DISCUSSION PAPER SERIES

IZA DP No. 1889

Income Taxes, Property Values and Migration

Amihai Glazer
Vesa Kanniainen
Panu Poutvaara

December 2005

Forschungsinstitut
zur Zukunft der Arbeit
Institute for the Study
of Labor

Income Taxes, Property Values and Migration

Amihai Glazer
University of California, Irvine

Vesa Kanniainen
University of Helsinki

Panu Poutvaara
University of Helsinki
and IZA Bonn

Discussion Paper No. 1889
December 2005

IZA

P.O. Box 7240
53072 Bonn
Germany

Phone: +49-228-3894-0
Fax: +49-228-3894-180
Email: iza@iza.org

Any opinions expressed here are those of the author(s) and not those of the institute. Research disseminated by IZA may include views on policy, but the institute itself takes no institutional policy positions.

The Institute for the Study of Labor (IZA) in Bonn is a local and virtual international research center and a place of communication between science, politics and business. IZA is an independent nonprofit company supported by Deutsche Post World Net. The center is associated with the University of Bonn and offers a stimulating research environment through its research networks, research support, and visitors and doctoral programs. IZA engages in (i) original and internationally competitive research in all fields of labor economics, (ii) development of policy concepts, and (iii) dissemination of research results and concepts to the interested public.

IZA Discussion Papers often represent preliminary work and are circulated to encourage discussion. Citation of such a paper should account for its provisional character. A revised version may be available directly from the author.

IZA Discussion Paper No. 1889
December 2005

ABSTRACT

Income Taxes, Property Values and Migration*

We consider taxation by a utilitarian government in the presence of heterogeneous locations within a country. We show that a utilitarian government never equalizes after-tax incomes, even when it can impose group-specific lump-sum taxes. If migration is impossible, a utilitarian government may even transfer income from the poor to the rich, reducing the rents earned by absentee landlords. The redistributive tax on the rich may be higher or lower when the rich can migrate than when they cannot.

JEL Classification: H21, H7, R21, R23

Keywords: taxes, land rents, property values, migration, redistribution

Corresponding author:

Panu Poutvaara
Department of Economics
P.O. Box 17 (Arkadiankatu 7)
FIN-00014 University of Helsinki
Finland
Email: panu.poutvaara@helsinki.fi

* Earlier versions of this paper were presented at the research seminar at the Department of Economics, University of Helsinki, and at the Area Conference on Public Economics, CESifo, Munich. We thank Marko Köthenbürger, Heikki Kauppi, Mikko Mustonen, Niku Määttänen, Tapio Palokangas and Matthias Wrede for helpful comments on those drafts.

1 Introduction

A state or other jurisdiction which imposes high taxes on the rich may induce some residents to move away. Such migration would appear to limit the government's ability to redistribute income or to finance generous social benefits. An extensive literature, starting with Tiebout (1956), identifies conditions under which interjurisdictional competition allows citizens to consume their preferred combination of public services by choosing in which jurisdiction to live, with each jurisdiction collecting taxes which just cover the cost of the public goods it provides. In a Tiebout framework with perfect mobility, governments cannot redistribute income between citizens. Despite this theoretical possibility, governments engage in significant redistribution. A race to the bottom is not universal.

Migration may be limited for several reasons: moving is costly; some people prefer one location over another; property values decline in response to higher taxes, thereby reducing the incentives to move. A recent literature, building on Epple and Romer (1991), concludes that redistribution and migration stratify communities, though not necessarily into full sorting. The insights and the modelling approach of this literature are better suited to the United States than to Europe. Epple and Romer (1991) and subsequent literature analyze local communities which rely on property taxes; in Europe, income redistribution is carried out by nation-states levying income taxes.

We shall examine income-tax financed redistribution in the presence of heterogeneous land. In particular, we suppose that good locations are scarce: people who want to live near the beach or on top of a mountain with a gorgeous view will find such locations limited.[1] We shall see that a small income tax imposed on the rich in a jurisdiction with heterogeneous locations reduces the utility of each rich person, increases the utility of each poor person, and reduces property values in desirable locations. Tax incidence, however, is complicated because a person's utility depends on three elements: his post-tax income, the rent he pays, and the location where he lives. The incomes of rich people, after paying the tax and after paying rents, fall, but by differing amounts. Property values also fall, hurting landlords. These results, which relate to the research tradition in urban economics, thus extend the conventional public finance view on taxes and migration.

Our model assumes that the rich, but not the poor, can migrate. This is consistent with behavior in the European Union, with migration disproportionately large among the highly educated. Docquier and Marfouk (2004) report that the emigration rate of people with tertiary education exceeds the emigration rate of all education groups in 24 member states.[2] The emigration rate of those with tertiary education exceeds 10 percent in Austria, Estonia, Hungary, Greece, Ireland, Latvia, Lithuania, Malta, Poland, Portugal, Slovakia, Slovenia, and the United Kingdom. The emigration rate of those with primary or secondary education exceeds 10 percent only in Ireland, Malta, and Portugal.

We find that incorporating the insights of urban economics, namely that taxes are

[1] The scarcity of desirable locations may also make the property tax attractive. We focus, however, on income taxes. This amounts to group-specific lump-sum taxes, given that labor supply is inelastic.

[2] There are no data for Cyprus.

partly capitalized in property values and rents, modifies some conventional results in the public finance literature. A key insight of the literature on tax competition is that mobility of taxpayers reduces the scope for redistribution, and that governments will impose low taxes on persons who may leave the country. This would imply that a utilitarian government aiming to transfer income from the rich to the poor in the absence of migration would redistribute less if the rich can emigrate. We find instead that migration can increase redistribution. We also find that even when taxation does not distort labor supply, a utilitarian government in a closed economy does not fully equalize incomes; it may even engage in regressive redistribution. If migration is possible, a utilitarian government will not impose regressive taxes.

2 Literature

Taxes and migration The effect of taxes on migration is a central topic in studies of international tax competition; see, for example, Wildasin (1991, 1994) and Sinn (1997). Christiansen, Hagen and Sandmo (1994) show how differences in average income tax rates across countries affect migration. Though migration is influenced by relative employment and earnings opportunities, they are considered elsewhere, and we abstract from this mechanism.[3] We focus on income taxes levied on the rich. Wilson (2003) presents an excellent summary and extends the results concerning property values and land taxation.

Choice of taxes Several papers consider the tax rates that a majority of voters in a jurisdiction will adopt; see Westhoff (1977), Epple, Filimon, and Romer (1984), Epple and Romer (1991), and Goodspeed (1989). The models assume that households differ along a single dimension, typically income. In these models, an appropriately defined marginal rate of substitution is assumed to vary monotonically across households. Use of such a monotonicity condition on the marginal rate of substitution was first introduced by Ellickson (1971). Under this assumption, households will completely stratify by income across jurisdictions. Subsequently, Epple and Romer (1991) assume that voters decide on taxation, taking as given tax and transfer package in other jurisdictions. Epple and Platt (1998) model local jurisdictions in which households differ in both income and tastes, and can thus generate less stark income stratification. Hindriks (1999) considers how redistribution affects mobility, which in turn determines the identity of the voters and the levels of redistribution they favor.

An alternative approach in fiscal federalism literature has been to take the identity and objectives of the government as the same both without and with migration as Wildasin (1991) and Wildasin and Wilson (1996). Our paper follows this strand of literature. We assume that taxes are chosen simultaneously by two utilitarian governments, which

[3] See Bover, Muellbauer, and Murphy (1989) for labor market aspects, and Haavio and Kauppi (2002) for the effects of liquidity constraints. Cameron and Muellbauer (1998) consider commuting as an alternative to migration.

recognize that transfers in both countries are endogenous, and depend on their tax choice.

Taxes and property values The effects of taxes on property values and on migration are studied by Epple and Romer (1991). They argue that though local redistribution induces sorting, the induced changes in property values make redistribution feasible. Where they assume that land is homogeneous, and the size of a house is endogenous, we have the size of a house be fixed, but have land heterogeneous. At first sight, these two ways of endogenizing the demand for housing seem equivalent. They are not. In Epple and Romer's framework, all households with the same income in a given community would enjoy identical housing. With heterogeneous locations, this is not possible. Each rich (and poor) household ends up with a different bundle of location and other consumption. The rents then adjust so that all the rich share one level of utility, and all the poor share one (lower) level of utility, independent of their location.

We identify a symmetric equilibrium with heterogeneous communities: the rich live in the same jurisdictions as the poor, though residences are segregated within each jurisdiction. Epple and Romer (1991), Epple and Platt (1998) and most of the other literature in the Tiebout tradition conclude that in equilibrium the population is segregated. We view the predictions and modelling choice in the Tiebout tradition as corresponding better to migration patterns in the United States, where local governments rely heavily on property taxes, and communities are segregated by income. In western Europe income taxes are much more important than property taxes, a feature we capture by our choice of the government's tax instruments. Also, increased migration within the European Union has not resulted in income segregation across jurisdictions, in line with the predictions from our model.

Hansen and Kessler (2001) study the interaction of mobility and taxation, but with a focus different from ours. Their model explains why tax rates are lower in small countries than in large ones. People differ in their incomes, and migration arises from self-selection. In their model, the political equilibrium has rich people voting for low taxes and low grants; poor people vote for high taxes and high grants. Their key asymmetry is geographical size, which differs across countries. The basic difference between our models lies in the timing of decisions: they have budgetary policy determined after people move; as in the public finance tradition, we have tax rates set by governments before people move.

3 Assumptions

Residents Each resident is either rich or poor. All have the same utility function. The pre-tax income of each rich person is y^R; the pre-tax income of each poor person is y^P. Land differs in its location and hence in its rent. Location is indicated by e, the elevation at which a person resides. Elevation is evenly distributed on $[0, 1]$. Each elevation can accommodate a density of one resident. If all the land on the hill is occupied, the population on the hill is unity. We can view quality differences in several ways. For example, the jurisdiction could be viewed as having one hill, or else one major city. In

the hill interpretation, higher elevations have a better climate or a better view. In the city interpretation, quality declines with distance from the city. Taking the perspective of a whole country, the top of the hill corresponds to the best parts of the most attractive municipalities.

An individual's utility defined over consumption of goods (x) and elevation (e) is

$$U = u(x) + v(e) = \ln(x) + \ln(e).$$

Initially, the jurisdiction has n^R rich people; migration can change that number. The number of poor residents is fixed at n^P; they cannot migrate. Assume that $n^P + 2n^R \leq 1$, ensuring sufficient space in each jurisdiction for immobile domestic poor and mobile rich from both jurisdictions.

Government policy Government can redistribute income between the rich and the poor using group-specific lump-sum taxes. A lump-sum tax on each rich person is denoted by τ. A positive τ has the government transfer income from the rich to the poor; a negative τ implies regressive redistribution. Let the number of rich people in jurisdiction i in the equilibrium with migration be n_i^R; then the total tax revenue from them is $n_i^R \tau_i$. Let each poor person receive a transfer of t, so that aggregate transfers are

$$n^P t_i = n_i^R \tau_i.$$

We assume throughout that the tax is not confiscatory: the post-tax income of a rich person cannot fall below the post-transfer income of a poor person. This requires that

$$\tau_i \leq \frac{n^P(y^R - y^P)}{n^P + n_i^R}.$$

Migration The poor do not migrate. The rich can. The reservation utility to a rich person outside the jurisdiction is given by the standard of living abroad: no rich person will live in a jurisdiction in which his utility is less.

Land Housing (or land) is owned by absentee landlords. Each person within a jurisdiction chooses where to live; the rent at elevation e is c_e.

4 Closed economy

4.1 Equilibrium of the rental market

We develop the analysis in steps. Before we can analyze an open economy, we develop the results without migration. This makes the section rather long, but allows us to derive a novel result on optimal taxation in a closed economy.

In a closed economy, the population is $n^R + n^P$, independent of government policy. Residences, however, are segregated: all rich people live above all poor people. The rent paid by a rich person in the lowest elevation occupied by the rich is determined by the willingness to pay by the poor for locations $1 - n^R - n^P < e < 1 - n^R$. Consumption by each poor person is $y^P + \frac{n^R \tau}{n^P} - c_e$. The willingness to pay by the poor for location e is determined from the condition that rental prices equalize the utilities of all the poor:

$$\ln(y^P + \frac{n^R \tau}{n^P} - c_e) + \ln(e) = \ln(y^P + \frac{n^R \tau}{n^P}) + \ln(1 - n^R - n^P).$$

Note that the rent at the lowest occupied location, $1 - n^R - n^P$, equals zero. With any positive rent, the poor resident would prefer to move marginally downwards to the adjoining empty slot. This indifference condition for the rental market allows us to determine the rent at the highest location occupied by the poor:

$$c_{1-n^R} = \frac{y^P n^P + n^R \tau}{(1 - n^R)}. \tag{1}$$

This must also be the rent paid by a rich person infinitesimally above this elevation. Income transfers to the poor will also increase the rents paid by all the rich people above this location. The rent paid by a rich resident at elevation e (above where the poor live) is[4]

$$c_e = \frac{(y^R - \tau)e - (y^R - \tau)(1 - n^R) + y^P n^P + n^R \tau}{e}, \quad 1 - n^R - n^P < e \leq 1 - n^R. \tag{2}$$

As $\partial c_e / \partial \tau > 0$ when $0 < e < 1$, income redistribution from the rich to the poor also increases the rents the rich pay at all other locations.

Notice that without taxes, three types of consumption patterns can appear

1. Each rich person consumes more than each poor person.
2. Some rich people consume less than some poor people.
3. Each rich person consumes less than some poor people.

To establish this, note first that the utility of each rich person is the same regardless of whether he lives at the top of the hill or at a lower location. However, the marginal utilities from consumption and location differ. At the top, the marginal utility from consumption is large but from location is small. Moreover, the utility of each rich person from location, $\ln(e)$, is higher than that of any poor person. As a rich person pays a higher rent, his utility from consumption, $\ln(x)$ can be less than that of a poor person. At the elevation $1 - n^R$, the utility of the rich and of the poor from location are equal

[4]This can be solved from the indifference condition that the utility of all the rich must be equal, namely $\ln(y^R - \tau - c_e) + \ln(e) = \ln(y^R - \tau - \frac{y^P n^P + n^R \tau}{(1-n^R)}) + \ln(1 - n^R)$.

and they pay an equal rent; the rich person enjoys a higher utility from consumption than does his neighboring poor person. At higher elevations, however, rents are higher and the utility from consumption of a rich person can be smaller than the utility of a poor person. A condition for this can be derived by comparing the utilities from consumption of the highest rich person and lowest poor person. When $\tau = 0$, the rent paid by the rich at the top is $y^R n^R + y^P n^P$ (this follows by inserting $\tau = 0$ and $e = 1$ into (2)). Then the condition in terms of consumption is

$$y^R < y^P \frac{1 + n^P}{1 - n^R}.$$

When this inequality holds, a rich resident at the top consumes less than a poor person at the bottom. Even though a rich person may consume less goods than some poor persons, the utility of a rich person must always exceed that of a poor person. For otherwise

$$\begin{aligned} \ln(y^R - \frac{y^P n^P}{(1-n^R)}) + \ln(1-n^R) &< \ln(y^P) + \ln(1-n^R-n^P) \\ y^R(1-n^R) - y^P n^P &< y^P(1-n^R-n^P) \\ y^R &< y^P. \end{aligned}$$

This can never hold. Nevertheless, consumption of goods by the lowest rich person may be less than that of the lowest poor person. That is, in equilibrium it can hold that $\ln(y^R - \frac{y^P n^P}{(1-n^R)}) < \ln(y^P)$, or that $y^P > y^R(1-n^R)/(1+n^P-n^R)$. With $n^P > 0$ this can hold even if $y^R > y^P$.

4.2 Optimal tax

If rents and residences would stay constant, a utilitarian government that is restricted to one tax/transfer instrument would set a tax that equalizes the marginal utilities of income for all people. With endogenous rents and locations, this cannot be achieved with a uniform tax on the rich and a uniform transfer to the poor. The reason is that the marginal utility from consumption depends on rents paid, which differ by location. Equalizing aggregate utility within each group requires differences in utility from consumption to compensate for differences in the utility from location. Social welfare is[5]

$$SWF = \int_{1-n^R}^{1} [u^R(y^R - \tau - c_e(\tau)) + v(e)]de + \int_{1-n^R-n^P}^{1-n^R} [u(y^P + \frac{n^R\tau}{n^P} - c_e(\tau)) + v(e)]de.$$

We note that a person's marginal utility from consumption and the effect of a tax on his rent and on his consumption depend on where he lives. A rich person living at the top of

[5] We assume absentee landlords whose income thus does not enter into social welfare. This assumption is also made by Epple and Romer (1991).

the hill pays a high rent, may consume little, and so may have a higher marginal utility of consumption than does a poor person. This can make it optimal to transfer from the poor to the rich.

Consider a per capita tax τ imposed on each rich person. The optimal tax for a utilitarian government satisfies

$$\frac{\partial SWF}{\partial \tau} = \int_{1-n^R}^{1} \left(\frac{\partial u^R}{\partial x^R}\right)\left(\frac{\partial x^R}{\partial \tau}\right) de + \int_{1-n^R-n^P}^{1-n^R} \left(\frac{\partial u^P}{\partial x^P}\right)\left(\frac{\partial x^P}{\partial \tau}\right) de = 0.$$

Social optimality then requires that the tax equalize the sum of the weighted marginal utilities of consumption across income groups, $\frac{\partial u^R}{\partial x^R} = \frac{1}{x^R}, \frac{\partial u^P}{\partial x^P} = \frac{1}{x^P}$, where the weights reflect the relative population size and the marginal tax effects on consumption, $\frac{\partial x^R}{\partial \tau} = -\frac{1}{e} < 0, \frac{\partial x^P}{\partial \tau} = \frac{n^R}{n^P} + \frac{1-e}{e} > 0$. Inserting, the social optimum satisfies

$$\frac{\partial SWF}{\partial \tau} = \int_{1-n^R}^{1} \left(\frac{\partial u^R}{\partial x^R}\right)\left(-\frac{1}{e}\right) de + \int_{1-n^R-n^P}^{1-n^R} \left(\frac{\partial u^P}{\partial x^P}\right)\left(\frac{n^R}{n^P} + \frac{1-e}{e}\right) de = 0.$$

To evaluate this social optimality condition requires considering the effect of taxes and transfers on rents. Finding the optimal tax rate, however, is simplified by recognizing a key property of the model: rents adjust so that, in equilibrium, all residents with the same income have the same utility regardless of their location. Note further that the utility of each poor person is identical to that of the poor person paying zero rent. Thus, to determine the optimal tax rate it suffices to derive the effect of the tax on the resident at the lowest location in each income group. Social welfare is then the product of the size of each income group and the utility of any member in that group, say of the person at the lowest location. Social welfare is thus

$$SWF = n^R U^R + n^P U^P.$$

The utility of the poor person living at the lowest elevation is

$$\begin{aligned} U^P &= \ln(y^P + \frac{n^R \tau}{n^P}) + \ln(1 - n^R - n^P) \\ &= \ln((y^P + \frac{n^R \tau}{n^P})(1 - n^R - n^P)). \end{aligned}$$

The utility of the rich person living just above a poor person is

$$\begin{aligned} U^R &= \ln(y^R - \tau - \frac{y^P n^P + n^R \tau}{(1 - n^R)}) + \ln(1 - n^R) \\ &= \ln((y^R - \tau)(1 - n^R) - y^P n^P - n^R \tau). \end{aligned}$$

Thus,

$$\begin{aligned} SWF &= n^R \ln((y^R-\tau)(1-n^R) - y^P n^P - n^R\tau) \\ &\quad + n^P \ln((y^P + \frac{n^R\tau}{n^P})(1-n^R-n^P)) \\ &= n^R \ln(y^R(1-n^R) - \tau - y^P n^P) \\ &\quad + n^P \ln((y^P + \frac{n^R\tau}{n^P})(1-n^R-n^P)). \end{aligned}$$

The first-order condition is[6]

$$n^R \frac{-1}{y^R(1-n^R) - \tau - y^P n^P} + n^P \frac{\frac{n^R}{n^P}}{y^P + \frac{n^R\tau}{n^P}} = 0.$$

The optimal tax by a utilitarian government is therefore

$$\tau = \frac{1}{n^R/n^P + 1}\left(-y^P(1+n^P) + y^R\left(-n^R+1\right)\right). \tag{3}$$

Proposition 1 *A utilitarian government may impose either a positive or a negative tax on the rich.*

Proof. From (3), $\tau > 0$ if an only if $y^R/y^P > \frac{1+n^P}{1-n^R}$, and $\tau < 0$ if and only if $y^R/y^P < \frac{1+n^P}{1-n^R}$. ■

A negative tax means that the government transfers from the poor to the rich. The condition that the after-tax income of the rich is not smaller than the after-transfer income of the poor translates into the condition

$$\tau \leq \frac{n^P(y^R - y^P)}{n^R + n^P}. \tag{4}$$

The condition that τ in (3) fulfills (4) is satisfied. We find an even stronger result that

Proposition 2 *A utilitarian government never fully equalizes incomes.*

Proof. We show that the tax rate chosen by a utilitarian government is less than $\frac{n^P(y^R-y^P)}{n^R+n^P}$ in (4). This holds when

$$\frac{1}{n^R/n^P + 1}\left(-y^P(1+n^P) + y^R\left(-n^R+1\right)\right) < \frac{n^P(y^R - y^P)}{n^R + n^P}.$$

This reduces to the condition $n^P y^P + n^R y^R > 0$, which always holds. ■

[6] The second-order condition reveals that this gives the tax rate maximizing social welfare.

To improve understanding of utilitarian taxation, let $y^R = 1$, $n^P = 0.2$, and $n^R = 0.8$. The first normalization is without loss of generality. The second assumption ensures a sufficient number of poor persons. Then the condition for a positive τ is that

$$y^P < \frac{5}{6}(1 - 0.2). \tag{5}$$

If this condition is violated, then a utilitarian government transfers from the poor to the rich.

Thus, a utilitarian government does not fully equalize the incomes of the rich and the poor, and may even transfer income from the poor to the rich. Moreover, the optimal utilitarian tax policy does not equalize the marginal utilities of consumption across citizens. Rather, it equalizes the marginal utility of disposable income weighted by the shares of population and the marginal tax effects on consumption.

The intuition for the result relates to the insight made by Mirrlees (1972). He shows that when otherwise identical people live in different locations and so spend different amounts on transportation, people will differ in their marginal utilities of income. Maximizing social welfare calls not for equalizing incomes, but for equalizing the marginal utilities of income. In other words, even with identical people, inequality of income distribution is part of the social optimum. In our model, the rich may consume less than the poor, and so enjoy a higher marginal utility of consuming goods; maximizing social welfare would then call for transfers to the rich. A related explanation for our finding lies in the property market. By transferring income from the poor, the government reduces the rents the poor are willing to pay. This, in turn, directly reduces the rent paid by each rich person. Thus, by transferring income from the poor to the rich, the government reduces rents and thus increases consumption.

Lastly, our result that a utilitarian government may transfer from the poor to the rich crucially hinges on the presence of heterogeneous land. If land is homogeneous and the rich and the poor differ in the amount of land they rent, as in Epple and Romer (1991), then the rich would have a lower marginal utility from their consumption than the poor. This would suggest transferring income from the rich to the poor. With heterogeneous land, the marginal utility from consumption differs inside both income groups. This renders government policy more difficult and may actually reverse the common view that a utilitarian government should engage in progressive income redistribution.

5 Open economy

5.1 Migration and rental markets

We now turn our attention to migration between countries. Assume two countries, a and b, with n^R rich people initially living in each country. The rich can migrate at zero cost, and exhibit no home country preference. Each jurisdiction has $n^P > 0$ poor residents, who do not migrate. Each resident pays taxes in the country in which he lives. Then

a tax on the rich creates an incentive to emigrate. We thus make the lowest locations occupied in each country endogenous. As we are concerned with tax competition, in our time line governments simultaneously choose their tax rates; people observe the tax rates when deciding to migrate.

The migration equilibrium for any given tax is determined by a simultaneous system of six equations. These represent per capita transfers to the poor, the rents paid by the rich at the lowest elevation that they occupy in the two countries, the population identity, and the arbitrage condition that the utility of the rich is the same in the two jurisdictions.

The per-capita transfer to the poor in country i is

$$t_i = \frac{n_i^R \tau_i}{n^P}. \tag{6}$$

The arbitrage condition in the rental market gives the rent paid by the poor in country i in the highest location that they occupy

$$\begin{aligned} & \ln(y^P + \frac{n_i^R \tau_i}{n^P} - c_{1-n_i^R}) + \ln(1 - n_i^R) \qquad (7) \\ = \quad & \ln(y^P + \frac{n_i^R \tau_i}{n^P}) + \ln(1 - n_i^R - n^P). \end{aligned}$$

This condition states that the utility of the poor living at the highest location occupied by the poor equals the utility of the poor living at the lowest occupied location (where the rent is zero). Equation (7) yields

$$c_{1-n_i^R} = \frac{y^P n^P + n_i^R \tau_i}{(1 - n_i^R)}. \tag{8}$$

The population identity states that the sum of post-migration rich populations equals the sum of initial rich populations:

$$n_a^R + n_b^R = 2n^R. \tag{9}$$

The arbitrage condition imposed by migration by the rich across the two jurisdictions states that

$$\ln(y^R - \tau_a - c_{1-n_a^R}) + \ln(1 - n_a^R) = \ln(y^R - \tau_b - c_{1-n_b^R}) + \ln(1 - n_b^R). \tag{10}$$

The arbitrage conditions in the rental market state that the utility of a rich person is the same at all locations occupied by the rich, so it suffices to present migration equilibrium as equating utilities of arbitrarily chosen rich individuals in the two countries. We choose those rich people living at the lowest elevation occupied by rich people in each country. As utility functions are continuous, rents are also continuous with elevation. Thus, the rent paid by the rich at the border between the rich and the poor equals the rent that would be paid by a poor person at the same location. Substituting $c_{1-n_a^R}$ and $c_{1-n_b^R}$ from (8)

and inserting (9), we can solve from the migration arbitrage condition the post-migration rich population in country a:

$$n_a^R = \frac{(y^R - \tau_a) - (y^R - \tau_b)(1 - 2n^R) + 2n^R\tau_b}{2y^R}. \tag{11}$$

Similarly, in the post-migration equilibrium the number of rich persons living in country b is

$$n_b^R = \frac{(y^R - \tau_b) - (y^R - \tau_a)(1 - 2n^R) + 2n^R\tau_a}{2y^R}. \tag{12}$$

Note that (11) and (12) are independent of the number of the poor. Though migration depends on the share of tax revenue transferred to the poor, it does not depend on how many poor receive the transfer.[7]

5.2 Government policies

Each government maximizes the utility of citizens initially living in the country.[8] Social welfare in country a is

$$SWF = n^P \ln(y^P + t_a) + n^P \ln(1 - n^P - n_a^R) + n^R \ln(y^R - \tau_a - c_{1-n_a^R}) + n^R \ln(1 - n_a^R). \tag{13}$$

In choosing the tax, a government must consider the public budget constraint, the effects of a tax on rents, and migration responses that equalize the utility of the rich between the two jurisdictions.

Inserting (6), (8) and (11) into (13) yields

$$\begin{aligned} SWF \;=\; & n^P \ln(2y^R n^P y^P - \tau_a^2 + \tau_a\tau_b + 2\tau_a n^R y^R) \\ & + n^P \ln(2y^R + \tau_a - \tau_b - 2n^R y^R - 2y^R n^P) \\ & + n^R \ln(y^R(2y^R - \tau_a - \tau_b - 2n^R y^R) - 2y^R y^P n^P) \\ & - n^P \ln(2y^R n^P) - n^P \ln(2y^R) - n^R \ln(2y^R). \end{aligned}$$

Differentiating with respect to τ_a yields

$$\begin{aligned} \frac{\partial SWF}{\partial \tau_a} = & \frac{n^P(-2\tau_a + \tau_b + 2n^R y^R)}{2y^R n^P y^P - \tau_a^2 + \tau_a\tau_b + 2\tau_a n^R y^R} \\ & + \frac{n^P}{2y^R + \tau_a - \tau_b - 2n^R y^R - 2y^R n^P} \\ & + \frac{-n^R}{2y^R - \tau_a - \tau_b - 2n^R y^R - 2y^P n^P}. \end{aligned}$$

[7] Note, however, the requirement that the rich cannot be made poorer than the poor.

[8] This assumption is needed because if the government maximizes the sum of the utilities of citizens living in the country after migration, and were utility negative, then each government would want a zero population. Furthermore, maximizing the utility of initial citizens would arise with probabilitistic voting taking place before migration decisions.

The analysis of Nash equilibria must distinguish between solutions in which the after-tax income of the rich can be or cannot be less than the after-transfer income of the poor. The condition of higher after-tax income is given by $\tau \leq \frac{n^P(y^R - y^P)}{n^R + n^P}$. When this condition does not bind, note that $\frac{\partial^2 SWF}{\partial \tau_a^2} < 0$ at $\tau_b = \tau_a$. Thus, a symmetric Nash equilibrium exists. We focus on it, as is common in the literature on fiscal federalism which considers *ex ante* identical jurisdictions and migrants of the same type; see Wildasin (1991), Wildasin and Wilson (1996) and Zodrow and Mieszkowski (1986).[9] Thus, we can simplify by using the symmetry property that $\tau_a = \tau_b = \tau$:

$$\frac{n^P(-\tau + 2n^R y^R)}{2y^R n^P y^P + 2\tau n^R y^R} + \frac{n^P}{2y^R - 2n^R y^R - 2y^R n^P} + \frac{-n^R y^R}{(y^R(2y^R - 2\tau - 2n^R y^R) - 2y^R y^P n^P)} = 0. \tag{14}$$

Our main result is

Proposition 3 *Utilitarian governments may choose either lower or higher taxes on the rich when migration is possible than when it is not.*

Proof. We prove existence of both cases directly with numerical examples exhibiting the claimed qualitative results. If $n^P = n^R = y^P = 0.1$ and $y^R = 1$, the optimal tax in a closed economy (with migration not possible) is 0.395; the optimal tax under tax competition (with migration possible) is 0.195. If $n^P = n^R = 0.1$, $y^P = 0.5$ and $y^R = 1$, the optimal tax in a closed economy is 0.175, and the optimal tax under tax competition is 0.183. ■

It is no surprise that migration (or tax competition) can lead to lower taxes: the ability of the rich to migrate imposes an additional constraint on the government's ability to tax them. But the opposite result appears novel and surprising. The reason tax competition can increase tax rates is because of the effects that appear in the rental market for land. Emigration by rich taxpayers reduces competition for desirable locations and so reduces rents. The reduced rents benefit the poor, either because they pay lower rents, or because they live in better locations. The immigration of the rich, on the other hand, generates two effects for the receiving country. Rich migrants generate more tax revenue. But they also bid up rents. When the rent effect dominates, a utilitarian government would prefer to induce part of the domestic rich to migrate to the other country. When symmetric countries in a Nash equilibrium choose identical tax rates, no one migrates. A government, however, may impose a higher tax than in a closed economy. Thus, the ability of the rich to avoid taxes by migrating hurts them by inducing both countries to impose higher taxes.

[9] Tiebout (1956) and Epple and Romer (1991) show that if everyone is mobile, migration tends to lead to sorting of heterogeneous citizens. We find their assumption that both the rich and the poor are mobile more suitable for the United States. In the European Union, in contrast, migrants tend to be those with higher education; see Docquier and Marfouk (2004).

6 Conclusion

The urban economics view of taxation and migration complements the standard public finance view of taxation with mobility. The fall in property values reduces the incentive of the rich to migrate, thereby allowing for more redistributive taxation than is predicted by standard models in public finance. Our paper established two conditions that together create scope for income redistribution from the rich to the poor even in the absence of mobility costs or complementarities between the rich and the poor: (i) the scarcity of desirable locations and (ii) lower willingness to pay by the poor for favorable locations. If either condition fails the scope for redistribution is limited.

Our finding relates to, yet differs from, the pioneering contribution by Epple and Romer (1991), and subsequent work in that tradition. There, redistribution is financed by property taxes and voters decide on tax rates, taking the tax rates and transfers in other jurisdictions as given. Our model has utilitarian governments set income taxes, taking into account that transfers in both countries are endogenous, and depend on taxes set by both countries.

Furthermore, the presence of heterogeneous land in our model implies that initially identical consumers end up with different levels of non-housing consumption. This differs from the results that Epple and Romer (1991) and subsequent literature derive with homogeneous land: they have identical consumers make similar housing choices in each jurisdiction. We find that when rents are endogenous, a utilitarian government in a closed economy may redistribute from the poor to the rich. The intuition for this was that by taxing the poor, the government reduces rents that both the poor and the rich pay. The resultant utility gains may exceed the decline in consumption by the poor. Related to this, we also find that some or, in some cases, even all the rich may consume less non-housing goods than do some of the poor. The average marginal utility of consumption for a rich person may exceed the average marginal utility of consumption for a poor person, further justifying transfers to the rich. This result would not arise with homogeneous land.

When the rich can migrate, and government disregards the welfare of landlords, a utilitarian government may impose a higher tax than when the rich cannot migrate. The result can arise because a tax which induces emigration by the rich reduces demand for desirable locations, allowing the poor to enjoy better locations. The increased number of rich people in the other country can also generate an externality, reducing the welfare of the poor in that country. Tax competition can then lead both countries to tax the rich more heavily than they otherwise would. Though such a strong result does not always apply, it suggests that accounting for responses in the housing market can overturn common views on the effects of migration on income redistribution.

Though we find that mobility allows for any sort of redistribution, specific results will appear for different functional forms or parameter values. Computational general equilibrium models could be useful here, and we show the importance of considering the heterogeneity of land. Lastly, our results may also show why a race to the bottom has not appeared in the European Union, despite large redistribution within some countries.

References

[1] Bover, Olympia, John Muellbauer and Anthony Murphy (1989) "Housing, wages and UK labour markets." *Oxford Bulletin of Economics and Statistics*, 51(2): 97-136.

[2] Cameron, Gavin and John Muellbauer (1998) "The housing market and regional commuting and migration choices." Centre for Economic Policy Research, Discussion Paper No. 1945.

[3] Christiansen, V., K.P. Hagen, and A. Sandmo (1994) "The scope for taxation and public expenditures in an open economy." *Scandinavian Journal of Economics*, 96(3): 289-309.

[4] Docquier, Frédéric and Abdeslam Marfouk. (2004). "Measuring the international mobility of skilled workers (1990-2000): Release 1.0." World Bank Policy Research Working Paper No. 3381.

[5] Ellickson, Bryan (1971) "Jurisdictional fragmentation and residentical choice." *American Economic Review*, 61(2): 334-339.

[6] Epple, Dennis, R. Filimon and Thomas Romer (1984) "Equilibrium among local jurisdictions: Towards an integrated treatment of voting and residential choice." *Journal of Public Economics*, 24: 281-308.

[7] Epple, Dennis and Glenn J. Platt (1998) "Equilibrium and local redistribution in an urban economy when households differ in both preferences and incomes." *Journal of Urban Economics*, 43: 23-51.

[8] Epple, Dennis and Thomas Romer (1991) "Mobility and redistribution." *Journal of Political Economy*, 99: 828-858.

[9] Goodspeed, Timothy J. (1989) "A re-examination of the use of ability to pay taxes by local governments." *Journal of Public Economics*, 38: 319-342.

[10] Haavio, Markus and Heikki Kauppi (2002) "Housing markets and labor mobility." Manuscript, University of Helsinki.

[11] Hansen, Nico A. and Anke S. Kessler (2001) "The political geography of tax h(e)avens and tax hells." *American Economic Review*, 91: 1103-1115.

[12] Hindriks, Jean (2001) "Mobility and redistributive politics." *Journal of Public Economic Theory*, 3: 95-120.

[13] Mirrlees, James (1972) "The optimum town." *Swedish Journal of Economics*, 74: 114-136.

[14] Sinn, Hans W. (1997) "The selection principle and market failure in systems competition." *Journal of Public Economics*, 66: 247-274.

[15] Tiebout, C.M. (1956). "A pure theory of local expenditures." *Journal of Political Economy*, 64: 416-424.

[16] Westhoff, Frank H. (1977) "Existence of equilibria in economies with a local public good." *Journal of Economic Theory*, 14: 84-112.

[17] Wildasin, David E. (1991). "Income redistribution in a common labor market." *American Economic Review*, 81: 757-774.

[18] Wildasin, David E. (1994) "Income redistribution and migration." *Canadian Journal of Economics*, 27: 637-656.

[19] Wildasin, David E. and John D. Wilson (1996) "Imperfect mobility and local government behaviour in an overlapping-generations model." *Journal of Public Economics*, 60: 177-198.

[20] Wilson, John D. (2003) "The property tax: Competing views and a hybrid theory." In Sijbren Cnossen and Hans Werner Sinn, eds., *Public Finance and Public Policy in the New Century*. Cambridge: MIT Press.