Strategic Nonlinear Income Tax Competition
with Perfect Labor Mobility*

by

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Abstract

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The Nash equilibria of a tax-setting game between two governments who can set nonlinear income taxes for a perfectly mobile workforce whose members differ in unobserved skill levels are examined. Each government maximizes the average utility of its residents. It is shown that there do not exist equilibria in which the total tax payments by the most highly skilled are positive. Equilibria are shown to exist in which the most highly skilled pay no taxes (for example, under laissez-faire) and in which the most highly skilled receive a net transfer funded by taxes on lower skilled individuals.

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1. Introduction

There is widespread concern that tax competition among jurisdictions for mobile capital and labor places severe constraints on the ability of these jurisdictions to engage in substantial redistributive taxation, to provide welfare programs for the needy, to maintain high safety and environmental standards, and to regulate labor practices, among other desirable social objectives. In other words, tax competition results in a “race to the bottom.” This phenomenon was first described by Stigler (1957) in the context of interjurisdictional competition among communities in the same country, but it is also a familiar feature of competition between national governments. With an ever expanding European Union, barriers to mobility across national boundaries within Europe are eroding. Similarly, restrictions on the free flow of capital around the world are diminishing. These developments have been accompanied by increased worries that the welfare state will wither and die due to the inability of national governments to maintain their social policies as the impediments to capital and labor mobility are relaxed. It is therefore important to determine the extent to which these concerns are justified.

There is a substantial literature that investigates the constraints that the competition between governments for mobile capital and labor places on the ability of governments to raise tax revenue and redistribute income. For the most part, this body of research assumes that there is full information about the relevant characteristics of the agents in the economy. For an overview of the main issues considered and a review of what has been learned in this literature, see Cremer and Pestieau (2004) and Wildasin (2006). However, in the context of redistributive income taxation, it is not only the tax policies of foreign governments that constrain the design of a country’s income tax schedule by creating incentives for the wealthy to emigrate or the foreign poor to immigrate. As emphasized by Mirrlees (1971), the inability of a government to distinguish workers with different skills also limits the amount of redistribution that is possible. Surprisingly, very little attention has been directed to investigating the validity of the race-to-the-bottom thesis in the presence of such information asymmetries when labor is internationally mobile.

In this article, we investigate tax competition between two national governments who set nonlinear income tax schedules when individuals of all skills are perfectly mobile between the two countries. In this context, the race-to-the-bottom thesis says that the ability of the national governments to engage in substantial redistribution will be severely constrained by the competition between them. In order to address this issue, we focus on how free mobility places constraints on the total tax liabilities of the most highly skilled individuals.

Our model is designed to highlight the forces of competition between two countries in a world in which, without competition, taxation would be redistributive in the sense that individuals with the highest level of innate ability would pay more taxes than less skilled individuals. We consider a discrete type version of the model used in the seminal paper of Mirrlees (1971) to analyze optimal nonlinear income taxation for a closed economy. However, there are now two tax-setting governments instead of one and individuals may
freely choose their countries of residence. There is perfect labor mobility in two senses: (1) no resources need to be expended in order to move and (2) there are no frictions to mobility based on residential attachments. We assume that it is only possible for a government to tax the income at source of its residents. It is not possible to tax the earnings of citizens who reside in the other country, nor do such individuals make remittances to their relatives in the country of origin. We further assume that the labor productivity of an individual does not depend on the country of residence. When combined with our assumption that labor is perfectly mobile, this assumption implies that locational decisions only depend on the tax schedules offered by the two countries, thereby allowing us to isolate the impact of adding interjurisdictional tax competition to the Mirrlees model without at the same time introducing other factors that might affect an individual’s choice of country of residence.

Each government designs a tax schedule to maximize an average utilitarian social welfare function defined over the utilities of its residents, given the tax schedule in the other country, but taking full account of any mobility that might result from its choice. With fixed, immobile populations, this welfare criterion provides a motivation for transferring income from higher to lower skilled individuals. Free labor mobility leads to aggressive competition among the two countries. We show that this competition is sufficiently strong that in any Nash equilibrium of the tax competition game, it is impossible to extract positive tax payments from the highest skilled individuals. Indeed, competition for the most highly skilled is so intense that there exist equilibria in which the two governments offer transfers to these individuals financed by positive taxes on lower skilled individuals.

Our results stand in sharp constrast to the findings of Hamilton, Lozachmeur, and Pestieau (2002). They show that there is no race to the bottom when the two countries choose linear income tax schedules to maximize a Rawlsian objective function when only the low skilled are mobile and these individuals do not work. However, the Rawlsian objective adopted is nonstandard. Governments are assumed to maximize the poll subsidy available to the low skilled, not to maximize the utility of the worst off residents. With the latter objective, no equilibrium with a positive poll subsidy exists because either government would want to lower its poll subsidy in order to induce the low skilled to move.

To the best of our knowledge, there are only two previous articles that consider strategic interaction among governments who can employ fully nonlinear income taxes when some individuals are free to choose both their country of residence and how much to work. Hamilton and Pestieau (2005) consider a political economy model of competition between a large number of small countries when there are two skill types and only one of them is mobile. The objective function of a government is determined by majority rule, with the consequence that it wants to maximize the utility of the type of individual who is in the majority. Like us, Piaser (2007) studies nonlinear income tax competition by benevolent governments in the presence of labor mobility, but in a model with only

\footnote{Huber (1999) considers how competition for mobile capital affects the choice of an optimal nonlinear income tax schedule when labor is immobile.}
two skills. However, there are important differences between our work and his that lead to more intense competition for the highly skilled in the problem that we consider. Piaser assumes that both countries are identical, both in the objective that they pursue and in their initial skill distribution. He restricts attention to symmetric equilibria and, hence, while the potential for free movement of labor constrains what tax schedules are sustainable, nobody actually moves. In contrast to our assumption that labor is perfectly mobile, Piaser assumes that only one type of individual is mobile, but even for the mobile type, it is costly to move. Naturally, the introduction of moving costs softens tax competition. Piaser considers two kinds of social welfare functions, one Rawlsian and one that evaluates outcomes by taking a weighted sum of the utilities of representatives of each type of individual, with the relative weight chosen so as to favor redistribution towards the low skilled. Both objectives have the feature that they are entirely indifferent to the number of individuals of a given type who reside in a country; all that matters is the utility achieved by each type. In contrast, with the average utilitarian criterion employed here, every resident counts positively. As a consequence, there is an incentive to compete for skilled individuals because, due to the incentive constraints that operate within a country, they have the highest utilities, and this would be the case even when increasing the numbers of skilled individuals residing in a country does not increase that country’s tax revenue.

Considerably more attention has been devoted to the analysis of optimal income taxation with mobile labor in the absence of strategic competition between governments. Early contributions to this literature include Bhagwati and Hamada (1982) and Wilson (1980) for the case of linear taxation and Mirrlees (1982) for the case of nonlinear taxation. Wilson (2006) provides an insightful interpretive survey of this literature. In much of this literature, potential emigrants choose between the best labour-consumption bundle available at home and some predetermined bundle or utility abroad. There is a potential conflict between a government’s desire to tax on the basis of ability to pay and the possibility that more able individuals might emigrate to avoid high tax burdens. Individuals make choices on two margins. The labor-leisure decision operates on the intensive margin, whereas the locational decision operates at the extensive margin. The labor-leisure decision is largely driven by marginal tax rates, whereas the locational decision is more sensitive to average rates of taxation. As shown by Wilson (1980) for linear taxation and by Wilson (1992) for nonlinear taxation, these two considerations can interact in complex ways, with the possibility of migration by skilled individuals lowering their average taxes while at the same time raising their marginal tax rates compared to what would be the case in a closed economy.\(^2\) With strategic interaction, as in our model, decisions made at the extensive margin play an even more central role, further constraining the amount of redistribution that is possible compared to what would be the case when other jurisdictions act passively.

We present our model in Section 2. In Section 3, we demonstrate that there are no

\(^2\)See also the recent articles by Krause (2007) and Simula and Trannoy (2006), both of which deal with nonlinear taxation.
Nash equilibria in our tax-setting game in which individuals with the highest skill make positive tax payments to either country. We establish the existence of an equilibrium for our model in Section 4 by showing that the laissez-faire solution is a Nash equilibrium. We also describe a class of equilibria in which the highest skilled individuals receive net transfers that are funded by taxes imposed on lower skilled individuals. In Section 5, we offer some concluding remarks.

2. The Model

There are two countries, A and B, who have access to the same constant returns to scale production technology that can be used to transform a single input, effective labor, into a single output. Units of these goods are normalized so that one unit of effective labor produces one unit of output. There are \( n \geq 2 \) types of individuals who differ in their labor productivities. An individual’s labor productivity is the same in both countries. A type \( i \) individual has productivity \( w_i \); that is, a unit of labor time supplied by such an individual is equivalent to \( w_i \) units of effective labor. Thus, by supplying \( l_i \) units of labor, an individual of type \( i \) produces \( y_i = w_i l_i \) units of output. The production sector is perfectly competitive and, hence, the wage rate of an individual of type \( i \) equals his productivity \( w_i \) and his pretax income equals the amount of output \( y_i \) that he produces. Types are ordered so that \( w_1 < w_2 < \cdots < w_n \). The total number of individuals of type \( i \) is \( N_i \). The distribution of these types is common knowledge.

Every individual has the same preferences over consumption \( c \) and hours of work \( l \). These preferences are represented by the cardinally significant utility function \( u(c, l) \). The function \( u(\cdot) \) is strictly increasing in \( c \), strictly decreasing in \( l \), strictly concave, and twice continuously differentiable. For an individual with labor productivity \( w \), his utility expressed in terms of observable variables is given by

\[
v(c, y; w) = u \left( c, \frac{y}{w} \right). \tag{2.1}\]

These preferences satisfy the usual single-crossing property. In \((y, c)\)-space, each person’s indifference curves are upward sloping, with the slope increasing along an indifference curve as \( y \) increases. Furthermore, the slope of the indifference curve through \((y, c)\) decreases with an increase in \( w \).

Utility is not directly affected by location; that is, holding consumption and labor supply fixed, individuals are indifferent between country of residence. Thus, countries possess no country-specific amenities that any individual might find attractive and that would therefore introduce frictions to labor mobility based on residential attachments. We also assume that no expenditure of resources is required to change country of residence. Together, these features of our model imply that labor is perfectly mobile. As a consequence, it does not matter whether we regard individuals as having an initial country of residence or if we treat them as being initially stateless. For concreteness, we make the latter assumption, so an individual acquires his nationality by his choice of residence.
The government in each country has the authority to levy taxes on its residents for the purpose of redistributing income among them. Neither government can observe the labor productivity or the hours worked of any individual, but each of them can observe who resides within its borders and what each resident’s pretax income is. Accordingly, taxes are based on labor income. The governments simultaneously and independently announce type-independent income tax schedules, \( \tau_A(\cdot) \) and \( \tau_B(\cdot) \), where \( \tau_j(y) \) is the tax paid by a resident of country \( j \), \( j = A, B \), whose income is \( y \). Each individual then chooses where to reside and how much labor to supply taking these tax schedules as given. These choices determine the amount of tax he pays and the government to which he remits payments. Thus, an individual who chooses to reside in country \( j \) and who earns income \( y_j^i \) pays \( T_j^i = \tau_j(y_j^i) \) in taxes to government \( j \). If \( T_j^i \) is negative, then person \( i \) receives a transfer of \( |T_j^i| \). Because there are no resource costs associated with the choice of residence, his consumption \( c_j^i \) of the single output good equals his after-tax income:

\[
c_j^i = y_j^i - T_j^i, \quad j = A, B, \quad i = 1, 2, \ldots, n. \tag{2.2}
\]

The number of individuals of type \( i \) choosing to reside in country \( j \) is \( N_j^i \), where \( N_A^i + N_B^i = N_i \) for all \( i \).

Because labor is freely mobile and taxation is anonymous in each country, standard revealed preference arguments imply that individual choices satisfy the self-selection constraints

\[
v(c_j^i, y_j^i; w_i) \geq v(c_k^j, y_k^j; w_i), \quad j, k = A, B, \quad h, i = 1, 2, \ldots, n \tag{2.3}
\]

for all income-consumption bundles actually chosen by some individual. As is well known, if the allocation in country \( j \) satisfies these self-selection constraints, then it can be supported by an anonymous income tax schedule. See, for example, Guesnerie and Seade (1982). In view of these observations, we can equivalently think of each government as choosing a tax schedule or as directly choosing an allocation of income-consumption bundles for its residents subject to the self-selection constraints that apply to its country. In the proofs of our results, we assume that governments directly choose allocations.

An immediate implication of the self-selection constraints is that if individuals of the same type reside in both countries, then they must receive the same utility regardless of where they live. Furthermore, within a country, (i) consumption and income are nondecreasing in type and two types have the same income if and only if they have the same consumption, in which case they are said to be bunched, and (ii) utility is increasing in type.

Each government wants to maximize the average utility of its residents. Formally, social welfare in country \( j \) is given by

\[
W(u_1^j, u_2^j, \ldots, u_n^j; N_1^j, N_2^j, \ldots, N_n^j) = \frac{\sum_{i=1}^n N_i^j u_i^j}{\sum_{i=1}^n N_i^j}, \quad j = A, B, \tag{2.4}
\]

where \( u_i^j \) is the utility of a type \( i \) individual residing in country \( j \). With this welfare criterion, the individuals whom a government cares for are exactly those individuals

\[3\text{If nobody of type } i \text{ resides in country } j, \text{ then the value of } u_i^j \text{ can be chosen arbitrarily. Because all} \]
whom it taxes. Moreover, individuals are sufficiently footloose that there is no meaningful distinction between residents and citizens of the type considered by Simula and Trannoy (2006) that might justify differential tax treatment of them.\footnote{The benefits provided by citizenship introduce frictions to mobility that have been ruled out by our assumption that labor is freely mobile. In a model with mobility costs, it would be natural to consider the possibility of subjecting residents and citizens to different tax schedules. Actual practice in this regard varies from country to country. For example, a citizen of the United States is subject to U.S. tax on his worldwide income regardless of his country of residence, whereas a Canadian citizen is not liable for tax in Canada if he resides elsewhere. For discussions of the relative merits of different proposals about who should count in a country’s social welfare function, who it should tax, and how it should compute its income tax base, see Mirrlees (1982), Cremer and Pestieau (2004), and Wilson (2006).}

The average utilitarian form of each government’s objective gives rise to an important trade-off. On the one hand, if individuals were not mobile, an average utilitarian government would want to depart from the laissez-faire outcome by redistributing income from more highly skilled to less highly skilled workers, provided that the natural conditions on individual utility functions described by Dixit and Seade (1979) are satisfied. The desirability of engaging in such redistribution is present whenever any of the adjacent downward self-selection constraints do not bind. On the other hand, because the self-selection constraints imply that utilities are nondecreasing in type, governments have an incentive to attract the most highly skilled workers so as to increase the average utility of their residents. Thus, each government faces a tension between the desire to redistribute resources from higher skill types to lower skill types and the possibility that, if taken too far, this redistribution might lead to exit by higher skill types and a concomitant decrease in average utility. As emphasized by Cremer and Pestieau (2004) and Wilson (2006), this tension plays a fundamental role in the literature on redistributive taxation in the presence of mobile labor.

In addition to taking account of the self-selection constraints when designing its tax schedule, each government must ensure that it has sufficient resources to carry out the redistribution that is required to implement the labor-consumption choices of those individuals who choose to reside in its county when faced with this tax schedule. Formally, the tax schedule in country $j$ must result in an allocation of consumption and pretax income (effective labor) satisfying

$$\sum_{i=1}^{n} N_i^{j} c_i^{j} \leq \sum_{i=1}^{n} N_i^{j} y_i^{j}, \quad j = A, B. \quad (2.5)$$

By Walras’ Law, this feasibility constraint is equivalent to requiring that the net tax revenue be nonnegative:

$$\sum_{i=1}^{n} N_i^{j} T_i^{j} \geq 0. \quad (2.6)$$

individuals of the same type obtain the same utility when the self-selection constraints are satisfied, it is only necessary to consider the number of individuals who reside in a country and their common level of utility.
A pair of tax schedules $\tau^A(\cdot)$ and $\tau^B(\cdot)$ is a Nash equilibrium if neither government has an incentive to change its tax schedule given the tax schedule in the other country. When deciding on the potential benefit of revising its tax schedule, a government anticipates the labor supply and locational responses of individuals to these changes. It is possible that the tax schedule announced by one country, perhaps one that is obtained by deviating from a candidate equilibrium, results in a set of individual residential decisions that causes the tax schedule offered by the other government to violate its budget constraint (2.6). Indeed, whenever a government, say in country $A$, considers modifying its tax policy for the express purpose of attracting individuals who pay positive taxes in the other country without otherwise altering the distribution of the other types of individuals across countries, the policy change in question results in a loss of revenue in the other country. Imposing the restriction that budget balance obtain in country $B$ after $A$'s tax change is inconsistent with the notion of Nash equilibrium, for such a restriction requires, contrary to the usual Nash conjectures, that country $A$ foresee a budget-balancing response by country $B$.\(^5\) Note, however, that the budget constraints of both governments are satisfied in a Nash equilibrium.

3. The Impossibility of Taxing the Most Highly Skilled

A government engaging in redistributive taxation has an incentive to attract highly skilled individuals from the other country. In single-country formulations of the optimal nonlinear income tax problem, the tax paid is nondecreasing in the skill level if, as is typically the case, the government wants to redistribute resources towards the lower skilled individuals.\(^6\) The more skilled individuals pay taxes that help finance transfers to individuals with low skills. This observation suggests that a country might wish to attract highly skilled individuals in order to make it easier to finance its redistributive goals. Moreover, because utility is increasing in the skill level, a government with an average utilitarian objective function would want to attract these individuals for the direct contribution they make to social welfare. The ability to announce a fully nonlinear tax schedule provides governments with a powerful tool to compete for the most highly skilled workers. Each government can design its tax schedule in such a way as to offer income-consumption pairs targeted directly at individuals of type $n$. Because these individuals are completely mobile, either government can attract all individuals of type $n$ by offering them a utility level slightly above that offered by its competitor. Therefore, the governments engage in Bertrand-type undercutting of the taxes paid by the highest skilled individuals. We show in Proposition 1 below that this intense competition makes it impossible for either government to raise any tax revenue from these individuals.

The following lemma is useful in developing the argument for Proposition 1. It shows that it is not possible to have a Nash equilibrium in the tax competition game that results

\(^5\)Piaser (2007) also employs this notion of equilibrium in his study of income tax competition.

\(^6\)This result is a direct consequence of combining Proposition 6 in Guesnerie and Seade (1982) with Proposition 1 in Brito, Hamilton, Slutsky, and Stiglitz (1990).
in individuals of type $n$ living in and paying positive taxes in each country.

**Lemma.** There does not exist a Nash equilibrium in which $T^A_n > 0$, $T^B_n > 0$, and individuals of type $n$ are located in each country.

**Proof.** Suppose, by way of contradiction, that there does exist a Nash equilibrium with $T^A_n > 0$ and $T^B_n > 0$ in which $N^A_n > 0$ and $N^B_n > 0$. For all $i$ and $j$, let $x^j_i = (y^j_i, c^j_i)$ be the bundle chosen by a type $i$ individual in country $j$. It follows from the self-selection constraints (2.3) that $x^A_n$ and $x^B_n$ are on the same indifference curve.

We first show that $x^A_n = x^B_n$. Without loss of generality, suppose that $x^B_n \gg x^A_n$. By self-selection and single-crossing, all individuals of a type other than $n$ strictly prefer the bundle designed for them in the country they are currently residing to $x^B_n$. Now suppose that the government of country $B$ increases $c^B_n$ by $\varepsilon > 0$ holding all other components of the allocation on offer fixed. By choosing $\varepsilon$ to be sufficiently small, no individual of types 1 through $n-1$ prefers the modified bundle for type $n$. However, all individuals of type $n$ strictly prefer the new allocation to the candidate equilibrium. Hence, all individuals of type $n$ initially residing in country $A$ now move to country $B$. These new residents pay positive income taxes. By choosing $\varepsilon$ sufficiently small, this new tax revenue exceeds the marginal loss in revenue from the type $n$ individuals residing in country $B$ prior to the tax reform. Thus, the new allocation satisfies the government budget constraint (2.6) in country $B$. Moreover, by self-selection, individuals of type $n$ have the highest utility level. Therefore, adding more individuals of type $n$ to country $B$ increases average utility in country $B$. Thus, the modified allocation constitutes a better reply for country $B$ to country $A$’s allocation on offer than does the allocation country $B$ offers in the candidate equilibrium, contradicting our supposition that the initial offers constitute a Nash equilibrium. Hence, it must be the case that $x^A_n = x^B_n$.

Starting with the allocations on offer in the candidate equilibrium, we now show how country $A$ can modify its proposed allocation so as to increase average utility in its country while at the same time satisfying all of the constraints that it faces. In the candidate equilibrium, the income-consumption bundles offered by either country to individuals of types 1 through $n-1$ must lie must lie on or below both the type $n$ and type $n-1$ indifference curves through $x^A_n = x^B_n$. Suppose that country $A$ replaces $x^A_n$ with a bundle $\tilde{x}^A_n \gg x^A_n$ lying above the type $n$ indifference curve through $x^A_n$ but below the type $n-1$ indifference curve through $x^A_n$, as illustrated in Figure 1. All individuals of type $i \neq n$ strictly prefer their initial bundles to $\tilde{x}^A_n$. The bundle $\tilde{x}^A_n$ increases the utility of type $n$ individuals residing in country $A$ and entices those type $n$ individuals residing in country $B$ to move to country $A$, thereby increasing average utility in country $A$. Let $\hat{T}^A_n$ be the tax payment associated with $\tilde{x}^A_n$. If $\hat{T}^A_n \geq T^A_n$, the new allocation also satisfies country $A$’s revenue constraint. Thus, the allocation initially offered by country $A$ is not a best reply to the one offered by country $B$. If $\hat{T}^A_n < T^A_n$, then country $A$’s revenue

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7Because indifference curves in $(y, c)$-space are increasing, we must have $x^B_n \gg x^A_n$ or $x^A_n \gg x^B_n$ if $x^A_n \neq x^B_n$.
constraint is satisfied provided that

\[ N_n^A \left( T_n^A - \tilde{T}_n^A \right) \leq N_n^B \tilde{T}_n^A, \]  

(3.1)

which is equivalent to

\[ \left( \frac{N_n^A}{N_n^A + N_n^B} \right) \leq \frac{\tilde{T}_n^A}{T_n^A}. \]  

(3.2)

By choosing \( \tilde{x}_n^A \) sufficiently close to \( x_n^A \), \( \tilde{T}_n^A \) can be made arbitrarily close to \( T_n^A \). For such an \( \tilde{x}_n^A \), the inequality in (3.2) is satisfied and, hence, \( \tilde{x}_n^A \) is feasible.

Having shown that the allocation offered by country A in the candidate equilibrium is not a best reply to the one offered by country B, we conclude that no such equilibrium exists. That is, there does exist a Nash equilibrium with \( T_n^A > 0 \) and \( T_n^B > 0 \) in which \( N_n^A > 0 \) and \( N_n^B > 0 \).

Even though a country must collect less tax revenue per person from its most highly skilled residents in order to attract more of this type of individual to its country, the additional tax revenue it receives from the newcomers can more than compensate for this loss. The small losses at the intensive margin are of marginal significance compared to the revenue gains at the extensive margin. Hence, either country can feasibly raid the other country for its most highly skilled workers. Because these are the individuals with the highest utilities, governments that want to maximize the average utility of their residents have an incentive to engage in such self-defeating competition.

If, contrary to the hypotheses of the Lemma, one of the two countries has all of the individuals of type \( n \) living inside its borders and it extracts positive tax revenue from them, then the other country has an incentive to redesign its tax schedule so as to induce
these individuals to move. As the proof of Proposition 1 demonstrates, it can do so without having to modify the taxes paid by its other residents and without running a budget deficit. Thus, in equilibrium, no country can levy a tax on the most highly skilled individuals.

**Proposition 1.** There does not exist a Nash equilibrium in which either (a) \( T^A_n > 0 \) and \( N^A_n > 0 \) or (b) \( T^B_n > 0 \) and \( N^B_n > 0 \).

**Proof.** Without loss of generality, we show that no equilibrium exists with \( T^A_n > 0 \) and \( N^A_n > 0 \). To that end, suppose, by way of contradiction, that such an equilibrium exists. There are two cases to consider: either \( N^B_n = 0 \) or \( N^B_n > 0 \). In each case, a single country changes the income-consumption bundle designed for the most highly skilled individuals, with no change in the rest of the allocation that is being offered. This new bundle is chosen so that the only individuals who move or receive a different bundle are those of type \( n \).

If \( N^B_n = 0 \), then country \( B \) can offer a bundle \( \tilde{x}^B_n \) above the type \( n \) indifference curve through \( x^A_n \) but below the \( n - 1 \) type indifference curve through \( x^A_n \) that is sufficiently close to \( x^A_n \) so that the resulting tax revenue \( \tilde{T}^B_n \) from an individual of type \( n \) is positive. All individuals of this type will move from country \( A \) to country \( B \), increasing average utility in country \( B \) while at the same time generating a budget surplus.

If \( N^B_n > 0 \), then \( x^A_n \) and \( x^B_n \) are on the same indifference curve. Country \( A \) can then offer a bundle \( \tilde{x}^A_n \) just like the one offered in the proof of the Lemma to break the candidate equilibrium.

The reasoning used to establish Proposition 1 does not extend to individuals of any type other than \( n \) for two reasons. First, there is no guarantee that attracting individuals of any other type results in an increase in a country’s average utility. Second, any attempt to adjust \( x^A_i \) for \( i \neq n \) in a manner analogous to the adjustment made to \( x^A_n \) in the proof of the Lemma may well violate a self-selection constraint by providing individuals of type \( i + 1 \) an incentive to pretend to be of type \( i \).

4. The Possibility of Making Transfers to the Most Highly Skilled

While equilibria with positive taxes on the most highly skilled individuals do not exist, there are Nash equilibria in the tax competition problem being considered here. Indeed, as the next proposition shows, it is an equilibrium for each government to choose a tax schedule of the form \( \tau(y) = 0 \) for all \( y \), thereby replicating the laissez-faire outcome.

**Proposition 2.** Setting \( \tau^j(y) = 0 \) for all \( y \), \( j = A, B \), is a Nash equilibrium.

**Proof.** Suppose that both countries use the laissez-faire tax schedule described in the statement of the proposition. We show that is not possible for one country, say \( A \), to unilaterally change its tax schedule so as to increase the average utility of its residents without violating its budget constraint.
In order to increase the average utility in country $A$ beyond its laissez-faire value, at least one type of individual, say type $h$, must receive more utility than under laissez-faire. For this to be the case, we must have $T^A_h < 0$ and $N^A_h > 0$. In order for the new allocation in country $A$ to be feasible, there must be some individuals of a type $k \neq h$ residing in country $A$ for which $T^A_k > 0$. However, any individual of type $k$ prefers the laissez-faire income-consumption bundle offered in country $B$ to any bundle for which $T^A_k$ is positive. Therefore, all individuals of type $k$ choose to live in country $B$ and, hence, the new allocation must violate country $A$’s budget constraint.

When both economies are initially tax free, the only way for a government to increase the utility of a group of individuals—either by benefiting some of its existing residents or by attracting individuals from the other country—is to offer them a transfer. However, this transfer must be financed from taxes levied on another group. Because the other country has no taxes, these would-be taxpayers emigrate.

The economic forces sustaining the laissez-faire equilibrium can also sustain equilibria in which individuals of some type less than $n$ pay positive taxes in both countries in order to make transfers to the most highly skilled individuals in the population. This point can be most simply illustrated when there are only two skill levels and two individuals with each skill.

**Example.** Suppose that each country offers a tax schedule that induces individuals to choose the bundles illustrated in Figure 2 and that, being indifferent between the two locations, one person of each skill type resides in each country. In this allocation, the individuals with skill $w_1$ (type 1) are taxed so as to make transfers to the individuals with skill $w_2$ (type 2). Furthermore, the marginal rate of substitution between income and consumption equals one for each type of individual; that is, everyone faces a zero implicit marginal tax rate on income.\(^8\) As a consequence, the only way to increase the utility of one type of individual is to lower the tax paid by any individual of that type. If the government of, say, country $A$ could costlessly induce the individual of type 2 residing in country $B$ to move, it would choose to do so because this move would increase average utility by changing the composition of its residents. However, this type 2 individual will move only if given an incentive to do so in the form of an increased transfer. Should the government of country $A$ attempt to implement such a transfer scheme, it would be required to raise additional tax revenue from its resident of type 1 in order to cover the combined cost of a larger transfer for its existing type 2 resident and the additional transfer it must now pay to its new type 2 resident. Any attempt to raise taxes on the type 1 individual lowers his utility, thereby causing him to move to country $B$. Thus, the government of country $A$ cannot feasibly attract the other type 2 individual. Moreover, it has no incentive to attract the type 1 individual living in country $B$ because this would decrease average utility in country $A$. Hence, neither government can feasibly modify the allocation illustrated in Figure 2 in a welfare improving way. The associated tax function, when implemented by both countries, is therefore a Nash equilibrium.

\(^8\)It is straightforward to modify this example so that individuals face non-zero marginal tax rates.
5. Concluding Remarks

Our results confirm the validity of the race-to-the-bottom thesis when redistributive taxation is carried out by average utilitarian governments in a strategic tax-setting environment when labor is perfectly mobile and individual skills are privately known. The threat posed to redistributive taxation by subnational governments led Stigler (1957) to advocate centralizing the redistributive role of government. The same reasoning could be applied to argue that national governments should transfer the responsibility for redistributive taxation to a supranational government, such as the European Union.

The economy considered in this article has two features that make it very difficult to sustain redistribution from the rich to the poor. First, the average utilitarian social welfare function used to evaluate tax policies, when combined with the requirements of self-selection, creates an incentive for countries to attract highly skilled individuals. Many studies of income taxation in the presence of migration cite the revenue loss associated with emigration as a reason to provide incentives for the highly skilled not to move. See, for example, the survey by Cremer and Pectieau (2004). But, as we have emphasized, this is not the only reason why the high skilled are desirable residents; they are also desirable for the direct contribution they make to social welfare. Assuming that the governments pursue an average utilitarian objective is just one way to capture this

\[ x_2^A = x_2^B \]

\[ x_1^A = x_1^B \]

\[ c = y \]

Figure 2: An equilibrium with transfers to the high skilled

\[ y \]

\[ c \]

\[ x_1^A = x_1^B \]

\[ x_2^A = x_2^B \]

\[ c = y \]

In the words of Johnson (1965, p. 300), our model generates the fundamental motive for worrying about a brain drain: the highly skilled “make a contribution to national welfare that goes beyond the money value of the services they perform and that this contribution can only be enjoyed if these people are resident within the nation.”
concern. Others include the general equilibrium effects of population composition on wages or the popular view that skilled workers are particularly valuable to a country in a knowledge-based economy.

Second, the perfect mobility of labor results in the competition for skilled individuals being particularly intense. Costless mobility is an extreme assumption. When mobility is costless, marginal changes in government policy can induce discrete changes in population composition. Moreover, when a marginal tax change leads to nonmarginal migration across borders, the effects of this migration on either welfare or budget balance outweigh whatever within-country effects the change might have. Thus, in our model, migration ultimately trumps other considerations. However, contrary to the view expressed by Piaser (2007, p. 75), free mobility does not necessarily lead to laissez-faire. Given a strong enough desire to attract the most highly skilled, governments might actually settle on an equilibrium in which the most highly skilled receive a net transfer.

Because adjustments at the extensive margin (the residential location decision), not the adjustments at the intensive margin (the labor-leisure trade-off), are the driving force behind our results, we are confined to making statements about total tax liabilities. In order to make clear cut statements about optimal marginal tax rates, our model needs to be modified so that marginal changes in taxes induce marginal changes in population composition. Models with individual-specific mobility costs, like the one presented by Piaser (2007), or some form of residential attachment, as in Blackorby, Brett, and Cebreiro (2007), provide settings in which to examine how the interaction of labor mobility and strategic tax competition affects marginal, not just average, tax rates. The extent to which the race-to-the-bottom thesis remains valid in these settings remains to be explored.

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