

Income Redistribution in a Common Labor Market

By DAVID E. WILDASIN*

When households are mobile among jurisdictions, income redistribution by individual jurisdictions creates fiscal externalities. A model of interjurisdictional migration is used to study the nature of this redistributive externality. Analysis of optimal redistribution and optimal corrective subsidies from higher-level governments shows that benefit levels for the recipients of income transfers and tax rates on mobile taxpayers should be equalized across jurisdictions. A system of jurisdictions with a common labor market can achieve welfare improvements through coordination of "domestic" redistributive policy or through the intervention of a higher-level government. (JEL H23)

Consider a system of jurisdictions (such as cities, states, provinces, or countries) among which households are mobile. Suppose that a policy of income redistribution among these households is to be implemented. At what level of government—central, provincial, or local—should this policy be undertaken? What economic considerations are involved in the "assignment" (in the terminology of Albert Breton [1965]) of the functions of the "redistribution branch" of the public sector to one or another level of government? These are perennial questions in established federations like the United States and Canada. They are also increasingly relevant in regions like Western Europe where ongoing economic integration and enhanced mobility of labor and capital create an emerging de facto economic federation.¹

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¹The European Economic Community (EEC), viewed as the fledgling central government of a European federation, spends most of its rather limited resources on redistributive programs of one type or

One traditional view on this subject (see e.g., George J. Stigler, 1957; Richard A. Musgrave, 1971; Wallace E. Oates, 1972, 1977) is that redistributive policies should be centralized because lower-level jurisdictions that engage in redistribution are likely to experience a kind of adverse selection: redistribution creates locational incentives that attract those who benefit from these policies (the poor) and repel contributors (taxpayers).² However, there is substantial evidence that "tastes" for redistribution vary across jurisdictions.³ When this is the case, it can be argued that decentralized redistribution is preferable (Mark V. Pauly, 1973). A further argument for decentralization is

another. Jacques Delors, the president of the European Commission (and thus the administrative chief of the EEC) has called explicitly for "a strengthening of the redistribution function" at the EEC level (Tommaso Padio-Schioppa et al., 1987 p. vi). German unification has raised similar issues.

²On a priori grounds, there are strong reasons to believe that such incentives must matter in the long run. For empirical evidence on migration of the poor and its importance as perceived by policymakers, see Edward M. Gramlich and Deborah S. Laren (1984), Charles C. Brown and Oates (1987), and Paul E. Peterson and Mark C. Rom (1988).

³For example, the level of average monthly AFDC (Aid to Families with Dependent Children) benefits in California is about five times the level of benefits in Mississippi, and differentials of this order of magnitude have persisted among the states over long periods. The extent of redistributive taxation and transfer programs also differs widely among European countries.

that the ability of taxpayers to escape taxation through migration can limit the power of a malign and rapacious government to extract rents from individuals (see e.g., Charles E. McLure, Jr., 1986).

The present paper examines decentralized redistribution in an economy containing several jurisdictions linked by a common interjurisdictional labor market. By a "common labor market," I mean one in which at least some portion of the work force is able to switch from jobs in one jurisdiction to jobs in another jurisdiction (within the time frame of the analysis, and possibly at a nonzero cost). With a common labor market, changes in redistributive policy in one jurisdiction have effects throughout the system, as migration flows equilibrate incomes net of taxes and transfers (within bounds set by migration costs) in all jurisdictions. An important feature of such an economy is the *endogenous* determination of wages in all jurisdictions. Wages adjust in response to changes in labor supply, and these adjustments serve to equilibrate migratory flows. Previous analyses of this issue (e.g., Pauly, 1973; Brown and Oates, 1987) have generally not incorporated a labor market within which the incomes of mobile households are endogenously determined, assuming instead that these incomes are exogenously fixed. Analyses based on such assumptions are probably most relevant when considering the migration of elderly individuals or other nonworking households whose incomes flow mainly from public or private pension benefits or other nonwage sources. The common-labor-market assumption is more appropriate when considering migration by middle- and high-income households in response to interjurisdictional tax differentials or migration of poor individuals in temporary spells of poverty, perhaps associated with unemployment resulting from a job layoff or a weak initial attachment to the labor market (if young). For such individuals, labor-market conditions are very important determinants of location, and it is therefore preferable to analyze the effects of redistributive policy on their migration within the context of a model that assumes that they do participate in the labor force.

The paper is organized as follows. Section I presents the basic model. Section II examines the interjurisdictional externalities associated with decentralized redistribution. The analysis shows how corrective subsidies (grants) from a central government to lower-level governments can internalize these fiscal externalities and achieve a social optimum. In the simple benchmark case with costless migration, optimal grants induce all lower-level governments to choose identical levels of transfer payments to the poor, even if the tastes of their residents for redistribution vary widely. (To achieve this outcome, the structure of optimal matching grants offered to lower-level governments should be nonuniform, so that those with a weak taste for redistribution are provided with sufficiently generous subsidies that they provide a level of transfer payments that is just as high as any other jurisdiction.) This simple and novel result follows directly from the assumption of a common labor market, which is the main feature that differentiates the present analysis from earlier work (Pauly, 1973; Gramlich, 1985; Brown and Oates, 1987). The intuition behind the result is that unequal levels of transfers among jurisdictions would give households purely fiscal incentives to migrate, resulting in a socially inefficient interjurisdictional allocation of labor. An optimal grant scheme induces equal fiscal benefits for mobile households in all jurisdictions and, thus, efficient locational choice. It is also shown that the subsidy rate that must be offered to lower-level jurisdictions to internalize redistributive externalities is higher the *higher* the elasticity of labor demand is in each jurisdiction. Section III shows that the basic model can be generalized in several directions, for example by allowing for costly migration. Section IV concludes with some remarks on policy applications.

I. The Model

There are two types of governmental units in the model, namely, a "central government" and a system of "lower-level" governments. In the U.S. context, the lower-level governments might be the states,

whereas in the European context they might be the member states of the EEC. The central government in the U.S. case would be the federal government, and, in the European case, it could be the EEC itself. Let the lower-level jurisdictions be indexed by subscripts i and j . The households in each jurisdiction are aggregated into two groups. The first group consists of immobile households, while the second type consists of households at least some of which are freely mobile. For the purposes of concreteness, assume that these types correspond to "rich" and "poor" households.⁴ Each poor household is endowed with one unit of labor, while rich households are endowed with other factors of production, possibly including labor of a different type from that of the poor households and also including other fixed factors of production (e.g., land and other natural resources). Each jurisdiction is endowed with a Ricardian technology, giving the output of a numeraire good, $f_i(l_i)$, as a strictly increasing and concave function of the number of poor employed there, l_i .⁵

The poor receive a gross wage w_i equal to their marginal productivity, $f'_i(l_i)$, while the rich obtain the remaining income generated by this productive activity, which they capture in the form of rents, namely $f_i(l_i) - l_i f'_i(l_i)$. These rents may literally be rents to land or other natural resources but would also include the return to any labor inputs

provided by the immobile households. As long as this labor is treated as being immobile and inelastically supplied, the equilibrium return to the labor of the rich may be aggregated with the returns to any other fixed factors, and the aggregate return to the rich will be given by the residual $f_i(l_i) - l_i f'_i(l_i)$.⁶

Let l denote the total number of poor in the economy, and let n_i denote the number of poor initially located in jurisdiction i . The amount of migration into i is thus $l_i - n_i$ and, in equilibrium,

$$(1) \quad \sum_i n_i = \sum_i l_i = l.$$

Not all poor households need be assumed mobile. It is only essential that there be *some* households that are mobile, at the margin, in each jurisdiction. Mobile households are assumed to be *costlessly* mobile. Relaxation of this assumption is discussed later.

Let z_i denote the subsidy paid to the poor in jurisdiction i .⁷ The net income of a poor household in i is thus $f'_i(l_i) + z_i$. The poor are assumed to care only about their consumption of the numeraire commodity and, therefore, to seek to maximize their net incomes. Free mobility therefore implies that, in all jurisdictions where the poor locate in equilibrium, their level of consumption must be the same. For any such jurisdiction i , it must be the case that

$$(2) \quad c = f'_i(l_i) + z_i$$

⁴The roles of the "rich" and "poor" can be interchanged without substantially affecting the analysis. Most prior literature focuses on the case in which the poor are mobile and the rich are immobile, so the same case is considered explicitly here. Section III briefly describes the results for the case of mobile taxpayers.

⁵The formal structure of the model is thus similar in many respects to those that have been used in the literature of fiscal federalism. (see e.g., Frank R. Flatters et al. [1974] and additional references in Wildasin [1986]. Readers familiar with the literature on tax competition with mobile capital will note that the present model bears many similarities to those used there (see e.g., George R. Zodrow and Pete M. Mieszkowski, 1986; Wildasin, 1988, 1989; John Douglas Wilson, 1990). The model is also formally similar to that of Robin W. Boadway and Wildasin (1990), which studies central-government income redistribution in the presence of interindustry or interregional migration with Ricardian technologies and sector-specific risk.

⁶Thus, absentee ownership of fixed factors is ignored in this analysis. It would be somewhat cumbersome but not difficult to generalize the model in this respect. Doing so would raise some issues of interest, but they are ignored here for the sake of simplicity.

⁷I assume that it is impossible to discriminate between migrants and nonmigrants in the distribution of social benefits, so that all poor households must be treated symmetrically. This is in accordance with the policy of states in the United States, and member states of the EEC are also prohibited from providing social benefits in a way that discriminates against non-residents. (In practice, of course, there may be many indirect ways to discriminate against migrants.)

where c denotes the equilibrium net income or consumption level of the poor, which is the same for all jurisdictions. Given the transfer policies of all jurisdictions (the z_i 's), equations (1) and (2) provide a system of $n + 1$ equations which can be used to solve for c and the l_i 's. (Interior solutions are assumed for convenience.)

The net income of the rich in jurisdiction i is equal to their gross income minus taxes. These taxes are used to finance subsidies to the poor and to support expenditures by the central government. The central government in turn may subsidize the income-redistribution activities of lower-level jurisdictions through either lump-sum or matching grants. To avoid complications associated with tax distortions, all taxes are assumed to be lump-sum in nature. Thus, let T_i be the net lump-sum tax assessed by the central government on the rich in jurisdiction i .⁸ In the European context, this would correspond to the national contribution to the EEC net of any pure lump-sum grants received back from it. In the U.S. context, T_i would correspond to federal income taxes paid by the rich. Let s_i be the effective subsidy rate to jurisdiction i embodied in any matching grants offered by the central government (i.e., s_i is the share of incremental redistributive expenditures in jurisdiction i that is financed by central government grants). Thus, the income of the rich in i , net of all taxes and transfers, is given by

$$(3) \quad y_i = f_i(l_i) - l_i f'_i(l_i) - (1 - s_i) z_i l_i - T_i.$$

The rich are assumed to be altruistic toward the poor and, therefore, to be willing to incur tax liabilities to support redistributive transfers to the poor. Let $u_i(y_i, c)$ denote the utility function of the rich in jurisdiction i , with both $u_{iy} > 0$ and $u_{ic} > 0$.

⁸Taxes paid by the poor are suppressed for notational simplicity. However, they are implicitly present in the z_i terms, which should be interpreted as transfers to the poor net of any taxes that they pay.

Since c is the same for all poor households (due to free mobility), the utility function u_i need not distinguish between the welfare of the poor in jurisdiction i itself and the welfare of the poor in some other jurisdiction.⁹

To close the model, it is natural to assume that central-government policy instruments must be chosen so as to balance its budget. Thus,

$$(4) \quad \sum_i (s_i z_i l_i - T_i) = 0.$$

This completes the specification of the basic model. The role of several simplifying assumptions should be noted. First, the model does not explicitly allow for nonwage components of real income in the form of locational amenities such as climate, environmental quality, and the like, nor does it allow for noncash public goods and services to influence migration decisions. The model therefore appears to carry the strong implication that money incomes for all poor households, inclusive of cash transfers, must be completely equalized across jurisdictions. However, some of the observed interjurisdictional variation in money income can be attributed to compensating differentials for "quality of life" variations, as is clear from the hedonic price literature (e.g., Sherwin Rosen, 1979, 1986; Glenn C. Blomquist et al., 1988). It is possible to incorporate these considerations into the model, at least in a simple way, merely by reinterpretation. Let $\phi_i(l_i)$ be output of numeraire in i , and let a_i be the monetized value to any resident of environmental amenities such as climate or crime. Then, one can redefine and reinterpret the production function $f_i(l_i) \equiv \phi_i(l_i) + a_i$ so that $w_i = f'_i(l_i) = \phi'_i(l_i) + a_i$ is now interpreted as the *real* income of a worker in i , gross of taxes and transfers. Further-

⁹It might seem reasonable to consider the case in which the rich have utilitarian preferences with respect to the poor initially located in their own jurisdiction. In this case, the term $n_i c$ would enter the utility function of the rich. However, this is just a special case of the utility function $u_i(y_i, c)$.

more, let z_i represent both cash benefits and the monetized value of any (quasi-private or congestible) local public goods such as transportation, public health care, education, and so on. Then the *real net income* of a mobile household in i is $w_i + z_i$, which reflects the benefits and costs of a wide array of local public goods and services and local amenities or disamenities. The assumption that this net income is equalized across jurisdictions, under this more general interpretation of the model, certainly does not require that *money wages* (i.e., the ϕ_i 's) would be equalized.

Second, the model aggregates all households into two classes. More realistically, there could be several categories of both rich and poor, differing by education or skill level, endowments of nonhuman resources, demographic characteristics, and so on. (Note that some of the observed interjurisdictional variation in average income is attributable to such heterogeneity.) Extending the model in this way would complicate the notation but would not change the essentials of the analysis (see e.g., Wildasin [1986] and references therein for examples of models with many household types).

Finally, when migration costs are nonzero, some interjurisdictional real income differentials can persist in equilibrium. Section III shows how the analysis can be extended, with some modifications to the results, to accommodate such costs.

II. Migration Spillovers from Income Redistribution

This section investigates the effects of transfer payments on the welfare of the poor and of the rich, both in the jurisdiction undertaking such transfers and in other jurisdictions as well. It shows that redistribution toward the mobile poor generates interjurisdictional externalities. Once one determines the benefits and costs to the rich in jurisdiction i of that jurisdiction's transfer programs, it is easy to describe the levels of these transfers that would be optimal from their viewpoint. The assumption that each jurisdiction's policies are chosen to maximize the welfare of the rich, taking

central government policies and the level of transfer payments of the other jurisdictions as given, provides a simple positive theory of transfer payments. One can then investigate the effect of changes in central government policy, taking into account the response of the lower-level governments to this policy. Of particular interest is the welfare impact of these central government policies on the rich and poor in both jurisdictions and the characterization of the optimal central-government subsidy policy.

Redistributive transfer payments made in jurisdiction i tend to raise the net income of the poor there, attracting additional households from other jurisdictions. To analyze this induced migration effect formally, use (2) to solve implicitly for $l_i(w_i) = l_i(c - z_i)$, the labor demand function in jurisdiction i , with derivative $l'_i(c - z_i) = f''_i(l_i)^{-1} < 0$. Next, substitute the functions $l_i(c - z_i)$ into (1) to solve for c as a function of the parameters (z_1, \dots, z_n) . Defining $\sigma_i = l'_i / \sum_k l'_k$, it follows that

$$(5) \quad \frac{\partial c}{\partial z_i} = \sigma_i > 0.$$

(Note that $\sigma_i \in (0, 1)$, and $\sum_i \sigma_i = 1$.) The general-equilibrium response of the distribution of poor households across lower-level jurisdictions to changes in the transfer payments of jurisdiction i is obtained by totally differentiating l_i or l_j (for $j \neq i$) with respect to z_i :

$$(6a) \quad \frac{dl_i}{dz_i} = l'_i \left(\frac{\partial c}{\partial z_i} - 1 \right) = (1 - \sigma_i) l'_i > 0$$

$$(6b) \quad \frac{dl_j}{dz_i} = l'_j \frac{\partial c}{\partial z_i} = \sigma_j l'_j < 0.$$

There are three groups whose welfare depends on redistributive transfers in jurisdiction i : poor households, the rich households in jurisdiction i who finance the transfers, and the rich households in other jurisdictions who are indirectly affected by the transfers. The general-equilibrium effect

of marginal transfers on the welfare of the poor (in all jurisdictions) is captured in (5). The welfare of the rich depends on transfers in two ways. First, transfers alter the net incomes of the rich (the y_i 's) directly and through general-equilibrium effects. Second, transfers increase c , the net income of the poor, which benefits the rich in all jurisdictions. The first of these effects can be expressed by differentiation of (3):

$$(7a) \quad \frac{dy_i}{dz_i} = \frac{\partial y_i}{\partial l_i} \frac{dl_i}{dz_i} - (1 - s_i)l_i$$

$$= - [l_i f_i'' + (1 - s_i)z_i] \frac{dl_i}{dz_i} - (1 - s_i)l_i$$

$$(7b) \quad \frac{dy_j}{dz_i} = \frac{\partial y_j}{\partial l_j} \frac{dl_j}{dz_i}$$

$$= - [l_j f_j'' + (1 - s_j)z_j] \frac{dl_j}{dz_i}$$

The first term in each of these expressions shows the change in rents accruing to fixed factors in each jurisdiction that results from a change in the number of workers there. This term is positive in the destination jurisdiction and negative in the source jurisdiction. The second term in each expression shows the change in transfer payments made to the poor resulting from migration; this is negative in the destination jurisdiction and positive in the source jurisdiction. Finally, for the destination jurisdiction i (i.e., the jurisdiction that is increasing its benefits z_i), there is an added loss of income equal to $(1 - s_i)l_i$, which is the cost of paying higher benefits to the existing population of beneficiaries.

The total effect of transfers on the welfare of the rich can now be obtained by totally differentiating the utility function u_i with respect to z_i and dividing by the marginal utility of income u_{iy} , in order to express the resulting welfare change in terms of real income. Denote this real income

change by $d\mu_i = (u_{ic}/u_{iy})dc + dy_i$. Using (5) and (7), and letting MRS_i denote u_{ic}/u_{iy} ,

$$(8a) \quad \frac{d\mu_i}{dz_i} = MRS_i - (1 - s_i)l_i - (1 - \sigma_i)\gamma_i$$

$$(8b) \quad \frac{d\mu_j}{dz_i} = \sigma_i\gamma_j$$

where

$$(9) \quad \gamma_i = MRS_i - l_i - (1 - s_i)z_i l_i'$$

These equations are of basic importance for the results to follow. The first two terms in (8a) show the difference between the marginal benefit and the effective marginal cost to the rich in jurisdiction i of a unit increase in z_i , ignoring any effects associated with migration of the poor. The terms in (8) involving σ_i , γ_i , and γ_j show the effect of migration. In (8a), γ_i shows the effect on the welfare of the rich in i of an increase in the gross wage of the poor. Holding z_i fixed, an increase in the gross wage (i) raises the net income of the poor, creating a benefit of MRS_i for the rich, (ii) reduces the rents accruing to the fixed factor by the amount l_i (i.e., the increase in the wage per worker times the number of workers), and (iii) changes the tax burden on the rich by the cost (to jurisdiction i) of the per-worker transfer payment, $(1 - s_i)z_i$, times the change in the number of poor workers, l_i' . Since the term $-(1 - \sigma_i)$ is the change in the equilibrium gross wage of labor resulting from an increase in z_i ,¹⁰ it follows that the term $-(1 - \sigma_i)\gamma_i$ in (8a) shows the indirect effect on the welfare of the rich in i taking into account the equilibrium migration response to an increase in transfer payments. The interpretation of (8b) is similar. The welfare of the rich in j is affected by z_i

¹⁰To see this, differentiate $w_i = f_i'(l_i[c + z_i])$ totally with respect to z_i , obtaining $dw_i/dz_i = f_i''dl_i/dz_i = -(1 - \sigma_i)$, using (6a).

through migration of the poor and through associated changes in the equilibrium wage of mobile workers. The change in the gross wage in j is $(1/l_j)(dl_j/dz_i) = \sigma_i$. As already explained, γ_j is the effect on the rich in j of an increase of the wage paid to the mobile workers. Hence, $\sigma_i \gamma_j$ is the welfare effect on the rich in j resulting from an increase in z_i . Thus, when jurisdictions are linked through a common labor market, changes in income-redistribution policy in jurisdiction i will create external effects in jurisdiction j .

The sign of these external effects depends on the level of income redistribution in each jurisdiction. Suppose, in accordance with prior literature (e.g., Pauly, 1973), that poor households play a completely passive role in determining the level of benefits, so that redistributive transfer policy is set in such a way as to maximize the welfare of the rich. This might be justified by appealing to low voter turnout rates for the poor or to their comparative lack of resources with which to finance political activities. Alternatively, if the poor group under consideration is a numerically small group (say, workers in a single small occupational category), their political influence might be small simply because of their size. (The case in which the recipients of transfers influence decision-making is discussed further below.) Assume further that jurisdictions optimize their own level of transfers taking as given the transfer policies of other jurisdictions, attaining a *Nash equilibrium in redistributive transfers* in which z_i is chosen such that $d\mu_i/dz_i = 0$ for all i . The precise levels of redistributive transfers chosen in each jurisdiction depend, of course, on the subsidy rates s_i offered by the central government. Suppose initially that the subsidy rates are all zero, a situation that will be referred to as an *uncorrected Nash equilibrium in redistributive transfers*. The externalities in such an equilibrium can be described in a strikingly simple way. Let $\varepsilon_i = (d \log l_i)/(d \log w_i) < 0$ be the labor-demand elasticity in jurisdiction i . Then:¹¹

PROPOSITION 1: *In an uncorrected Nash equilibrium with redistributive transfers, the spillover benefit to jurisdiction j from an increase in redistributive transfers in jurisdiction i is given by*

$$w_i \frac{d\mu_j}{dz_i} = -\varepsilon_i l_i z_j > 0.$$

Thus, to measure the size of the spillover benefits to j associated with additional redistribution in i , it is necessary to measure only two variables for jurisdiction i , namely its demand elasticity for poor workers and the size of its labor force of poor workers, and only one variable for jurisdiction j , namely z_j , the level of transfer payment per poor household. Of course, as a special case, Proposition 1 shows that there is no spillover if $z_j = 0$. That is, the spillover is fiscal in nature: if the rich in jurisdiction j do not chose to undertake any redistribution, then changes in redistribution in other jurisdictions do not affect them. Note further:

COROLLARY: *The ratio of the spillover benefits received by jurisdictions j and k from redistribution undertaken in any other jurisdiction i is equal to the ratio of the redistributive transfers in jurisdictions j and k , that is,*

$$\frac{d\mu_j/dz_i}{d\mu_k/dz_i} = \frac{z_j}{z_k}.$$

Based on this result, it is very easy to ascertain which jurisdictions obtain the largest spillover benefits from redistributive transfers in other jurisdictions: jurisdictions with large amounts of redistribution benefit much, and jurisdictions with small amounts of redistribution benefit little.

Consider now the use of corrective matching grants to internalize the externalities associated with redistributive policies. An increase in z_i creates an externality for jurisdiction j equal to $d\mu_j/dz_i$, as shown in (8b). Furthermore, when redistributive transfers are supported by grants, a change

¹¹The Appendix provides proofs for several of the main results.

in z_i adds to the burden of the central government budget:

$$(10) \quad \frac{d \sum_j s_j z_j l_j}{dz_i} = s_i l_i + \sum_j s_j z_j \frac{dl_j}{dz_i} \\ = s_i l_i - s_i z_i l_i' + \sigma_i \sum_j s_j z_j l_j'$$

where the last equality follows from (6b). This burden falls on the taxpayers in each jurisdiction. Thus, the *net* external benefit from an increase in z_i is just

$$(11) \quad \text{MEB}_i = \sum_{j \neq i} \frac{d\mu_j}{dz_i} - \frac{d \sum_j s_j z_j l_j}{dz_i}.$$

A system of grants that correctly internalizes the redistributive externality insures that $\text{MEB}_i = 0$ for all i . Thus, define a *corrected Nash equilibrium with redistributive transfers* to be a vector of subsidies (s_1, \dots, s_n) and a vector of transfers (z_1, \dots, z_n) such that $d\mu_i/dz_i = 0$ and $\text{MEB}_i = 0$ for all i . How can one characterize such an equilibrium and the system of grants that supports it? The first result gives a necessary (but not sufficient) condition describing the structure of transfer payments in a corrected Nash equilibrium:

PROPOSITION 2: *In a corrected Nash equilibrium with redistributive transfers, the level of redistributive transfers chosen in each jurisdiction is identical (i.e., $z_i = z_j \forall i, j$).*

Note that no symmetry among the jurisdictions themselves has been assumed here. In particular, the rich in different jurisdictions need not have identical preferences for redistribution. Nevertheless, the level of redistributive support for the poor must be the same in all jurisdictions. The intuition behind this strong result is fairly straightforward. If the z_i 's are unequal, there exist fiscal incentives for the poor to migrate, and these incentives distort the allocation of labor (Wildasin, 1980). Any given degree of

redistribution to the poor can be achieved more efficiently by subsidizing redistribution more heavily in jurisdictions with small redistributive transfers and less heavily in jurisdictions with large transfers, so as to bring these transfer levels closer together and thus reduce fiscal distortions of locational choice. In the absence of such corrective subsidies, redistribution will be a socially more costly policy than necessary. With optimal corrective policies, the allocation of labor results in equalization of *gross* wages (marginal productivities) across all locations.¹²

The attainment of uniform levels of redistribution implies an outcome that is equivalent, in Oates's (1972) sense, to a fiscally centralized outcome. Indeed, the redistribution function is conventionally assigned to the central government in normative theories of fiscal federalism (see e.g., Oates, 1968, 1972; Musgrave, 1971). If this were done in the present model, one would expect that optimal central-government policy would involve the determination of a uniform level of redistributive transfers \bar{z}^* such that the social marginal benefits of redistribution would equal the social marginal cost. Recognizing that a uniform lump-sum allowance for the poor is a socially costless transfer in the present model with fixed individual labor supplies and that spatial arbitrage would still result in equalization of net incomes for the mobile households in all jurisdictions even with centralized redistribution, it is easy to characterize the centralized optimum level of redistribution. It would be that level \bar{z}^* such that the sum of the MRS_i 's across all jurisdictions would be equal to l , the marginal cost of increasing the per-household subsidy to all l members of the mobile population. The corrected Nash equilibrium with redistributive transfers does in fact result in this outcome:

PROPOSITION 3: *In a corrected Nash equilibrium with redistributive transfers, the*

¹²Note that equalization of transfer payments, while necessary, is not a *sufficient* condition for efficiency. For example, $z_i = 0$ for all i is not efficient.

uniform level of redistributive transfers satisfies the Samuelson condition

$$\sum_i \text{MRS}_i = 1.$$

What can be said about the structure of optimal subsidy rates? In general, subsidy rates must vary across jurisdictions, depending on preferences, incomes, and technologies. However, in the special case in which all jurisdictions are identical, one obtains a simple and illuminating result:

PROPOSITION 4: *Suppose that all jurisdictions have identical preferences, technologies, and endowments. Then, the rate of subsidy for redistributive transfers in a corrected Nash equilibrium is (dropping subscripts on all variables)*

$$s = \frac{1}{1 - \left(\frac{n}{n-1}\right) \frac{w}{z\varepsilon}}.$$

To interpret this result, note that z/w is the rate of redistributive transfers expressed in ad valorem terms (i.e., as a proportion of the wage rate). The elasticity of demand for labor, ε , is negative. Hence, $s \in (0, 1)$. Roughly speaking, the subsidy rate should be high when redistribution is extensive (z/w is high) and when the allocation of labor is relatively sensitive to the wage rate ($|\varepsilon|$ is large).¹³

Proposition 4 can be used to obtain some idea of the order of magnitude for corrective subsidies for income redistribution. Suppose $n = 12$ (the number of EEC member states) and $z/w = 0.25$. Suppose that $\varepsilon = -0.1$ in the short run and $\varepsilon = -1$ in the long run (reflecting the usual idea that it is easier to substitute away from any factor of production given additional time to adjust).

¹³As in interpretations of optimal tax formulas, here too one must recognize that the variables on the right-hand side of the formula for s in Proposition 4 are themselves endogenously determined and that they in fact depend on s .

Then, $s = 0.000189$ in the short run, and $s = 0.186$ in the long run. Increasing n to 50 (the number of U.S. states) while keeping z/w fixed results in $s = 0.20$ in the long run. (It is of interest to note by way of comparison that, in the United States, the federal government provides open-ended matching subsidies of between 50 and 80 percent to support the AFDC payments of each state government.) Of course, these figures only provide a notion of the relevant orders of magnitude; in practice, the symmetry conditions underlying these calculations will certainly not hold. It would be possible to develop more detailed estimates of the corrective subsidy rates for a given system of governments by solving the system of equations $\text{MEB}_i = 0$ for all i , using detailed information on transfer payment levels and labor-market conditions. In general, the corrective subsidy rates s_i will differ across jurisdictions, as Proposition 1 and its corollary would lead one to expect. While such detailed calculations are not undertaken here, it is important to note that their fundamental informational requirements are no more complex than for the symmetric case.¹⁴

III. Generalizations

The assumptions underlying the preceding analysis can be relaxed in several ways.

¹⁴The results here bear an interesting relationship to prior literature on intergovernmental grants. Analyses of *equalizing* grants, which offset interjurisdictional horizontal inequities (or the fiscal incentives to migrate that they create), provide a rationale for per capita transfer programs (e.g., James M. Buchanan, 1950; Boadway and Flatters, 1982). Other studies (Oates, 1972; Boadway et al., 1989) emphasize the *externality internalizing* function of matching grants which can induce efficient spending in the presence of spillover benefits. The results of this section contrast with these two branches of the literature. Optimal grants here provide a subsidy to raise the level of benefits per mobile household (like a matching grant) but also increase in proportion to the number of beneficiaries (like an equalizing grant). They both internalize redistributive externalities and induce equal treatment of the poor in all jurisdictions.

Doing so widens the scope of applicability of the model.

First, the assumption that each jurisdiction's policies are governed only in accordance with the preferences of the rich can be relaxed. I have interpreted the utility functions $u_i(y_i, c)$ as the utility functions of altruistic rich households. They could alternatively be considered as social-welfare functions for each jurisdiction depending on the net incomes of the rich, y_i , and of the poor, c . This could represent an amalgamation of the preferences of rich households whose utilities depend on y_i and, possibly but not necessarily, on c and the preferences of the poor, whose utilities depend on c and, possibly but not necessarily, on the incomes of the rich. For example, one could have a utilitarian function $u_i(y_i, c) = \phi_i(y_i) + n_i\psi_i(c)$, where it should be recalled that n_i denotes the number of poor households initially located in i and where ϕ_i and ψ_i are monotonically increasing concave functions. Obviously, this is only one particular case among many, so that the utility function $u_i(y_i, c)$ that has been used in the analysis is actually quite general. [The function $u_i(y_i, c)$ could also represent the preferences of the politicians who make policy in each jurisdiction.] With this reinterpretation of the meaning of u_i , all of the foregoing results still pertain.

Second, the assumption that workers are costlessly mobile can be relaxed without changing the basic nature of the results. Consider for simplicity the special case in which there are only two jurisdictions, i and j . Let x_{ij} (x_{ji}) denote the cost of moving from jurisdiction i to j (j to i). If migration costs are strictly positive, then for some specifications of tastes, technologies, and endowments, no households will migrate in equilibrium, nor will there be "incipient" migration (i.e., households that are just on the verge of moving. In such a zero-migration equilibrium, it is clear that jurisdictions i and j are effectively disconnected, in the sense that small variations in policy in one jurisdiction will have no effect on the other. In such an equilibrium, there is no externality at the margin that needs to be corrected.

On the other hand, suppose that jurisdiction i has a favorable technology or some other attribute that causes workers to migrate to it from j . Let c_i denote the consumption of poor households initially situated in i , and let c_j be the consumption of those who remain in jurisdiction j . Then $c_k = w_k + z_k = f'_k(l_k) + z_k$ for $k = i, j$. Spatial arbitrage (or migration equilibrium) implies that $c_i = c_j + x_{ij}$. That is, if migration occurs in equilibrium, the welfare levels of the poor in different jurisdictions differ only by the magnitude of migration costs. While the welfare of the poor will not be equalized in all jurisdictions in the presence of migration costs, migration equilibrium means that policies to improve the welfare of the poor in one jurisdiction will cause identical changes in the real incomes of the poor in other jurisdictions.

Thus, suppose that the welfare of the rich in jurisdiction i depends on their own real income y_i and on the net income of the poor in their jurisdiction as expressed in a utility function $u_k(y_k, c_k)$. One can then show that the preceding results, such as Propositions 1–4, remain valid, *provided that the two jurisdictions i and j are linked in equilibrium through nonzero migration*. In fact, the results are quite intuitive. If migration costs are sufficiently low (relative to wage differentials, etc.) so that migration does occur in equilibrium, then the jurisdictions will be actively linked through migration, and the essential nature of the redistributive externalities is no different from the case of zero migration costs. The justification for these claims is sketched in part B of the Appendix.

Third, although the analysis has focused on the role of redistributive transfers to the poor as the cause of redistributive externalities, it easily accommodates the other side of the overall redistributive mechanism: that is, the imposition of taxes on the rich (or whoever is to finance the redistribution to others). It might indeed be argued, in some circumstances, that the attempt by the rich to escape heavy taxation, rather than the attempt by the poor to capture generous redistributive transfers, poses the more se-

vere problem for redistributive policy. To cover this case, one can simply reverse the roles of the "rich" and "poor" in the model, supposing that rich taxpayers can migrate freely across jurisdictions and that the poor are immobile. The rich pay taxes, represented by values of $z_i < 0$, and the poor capture these taxes through government tax/expenditure programs. This amounts to nothing more than a reinterpretation of the model, which of course does not change any of the formal analysis. Virtually all of the previously established results therefore remain formally valid.¹⁵

The fact that there is a strong parallel between the analysis of the externalities associated with redistributive transfers and those arising from redistributive taxation is not surprising. The two situations can be regarded simply as particular instances of a single general type of interdependency among households. The general model is one in which the net income of mobile households enters the utility function of the immobile households. If the altruistic interdependency between the two types is sufficiently strong, positive transfers from immobile to mobile households result. If the interdependency is not so strong (e.g., because the mobile households have high incomes relative to the immobile ones), then negative transfers (positive taxes) result. The nature of the interjurisdictional fiscal externalities among jurisdictions does not change in any basic way, however, nor does the rationale for and formulation of optimal corrective policies.

In view of the above generalizations, the scope of potential application of the model is reasonably broad. Two crucial features of the model are the existence of a "common labor market" for at least some of the households that are affected by redistributive activities, either as beneficiaries or as contributors, and the existence of some degree of altruistic concern among house-

holds. The latter is important because it rationalizes the existence of redistributive policies in the model, while the former establishes a market linkage through which the effects of redistribution in one jurisdiction are propagated throughout the population of mobile households. Since the present analysis is differentiated from previous research primarily by its reliance on the assumption of a common labor market, a brief discussion of the empirical validity of this assumption is in order.

To begin with, few economists would dispute the empirical assertion that migration responds to real income differentials, comprehensively defined to include those attributable to nonpecuniary components of income such as environmental amenities and those deriving from fiscal policies such as taxes and public service provision. Patterns of interregional migration in the United States attest to the importance of income differentials as a motivating factor in migration decisions. Whether the migration that is observed serves to equalize real incomes net of migration costs may be somewhat more problematic.

The issue can be illustrated very simply using data on regional per capita incomes in the United States. Decennial data spanning the period 1880–1980 (cited in Mieszkowski [1979] and in Edwin S. Mills and Bruce W. Hamilton [1984], especially fig. 2.1) reveal per capita money-income disparities among regions. Per capita income in the South was about 45 percent of the U.S. average in 1900, while incomes in the Pacific and Northeast regions exceeded the national average by more than 60 and 30 percent, respectively. These rankings did not change during the next 80 years. However, the interregional differentials were substantially eroded during this period. By 1980, per capita income in the South had risen to about 90 percent of the average, while incomes in the Pacific and Northeast regions were only 5–10 percent above average.

If these measured income differentials reflect real income differentials, then their persistence over such a long period could be taken as evidence that neither migration of

¹⁵An earlier version of this paper, available from the author upon request, explicitly describes the extension of the results to the case of redistributive taxation.

labor nor any other market-adjustment mechanism leads to equalization of real incomes over time. Spatial arbitrage of the type implied by the common-labor-market assumption seems to fail. On the other hand, the data also indicate that the *magnitude* of interregional income differentials has fallen dramatically during this period. This could be taken as evidence that income differentials do *not* persist over time. Therefore, on balance, do data of this type support or detract from the assumption of a common labor market?

This question cannot be answered in a general and definitive way. As is typical in economic analysis, the proper answer in any particular case depends on, among other things, the time frame of the analysis, which really depends on the specific policy or other question under investigation. It would seem reasonable to take the equilibrating effect of migration on real incomes into account when considering long-run structural changes in tax and transfer systems within the United States. It might also be appropriate to do so when thinking about long-run redistribution in the context of a more integrated Europe. If one's objective is instead to test for the existence of interregional income differentials and to explain whatever differentials do exist, a rather different approach would be needed.

IV. Conclusion

The externalities associated with redistributive tax and transfer policies are of a twofold nature when working taxpayers or transfer recipients are mobile among jurisdictions. As emphasized in previous studies, redistributive activity in any one jurisdiction attracts beneficiaries and repels taxpayers, which creates external benefits for other jurisdictions because their tax bases increase and their redistributive burdens diminish. A second externality arises when mobile households in different jurisdictions participate in a common labor market. If the residents of all jurisdictions share an interest in the welfare of mobile households, the effects of redistributive policy on the welfare of these households also gener-

ate externalities. The presence of this second type of externality changes the analysis of income redistribution in a major way. In particular, the externalities that are propagated through the common labor market are responsible for the conclusion that all jurisdictions undertake the same amount of redistribution when the structure of intergovernmental grants is optimal. This finding contrasts with prior literature claiming that decentralized redistribution is preferred because it makes it possible to vary the level of redistribution in accordance with heterogeneous tastes. When mobile households, whether beneficiaries or contributors, participate in a common labor market, heterogeneous preferences for income redistribution imply that central-government corrective subsidies must differ among jurisdictions. Other things being the same, communities with weaker preferences for redistribution should receive larger subsidies. Thus, the structure of subsidies, rather than the pattern of redistribution itself, should reflect the heterogeneity of preferences for redistribution across jurisdictions.

At this point, it is natural to ask whether decentralized redistribution offers any advantages that centralization does not. After all, if efficiency in a decentralized system is only obtainable with a system of grants that merely enable one to replicate a centralized outcome, why not simply use a centralized system in the first place? This question cannot really be answered within the model presented above, since, within it, optimal decentralized and optimal centralized policies are equivalent. An interesting topic for future research, however, would be to determine whether decentralization might provide a better structure for the revelation of the information needed for optimal policy. For a centralized system to work efficiently, it is necessary to solve the classic public-goods problem, which requires obtaining information about preferences for redistribution. Lower-level governments face the same problem, but if they are more homogenous than the collectivity as a whole, this problem may not be as acute for them.

Whatever its theoretical advantages or disadvantages, decentralized redistribution

is a fact of life that must be dealt with as a practical matter. Significantly, the redistributive policies of lower-level governments are often supported by explicit or implicit grants from higher-level governments. Examples based on U.S. experience are easily cited.

(i) *Education*.—Primary education and secondary education have historically been provided at the local level. Wide variations in the level of education expenditures across school districts are frequently viewed as inequitable (and sometimes as unconstitutional), however.¹⁶ Consequently, local school expenditures are extensively supported by grants from state governments.

(ii) *AFDC*.—Within broad limits, each state is free to choose the level of benefits to be granted to its AFDC recipients, and there is in fact wide variation in the level of benefits that states provide. Each state receives substantial financial support from the federal government for its AFDC and Medicaid benefits, amounting essentially to an open-ended matching subsidy to the states in which the federal government covers 50 percent or more of the cost of state welfare expenditures.

(iii) *Federal income tax deductibility of state and local income taxes*.—Deductibility encourages states and localities to impose taxes with more progressive rate structures. It operates like an open-ended matching grant with a matching rate that varies with the marginal federal tax rate of the individual taxpayers.

These examples illustrate several ways in which higher-level governments support redistribution undertaken by lower-level governments in the United States, consistent with the basic objective of internalizing redistributive externalities. However, equal levels of redistributive activity are typically

not observed in practice, perhaps reflecting inadequate differentiation of explicit and implicit subsidy structures. It is noteworthy, however, that the federal matching grant rates to states for AFDC and Medicaid do vary inversely with state per capita incomes: for poor states (like Mississippi), up to 80 percent of the costs of these programs are covered, while the rate is only 50 percent for high-income states (such as California). Since AFDC benefits are highly correlated with income across states, this formula for determining matching grants does exhibit differentiation among jurisdictions of a kind that is consistent with Proposition 2.¹⁷

The EEC countries are ostensibly integrated economic systems characterized by considerable decentralization of the redistribution function. These countries are legally committed to a common labor market. According to the Treaty of Rome (Articles 48 and 51), these countries may not deprive citizens of other member states of the employment and social rights and benefits that they extend to their own citizens. Citizens of any EEC country are legally entitled to work in any other member state and must be treated identically to native citizens with respect to taxation, social security, family allowances, access to education, and all other social benefits. While this is only a description of the state of affairs *de jure*, not *de facto*, it is nonetheless true that the EEC countries are getting closer to a "common labor market," and this is likely to be increasingly true in the future.¹⁸ Re-

¹⁷A simple regression of $MATCH_i$, the AFDC matching rate for state i (or the District of Columbia) in 1990, on $BENEFIT_i$, measured as the 1989 level of food-stamp and AFDC benefits for a family of three as a percentage of poverty income, yields $MATCH_i = 93.49 - 0.518(SE = 0.091)BENEFIT_i$, $R^2 = 0.399$, indicating considerably more generous subsidy rates for states with low benefit levels (data source: Janice Pessin, 1989 pp. 3–4).

¹⁸As a practical matter, the degree of uniformity of treatment of native residents and immigrants depends considerably on administrative procedures which can effectively obstruct the provision of at least some social benefits to immigrants if desired. For instance, information about participation in social insurance programs, eligibility for health care, and the like can be

¹⁶The recent highly publicized debate on school finance reform in Texas (which is only the most recent in a long series of related controversies that have arisen in many states) exemplifies many of the issues involved. Robert P. Inman and Daniel L. Rubinfeld (1979) provide an excellent survey of both the economic and legal issues involved in the debate about equity in education.

distributive policy undertaken at the national level by EEC member states may therefore be viewed as decentralized redistribution within the broader European context. Increased labor and capital mobility are likely to limit the amount of income redistribution undertaken by EEC countries (see e.g., A. Lans Bovenberg, 1990; Timothy J. Goodspeed, 1990; Hans-Werner Sinn, 1990; Vito Tanzi and Bovenberg, 1990; Frederic van der Ploeg, 1990). It may also increase interest in devising mechanisms at the EEC level (or perhaps by other means) that support redistributive activities by member states in order to internalize fiscal externalities.

In fact, developments along these lines have been occurring for some time. A number of EEC countries have reformed their personal tax structures in the past 10–15 years in a way that lowers their progressivity. Discussions of VAT (value-added tax) harmonization in the wake of the Cockfield report and the decision to abolish fiscal frontiers emphasize the possibility of downward pressure on high VAT rates, which could limit the resources available to support redistributive activity in high-VAT countries such as Denmark. The main fiscal function of the EEC itself (which functions in some ways like a central government) is to use revenues collected from member states to subsidize redistributive activities (Wildasin, 1990). These include agricultural subsidies and distributions to underskilled workers and disadvantaged regions through the European Social Fund (ESF) and the European Regional Development Fund (ERDF). The European Commission and its President, Jacques Delors, have repeatedly

stressed the importance to maintaining “solidarity” in the process of completing the internal market by 1992. “Solidarity” and “Social Europe” (e.g., Commission of the European Community, 1989) in this context means maintaining a concern with equity and distribution as European integration proceeds. This has taken a tangible form in the decision to double the expenditures of the ESF and the ERDF by 1992.

There may be grounds for skepticism about the empirical importance of intra-EEC migration (see e.g., Stephen Smith, 1990). However, several recent trends highlight its relevance. First, migration among EEC member states can be quantitatively important. Evidence from Portugal (see José Pedro Barosa and Pedro Telhado Pereira, 1989) shows that such migration is certainly not unprecedented. In fact, more than 8 percent of the inhabitants of France are legal immigrants, the largest number of which are Portuguese. (Illegals may constitute another 2 percent.) Second, the applications of Austria and Turkey for EEC membership raise questions both within those countries and in existing EEC countries about fiscal externalities. The potential for migration between Austria and Germany is great since they share a common language, and the potential for Turkish migration is well-documented from the German guest-worker experience. Concern about migration will certainly play an important role in the consideration of the Turkish application for membership. Finally, the recent German experience with East–West migration (both from East Germany and, previously, from the Soviet Union and other East-bloc countries that were permitting people of German ancestry to emigrate) is instructive. It reveals that fiscal externalities can be perceived as large and, in the case of East Germany, that the desire to avoid these externalities may induce significant intergovernmental transfers in order to offset migration. It also raises questions about the desirability of expanding the EEC to include other European countries such as Hungary, Poland, and Czechoslovakia.

made available only in the native language, with no outreach to immigrant populations, by limited numbers of bureaucrats with no strong mandate to make their services easily accessible. Nevertheless, the *de jure* commitment is not a meaningless one, and broadly speaking, the *de facto* reality undoubtedly approximates the *de jure* state of affairs to an increasing extent over time.

APPENDIX

A. Proofs

PROOF OF PROPOSITION 1:

In any Nash equilibrium with redistributive transfers, it follows from (8a) that $\sigma_i(MRS_i - l_i) = -(1 - \sigma_i)(1 - s_i)z_i l'_i - s_i l_i$ for all i . Substituting into (9) yields

$$(A1) \quad \gamma_i = - \frac{-(1 - s_i)z_i l'_i - s_i l_i}{\sigma_i}.$$

Substituting from (A1) into (8b), setting $s_i = 0$, and multiplying through by w_i yields

$$\begin{aligned} w_i \frac{d\mu_j}{dz_i} &= w_i \sigma_i \gamma_j = -w_i \frac{\sigma_i}{\sigma_j} z_j l'_j \\ &= -w_i l'_i z_j = -\varepsilon_i l_i z_j. \end{aligned}$$

PROOF OF PROPOSITION 2:

Since $d\mu_i / dz_i = 0$ in a Nash equilibrium, (8a) implies that

$$\begin{aligned} MRS_i - l_i \\ = [-s_i l_i - (1 - \sigma_i)(1 - s_i)z_i l'_i] \sigma_i^{-1} \end{aligned}$$

and hence, by (9),

$$(A2) \quad \gamma_i = \frac{-s_i l_i - (1 - s_i)z_i l'_i}{\sigma_i} \quad \forall \quad i.$$

Therefore, by (8b),

$$\begin{aligned} (A3) \quad \sum_{j \neq i} \frac{d\mu_j}{dz_i} &= \sum_j \frac{d\mu_j}{dz_i} - \frac{d\mu_i}{dz_i} \\ &= \sigma_i \sum_j \gamma_j + s_i l_i \\ &\quad + (1 - s_i)z_i l'_i. \end{aligned}$$

Now, using (10) and (11), it follows that $MEB_i = 0 = \sigma_i \sum_j (\gamma_j - s_j z_j l'_j) + z_i l'_i$ at a corrected Nash equilibrium, or, by the defini-

tion of σ_i ,

$$z_i = \frac{-\sum_j (\gamma_j - s_j z_j l'_j)}{\sum_j l'_j} \quad \forall \quad i.$$

PROOF OF PROPOSITION 3:

In a corrected Nash equilibrium, all z_j assume a common value, say \bar{z} . From (8b) and (11), the condition $MEB_i = 0$ implies that

$$\sigma_i \sum_{j \neq i} (MRS_j - l_j) = \bar{z} \sum_{j \neq i} \frac{dl_j}{dz_i} + \bar{z} s_i \frac{dl_i}{dz_i} + s_i l_i.$$

Optimizing behavior by jurisdiction i implies [from (8a)] that

$$\sigma_i (MRS_i - l_i) = -s_i l_i - \bar{z} (1 - \sigma_i) (1 - s_i) l'_i.$$

Adding these two expressions and noting that $\sum_j (dl_j / dz_i) = 0$ yields the Samuelson condition.

PROOF OF PROPOSITION 4:

Using symmetry, drop all subscripts. From (10),

$$\frac{d \sum_j s_j z_j l_j}{dz_i} = sl.$$

Moreover, using (A2),

$$\sum_{j \neq i} \frac{d\mu_j}{dz_i} = -(n - 1)sl - (n - 1)(1 - s) \frac{z}{w} l\varepsilon.$$

One can solve

$$0 = MEB = \sum_{j \neq i} \frac{d\mu_j}{dz_i} - \frac{d \sum_j s_j z_j l_j}{dz_i}$$

for s . Rearrangement of terms proves the result.

B. The Model with Migration Costs

Assume (as in the text) that there are only two jurisdictions, i and j , and that it costs x_{ij} to migrate from i to j . Using the migration-equilibrium condition $f'_i(l_i) + z_i - x_{ij} = f'_j(l_j) + z_j$, one can solve implicitly for $l_i(z_i, z_j)$ such that

$$\frac{dl_i}{dz_i} = - \frac{1}{f'_i + f'_j} = - \frac{dl_j}{dz_i}.$$

Substitution of $l_i(z_i, z_j)$ into $c_i = f'_i(l_i) + z_i$ and the analogous equation for c_j shows how the net income of the mobile households depends on transfers. The dependence of y_i and y_j on transfers is described similarly. Differentiation of the utility functions of the immobile households in each jurisdiction yields

$$\begin{aligned} \frac{d\mu_i}{dz_i} &= \text{MRS}_i - (1 - s_i)l_i \\ &+ [\text{MRS}_i f''_i - l_i f''_i - (1 - s_i)z_i] \frac{dl_i}{dz_i} \end{aligned}$$

$$\frac{d\mu_j}{dz_i} = [\text{MRS}_j f''_j - l_j f''_j - (1 - s_j)z_j] \frac{dl_j}{dz_i}$$

which are essentially identical to (8a) and (8b) of the text. The analysis of externalities and corrective subsidies proceeds from these expressions as before. Propositions 1–4 remain valid as stated, except that they only apply to the case in which migration costs are not prohibitively high.

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