (all j)	.712	.404	.016	.081	.081
4	25	0.5	1	$\tau_j = .3$ (all j)	.856	.168	.014	.168	.168
5	25	1.3	1	$\tau_j = .3$ (all j)	.626	.598	.089	.598	.598
6	25	1.5	1	$\tau_j = .3$ (all j)	.568	.761	.289	.761	.761
7	3	1	1	$\tau_j = .3$ (all j)	.800	.250	.031	.250	.250
8	50	1	1	$\tau_j = .3$ (all j)	.701	.416	.087	.416	.416
9	25	1	1	$\tau_j = .1$ (all j)	.904	.106	.006	.106	.106
10	25	1	0.5	$\tau_j = .1$ (all j)	.904	.106	.003	.053	.053
11	25	1	1	$\tau_j = .2$ $j = 1,\ldots,5$	.708	.412	.074	.361	.412
				$\tau_j = .3$ $j = 6,\ldots,20$	.712	.404	.082	.404	.404
				$\tau_j = .4$ $j = 21,\ldots,25$	.716	.397	.092	.463	.397
12	25	1	0.5	$\tau_j = .2$ $j = 1,\ldots,5$	.708	.412	.037	.180	.206
				$\tau_j = .3$ $j = 6,\ldots,20$	.712	.404	.041	.202	.202
				$\tau_j = .4$ $j = 21,\ldots,25$	.716	.397	.046	.213	.198

[a]Source: Author's computation, as explained in text.

The marginal subsidy rate is over 40%, and the social marginal cost of local spending is only 71% of the cost perceived by the locality. (Note that $MC^* = 1$ for all jurisdictions in this and all subsequent cases where tax rates are uniform across localities. The implied values of MC are thus easily inferred from the table.) A 40% subsidy would lead to a 40% expansion of the local public sector, given $\eta = 1$, and 0.40 is also the marginal social benefit (MDWL) per dollar of subsidies paid to localities. Of course, the distortion of local public spending becomes less severe as the level of spending rises, and the gains from additional subsidies diminish. In total, the deadweight loss from distorted local public spending in this case is 8.2% of total spending. Given that local public spending amounts to about 5% of the U.S. GNP, this loss would be about 0.4% of the GNP.

These figures show that property tax externalities are *potentially* important. Let us now experiment with different parameter values to see how robust these estimates are.

First, note the changes in η do not affect the size of the external effect as measured by the marginal subsidy rate or by MC^*/MC. The value of η does strongly influence the welfare impact of the externality, however, and indeed DWL and MDWL are proportional to η as shown in (14) and (15). Empirical work on the demand for local public goods, as surveyed in Inman [9] and more recently by Rubinfeld [18] would indicate lower elasticities, perhaps as low as 0.2. Cases 2 and 3 consider how the results change for $\eta = 0.5$ and $\eta = 0.2$. The welfare loss and quantity charge measures fall to 50 and 20%, resp., of their previous values. These measures are still nonnegligible, although in Case 3 they are all less than 10%.

A parameter which directly affects the perceived marginal cost of public goods to a jurisdiction is the demand elasticity for capital, ε. To determine reasonable values for it, suppose that mobile capital combines with one other perfectly immobile factor of production in a constant return to scale production function. If the locality faces a perfectly elastic demand for its output, if σ^* denotes the elasticity of substitution between capital and the immobile input, and if α_k is capital's share of income, then one can show

$$\varepsilon = -\frac{\sigma^*}{1 - \alpha_k}. \qquad (16)$$

More generally, if the demand for output is less than perfectly elastic, $|\varepsilon|$ will be smaller also. (See, e.g., Wildasin [31, p. 104] for derivations.) In fact, if $\sigma^* = 1$ and the demand for local output is unit-elastic, $\varepsilon = -1$. In the extreme, if the demand for local output is perfectly inelastic, $\varepsilon = 0$, regardless of the values of σ^* and α_k. On the other hand, (16) shows that $|\varepsilon|$ could well be greater than 1 for the case of perfectly elastic output demand. For example, $\sigma^* = 1$ and $\alpha_k = \frac{1}{3}$ implies $\varepsilon = -1.5$. Empirical evidence on substitution elasticities favors a value of σ^* less than 1, however. This might put ε close to -1 again.

In order to show how the analysis is affected by wide variations in ε, Cases 4, 5, and 6 consider $\varepsilon = 0.5$, $\varepsilon = -1.3$, and $\varepsilon = -1.5$. In the first of these cases, the marginal subsidy rate falls to only about 17% and the social marginal cost rises to 86% of that perceived by the locality. A small subsidy program still generates a substantial welfare gain, 17% per dollar of subsidy, although this would be cut in half if we assumed a perhaps more realistic value of 0.5 for $|\eta|$. The total deadweight loss from the fiscal externality is only 1.4% of local government spending with this low value of ε, even when $|\eta| = 1$.

On the other hand, Cases 5 and 6 show that the externality increases substantially when $|\eta| > 1$. For example, the marginal subsidy rates are 60 and 76%, resp., when $|\varepsilon| = 1.3$ and $|\varepsilon| = 1.5$, and the welfare loss measures likewise are much higher as well. These calculations show not only that the magnitude of ε is an important determinant of the fiscal externality, which we already know on theoretical grounds, but also that variations of this parameter within the range that seems consistent with empirical work can have a substantial impact on the size of the externality. In short, ε is a parameter that one would need to estimate with considerable accuracy if one actually sought to implement a scheme of corrective subsidies.

Cases 7 and 8 are included to show the effect of variations in n on the estimates. Our theoretical analysis is predicated on the assumption that jurisdictions are "small." If jurisdictions are large, they may interact strategically, a kind of behavior we have abstracted from. Moreover, taxes imposed by large jurisdictions will depress the net return to capital, so that capital outflows in response to tax increases are smaller. This would work to reduce the fiscal externality. Case 7, with $n = 3$, confirms this fact. More importantly, from the practical perspective of simulation methods, when is n "large enough?" A comparison of Cases 1 and 8 show that increasing n from 25 to 50 has little impact on the results. Hence, $n = 25$ is "large enough" for our purposes.

As noted earlier, effective tax rates might be as high as 30% in the United States if local governments obtained no assistance from higher level governments. An analysis of the rationale for subsidies to local governments is most useful when localities are assumed to be initially unsubsidized. However, given that local governments do receive substantial transfers, and given that local property tax rates are in fact substantially lower than 30%, it is obviously of interest to determine the amount of any remaining fiscal externality, starting from the current situation with low tax rates.

Cases 9 and 10 address this question. Each assumes that localities have uniform property tax rates of only 10%. Case 9 otherwise conforms with the benchmark Case 1, while Case 10 sets $|\eta|$ at a more realistic value of 0.5. The reduction in the tax rate greatly reduces the size of the fiscal externality. The marginal subsidy rate drops from 40% in the benchmark case to only 11%, and the marginal deadweight loss is only 11% when $|\eta| = 1$ or 5% when $|\eta| = 0.5$. Clearly the rationale for additional subsidies to local governments is much weaker when existing levels of transfers have already reduced tax rates substantially. Intuition leads one to expect just such a conclusion, of course: the first few steps toward the reduction of an externality bring the biggest welfare gains, and incremental steps bring diminishing benefits.

Finally, Cases 11 and 12 examine the implications of diversity of tax rates among jurisdictions. In each case, five jurisdictions have 20% tax rates, five have 40% tax rates, and the remainder have 30% rates. In case 11, other parameters assume their benchmark values, while Case 12 sets $|\eta| = 0.5$.

Note first that the results for Cases 11 and 12 are identical to those of Cases 1 and 2 for the localities with average tax rates. All of the differences arise for the below- and above-average tax rate jurisdictions. One interesting result is that localities with lower tax rates receive higher subsidy rates. The rationale for this result is that capital that leaves a low-rate locality will (on average) move into a jurisdiction with higher rates, thus generating a higher fiscal externality. For n large, however, this effect is very small. More interesting is the fact that MC_i^* is not unity for all i, unlike the uniform tax cases previously considered. Indeed, in both cases, $MC_i^* = 0.875$ for low-tax localities and $MC_i^* = 1.167$ for high-tax ones (figures not shown in table). Also, $MC_i = 1.236$ for low-tax localities and $MC_i = 1.629$ for high-tax ones. As shown in the table, the ratio of these two numbers does not vary greatly across jurisdictions. Note that their *absolute* difference, however, does vary quite a lot: $MC_i - MC_i^* = 0.361$ for $i = 1, \ldots, 5$ and $= 0.463$ for $i = 21, \ldots, 25$. It is this absolute spread that determines the size of the allocative inefficiency in local public spending, as shown in (14) and (15). Accordingly, the welfare loss from the fiscal externality is higher in the high-tax localities, and the welfare gains from directing subsidies toward them are also correspondingly high. This is true even though a system of subsidies that internalize the externality would cause somewhat smaller percentage increases in spending in the high-tax jurisdictions.

V. CONCLUSIONS

It is reasonable to infer from the above calculations that property taxation of highly mobile capital could result in significant misallocation of resources. The subsidy rates required to internalize such externalities might be quite high. The results also suggest, however, that the magnitude of such externalities is far lower at current local tax rates than would be the case at the rates one might observe if local governments relied entirely on own-financing. That is to say, existing levels of intergovernmental transfers to local governments have probably reduced local tax rates and increased local public spending enough so that there is only a weak case for further subsidies on fiscal externality grounds. Indeed, it is quite possible that existing explicit and implicit subsidy rates for local spending, via matching grants and federal income tax deductibility of local taxes, are already higher than can be justified on tax competition grounds. To address this question adequately would require a detailed examination of the effective marginal subsidy rates to local governments, however, which is beyond the scope of the present paper.[10]

These tentative conclusions are subject to a number of qualifications, and cannot support specific policy recommendations. The remainder of this section enumerates several important qualifications that limit the applicability of the estimates in Section IV. Readers who judge these limitations to be relatively unimportant may wish to attach greater weight to the tentative conclusions just offered. Alternatively, the following qualifications may be seen as part of an agenda for future research.

[10]See also Wildasin [30] for a welfare analysis of grant policy, including the effects of matching grants. That analysis deals with the case where local taxes are inherently distortionary, and it also abstracts from interjurisdictional factor mobility. A further analysis unifying these two would be quite useful.

To begin with, the model used here has focused solely on tax competition among jurisdictions. One observes, however, that localities provide public services to households and firms, and that these public services can attract both workers and capital. Tax competition, therefore, should be seen as only one aspect of the more general phenomenon of "fiscal competition," that is, competition with both tax and expenditure instruments. A thorough analysis of this issue goes beyond the scope of the present paper. Note, however, that the model presented above can be interpreted as including expenditure competition in a rather simple way. In particular, suppose that in addition to whatever other public goods it provides (e.g., for resident households), locality i also provides some public services for each unit of local capital. Suppose that these services cost c_i per unit of capital, and that they raise the net return on capital by s_i. Let $t_i^{\#}$ now denote the tax levied per unit of capital. The net return to capital is now $\mathrm{MP}_i - (t_i^{\#} - s_i)$, which is equated across jurisdictions in equilibrium.

In the special case where $c_i = s_i$, the public services provided to capital are functionally equivalent to tax reductions in terms of their impact on the return to capital and on the local government budget. If one then defines $t_i = t_i^{\#} - s_i$, the analysis in Sections II–IV above goes through unchanged. However, one should recognize that t_i in the model no longer corresponds to effective tax rates. To obtain t_i empirically, one must reduce the effective tax rates $t_i^{\#}$ by the subsidy rates s_i. Seen from this perspective the foregoing analysis has assumed $s_i = 0$. If $s_i > 0$ in practice, the above quantitative estimates of the distortions caused by tax competition, and of the subsidy rates required to correct these distortions, are biased upward. More generally, one might have $c_i \neq s_i$, which would occur if local public services generate increases in the return to capital that exceed ($s_i > c_i$) or fall short of ($s_i < c_i$) their cost to the locality. In either case, $\mathrm{MP}_i - t_i$ must still be equalized across localities in equilibrium. Now, however, the net benefit generated by the entry of a unit of capital into locality i is $t_i^{\#} - c_i = t_i^{\#} - s_i + s_i - c_i = t_i + s_i - c_i$. If, for example, extra units of capital require very costly services, so that $c_i > s_i$, the net benefit to the locality of extra capital is reduced below t_i. In this case, a locality that raises its property tax generates smaller external benefits for other jurisdictions, and optimal subsidy rates should be adjusted downward accordingly. Conversely, if $c_i < s_i$, optimal subsidy rates should be increased. Which of these possibilities might be empirically more relevant, and indeed whether either is empirically important at all, is a question worth further exploration.

A second limitation of the model used here is that it has assumed that each locality can be modeled as if it contains a single immobile household, whose preferences for private and public goods are respected by the local political process. This abstracts from failures of the political process to function efficiently, which can arise for many reasons, including bureaucratic inefficiency (e.g., Romer and Rosenthal [17], Ott [16], and Brennan and Buchanan [5]), the well-known inefficiencies associated with simple majority voting equilibria, their possible nonexistence, etc. Consideration of some of these issues would lead one to conclude that local government spending would be too high in the absence of property tax competition. Fiscal externalities of the type described here might serve a useful function in constraining local governments, a view expressed quite explicitly in Brennan and Buchanan [5, Chap. 9] and considered more recently by Oates and Schwab [15] and McLure [11].

The model of this paper also abstracts from household mobility, and thereby from congestion externalities (e.g., Flatters *et al.* [6]; Wildasin [27]) and the way that a failure to tax them efficiently may distort local expenditure decisions (Starrett [19]). As discussed in Wildasin [28], these effects should be taken into account in optimal grant design. It is possible, however, that local taxes will be imposed in such a way that congestion effects are properly internalized. Notably, Hamilton [7, 8] has stressed that when localities impose zoning controls, the property tax may operate like an ideal local head tax. Such a zoning and tax policy not only internalizes congestion externalities, it also obviates the fiscal externality associated with tax competition that is the central focus of the present paper.[11] Mieszkowski and Zodrow [12, 13] argue that zoning is not likely to mitigate property tax distortions perfectly, so that, at least to some extent, the property tax will distort the capital market in the manner modeled here. Which of these competing views of the property tax is more accurate is an empirical matter that has not yet been resolved.

The model employed in this paper is greatly simplified by the assumption that the only tax instrument available to a locality is a single uniform tax on capital. In reality, taxes might be assessed at different effective rates on different types of capital, and other, quite different tax bases might also be used. Some of these might permit some tax exporting to occur. Accomodation of such diversity in the tax structure would require a model of the determination of local taxes. One might assume, for instance, that localities follow the Arnott and Grieson [1] optimal fiscal policies. This could result in differentially lower taxation of highly mobile capital (Beck [33]), and this might blunt or eliminate the tendency to underspend on local public goods that tax competition would otherwise create.[12] To take a simple example, if

[11] The easiest way to see this is to note that the property tax with perfect zoning is precisely equivalent to a head tax. Fiscal externalities clearly do not arise with proper head taxes. The equivalence result establishes that the same is true with ideal zoning and property taxation.

[12] Although it is easy to determine the optimal local tax structure in this special case, optimal local taxes depend more generally on the nature of local production and on the demand for locally produced goods, as discussed in Wilson [32].

a locality could optimally balance its taxation of immobile and inelastically supplied land or labor against taxation of mobile capital, it would tax only the immobile factor. (Standard optimal tariff analysis confirms this result.) Such a tax, being distortionless, would induce an optimizing jurisdiction to achieve a first-best efficient level of public expenditure.

The analysis here has also assumed that each locality produces a single homogeneous good. However, Wilson [33] shows that when localities specialize in the production of particular private goods and engage in trade, taxation of mobile capital may result in excessive public spending in some localities and inadequate spending in others. There is, in particular, no presumption that tax competition causes too little spending. Clearly the present analysis needs to be extended to accommodate such trade.

Obviously, by assuming a fixed national capital stock, this paper has ignored any inefficiencies that might arise from a uniform nationwide tax on capital. Much of the recent public finance literature, however, has stressed that this assumption may be unappealing.[13] On the one hand, if the national economy is closed, capital taxation can interfere with the incentive to save, resulting in efficiency losses from inadequate capital formation. On the other hand, if the national economy is open, capital taxation may drive capital abroad—creating losses for the national economy exactly analogous to those discussed here for individual localities. To the extent that savings responses or international capital mobility are important, local capital taxes really do generate social losses (at least from the viewpoint of national welfare), as opposed to externalities that should be subsidized by a higher level government. By abstracting from such distortions, the analysis here tends to overstate the optimal subsidy rates to local governments.

Finally, the determination of the optimal subsidy to local governments is based on the implicit assumption that the higher level government has access to a nondistortionary tax base of its own, and that whatever interpersonal transfers are desired on equity grounds can be carried out in lump-sum fashion. Both of these assumptions could usefully be relaxed. See, e.g., Wildasin [30] for some analysis of these issues in a somewhat different context.

In view of the above limitations, the analysis presented in this paper is best regarded as exploratory in nature. Its objective has been to develop a useful way of thinking about tax competition, at least in the context of some of the simple models that have appeared in the literature, and to obtain some rough notion of the possible quantitative significance of tax competition. Since this preliminary analysis indicates that tax competition

[13]See, e.g., Boadway and Wildasin [4] and Kotlikoff [10] for discussion of these issues and references to the literature.

could be quite important empirically, additional investigation definitely appears to be warranted.

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