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Migration, wages and fiscal competition*

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Abstract

We analyze the effects of labor migration flows on income taxation between two countries (regions) differing by the size of their population and the level of productive efficiencies. Residents, otherwise identical, are heterogeneous because they incur different migration costs. Each resident compares the post-tax amount of money at home with the one obtained abroad, including the cost of migration. The government in each country maximizes the tax receipt in order to provide the largest possible amount of public good. We prove the existence of an equilibrium for any configuration of wage and any different relative size of the countries (regions). Then, we compute and characterize the equilibrium for any set of parameters, size and wage differential. Finally, we show how equilibrium migration flows affect the level of income taxation in the origin and destination country.

KEY words: migration, income tax, fiscal competition

JEL classification: F22, H20.

1 Introduction

In this paper, we analyze the effect of labor mobility on optimal taxation, in a two-country setup. Countries have different population sizes and different productive efficiencies.

In the past two decades, the removal of political and economic barriers among countries in the European Union has set in motion an increasing mobility of factors of production, including labor. As a consequence, a large body of literature has flourished analyzing the main drivers of international migration, thereby identifying different redistributive policies of governments' members of

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the Union to which migrants are highly sensitive[1]. The idea that individuals decide where to live by comparing net income levels in their origin country with those of potential destination countries is now commonly accepted in the theoretical literature and validated by many empirical papers. A natural companion question concerns the impact of migrations on optimal taxes. As early as 1972, Oates (1972) argued that international factor mobility, combined with tax competition among countries, might lead to a "race-to-the-bottom": in order to attract mobile factors or prevent them to fly away, governments reduce tax rates with potential negative effects on welfare-state benefits due to the resulting narrowed State budget. These negative effects are particularly sensitive in the relatively high tax country, the tax base shrinking due to the migrants' movement to the relatively low tax country.[2]

Recent advances in this field show that, in some circumstances, the above statements do not hold. For example, when accounting for the heterogeneity of migrants, namely unskilled *versus* skilled workers, one could observe higher taxes under fiscal competition than in the alternative case of coordination among countries. Typically, when high productivity-capital rich countries provide large welfare-state benefits, then unskilled migrants can be attracted to these countries. As a consequence, higher redistributive taxes need to be implemented in these destination countries (Razin, 2012). This increase in the fiscal burden on native-born citizens induced by the arrival of migrants can explain why liberalizing migration is not as easy to be coordinated among countries as international trade agreements.

Other elements can also affect the race-to-the bottom process, with strong fiscal policy implications. In 2004, there was the accession of eight new member states from Central and Eastern Europe, followed in 2007 by Bulgaria and Romania. As the EU is still expanding to include possibly other countries (such as Turkey), one may wonder whether further asymmetries among countries can play a role in fiscal competition. In particular, asymmetries in *population size* or *productivity* should also be expected to play an important role in the interaction among national fiscal mechanisms. For instance, concerning size asymmetry between countries, it has been pointed out that a smaller country is expected to be more aggressive than a larger rival when competing in taxes: the former has less revenue to loose if some of its native citizens fly away, while gaining possibly a larger tax base from lowering the tax more than the rival does. Still, the argument is no longer as simple if country size asymmetry is combined with productivity asymmetry.

In order to disentangle the influences of both size asymmetries and productivity discrepancies between countries, a model is needed to capture how income taxes and migration flows are interrelated "at equilibrium" under such

[1] See, for instance, Wildasin (1988, 1991, 2006), Myers (1990), Epple and Romer (1991), Wellisch (2000), Hansen and Kessler (2001), Piaser (2003), Puy (2003) among others.

[2] Hamilton and Pestieau (2005), Simula and Trannoy (2010) are two of the existing papers that analyze the role of migration in fiscal competition depending on the type of migrants, namely skilled vsus unskilled workers.

asymmetries.

To this end, we provide hereafter a two country model with asymmetric productive efficiencies and different population sizes. In spite of incurring a positive migration cost, individuals may freely want to move from a country to another: while a higher gross wage abroad plays as a powerful attractor for migrants, a larger tax pressure on the contrary operates as a strong repellent. Hence, each resident compares the post- tax amount of money obtained at home with the one obtained abroad, including the cost to be incurred due to migration.[3] Further, individuals in each country are heterogeneous according to their attachment to the home country: as a result, the cost of moving abroad is heterogeneous across the population of residents. Some of them are strongly linked to their relatives living in their home country while others are considerably more mobile, simply because they are less attached to the people living around them. National traditions, patriotism, historical origins and meteorological conditions[4] constitute other values to be considered, with a varying influence across citizens of a given country. Accordingly, individuals placed otherwise in similar situations appear as heterogeneous in their willingness to move abroad to find better conditions in their economic environment. The government in each country maximizes the tax revenue. Countries are assumed to play a two stage game. In the first stage, each government is assumed to set its income tax, taking into consideration the possible migration flow initiated as a consequence of its fiscal pressure. In the second stage, residents in each country decide whether to stay in their own country or to migrate, thereby affecting the tax base both in their origin, and in the destination, country.

In order to clearly identify the influence of each asymmetry (size and productivity) on equilibrium, we start by finding this equilibrium in a framework where countries only differ in size while sharing the same productive efficiency. Hereafter we call this framework the *benchmark*. Then, we develop the game while accounting simultaneously for both sources of asymmetry, namely relative size and productivity. This analysis embodies all possible combinations of asymmetries, with a higher productive efficiency (or wage) in the larger country or, alternatively, in the smaller one, and identifies the corresponding equilibrium in each country.

Our findings are as follows. In the benchmark case, without any productivity asymmetry but different size, the unique equilibrium of the tax game provides migration from the large country to the smaller one. Also, there exists no interior equilibrium with a positive flow of migrants from the smaller to the large country whenever the smaller country has lower wages. Further, when migrants quit low wage-large countries towards high wage-small countries, migration entails

[3] These ingredients of of the model are reminiscent of the well-known Tiebout model (1956) designed to analyse the assignement of heterogeneous individuals among different jurisdictions through local taxes. However, a major difference between the two approaches is that, in our model, individuals are at the start already assigned to a specific country when having to decide to move or stay.

[4] See Marchiori et al (2012) and Beine and Parsons (2012) for climatic determinants of international migration.

a reduction in income tax in the small country but an increase in income tax in the large country, as compared to the equilibrium in the benchmark. On the contrary, when migrants quit high wage countries, whether large or small, towards low wage countries, whether large or small, migration causes an increase in income tax in the destination country but a decrease in income tax in the large country, as compared with the benchmark.[5]

In summary, our paper provides a two-fold contribution to the existing literature. It contributes to the theory of labor migration, providing a setup where individual choices to migrate from one country to another are aggregated and simultaneously influence their respective governments when deciding their level of income tax. Using a stylized model to obtain a closed solution we identify the equilibrium income taxes chosen by the governments and the size and direction of migration flows between countries. Secondly, our paper contributes to the asymmetric tax competition literature (Bucovestky, 1991, Kanbur and Keen, 1993). We show that the benefit of smallness can still hold in the case of labor migration but depending on the productivity gap between countries. Importantly, we show that migratory flows are directed towards large countries who tax more than small countries when they own a certain level of productive efficiency.

Finally, notice that the approach provided in this paper allows to take into account simultaneously the effects of structural discrepancies among countries, like size and productivity, on national income taxes when these countries are engaged into fiscal competition.

The paper is organized as follows. In the next section, the model is detailed. Then, in Section 3, we characterize the equilibrium in the benchmark. In Section 4, we analyze the equilibrium of the game when countries differ both in the population size and productivity and compare the equilibrium with the benchmark equilibrium. Section 6 concludes.

2 The model

Consider two asymmetric sized countries whose governments impose taxes on income on their residents. The population in each country is uniformly distributed over types, and the set of types is represented in each country by the $[0, 1]$ interval. Each type of resident is supposed to be endowed with one unit of labour sold on a (national) labour competitive market. In country i, labour demand comes from a continuum of firms with an identical constant returns to scale production function $\alpha_i z$, $i = h, f$. Then, competitive wages $\bar{w}_h$ and $\bar{w}_f$ are given by $\bar{w}_h = \alpha_H$ and $\bar{w}_f = \alpha_F$.

Assume, without loss of generality, that the population is larger in country H than in country F. Furthermore, assume that the two countries let freely their residents to decide where to live after comparing the net income received

[5] It is worth noting that this finding is in line with Razin (2012) where such a type of migration effect is discussed at length in terms of migrants' skills.

in each country. We also suppose that the population is ranked each in the unit interval $[0,1]$ according to the *migration cost* to be paid when moving from one's own country to the other, assumed to be equal to x for individuals of type $x, x \in [0,1]$ .Thus, migration cost is the only source of heterogeneity among the agents. We denote by t_i $i = h, f$, the tax in country i, $t_i \in [0, w_i]$. Denote by $l_0, l_0 \in (0,1)$, the population density in the destination country and $1 - l_0$ the population density in the origin country. The income tax revenue of the government writes as $(1 - l_0)t_i$ in country i, and $l_0 t_j$ in country j, with $i \neq j, i = h, f, j = h, f$.

We define hereafter a game, with players consisting of the two governments and the residents in both countries. The set of strategies for each government i, $i = h, f$, is the set of taxes t_i satisfying the constraint that $t_i \in [0, \bar{w}_i]$. As for the residents in country i, the strategy set consists of two elements: stay in country i, move to country j, with $i \neq j$. The payoffs of this game are defined as follows. Let t_i be the strategy selected by Government i. Then, payoffs of country i and j are given by $(1 - l_0)t_i$ and $l_0 t_j$, respectively, with $i \neq j, i = h, f, j = h, f$. Now consider the set of residents selecting the strategy *stay in country* i. Then, it is easy to see that the set of residents' types x in country i who have selected strategy *stay in country* i is necessarily given by the interval $[0, x]$ with x defined by $\bar{w}_i - t_i = \bar{w}_j - t_j - x$. Those who have selected the strategy *move to country* j are defined by the complementary interval $]x, 1]$. It is clear that, in order to obtain a non-null set of residents in i choosing the strategy *move to country* j, it is necessary and sufficient that the value of x is strictly positive.

A Nash equilibrium is a pair of strategies (t_i^*, t_j^*) for the Governments, and a strategy for each resident in each country such that no Government can unilaterally increase its payoff by selecting another strategy while no resident is willing to move abroad (resp. to stay at home) when he has chosen to stay at home (resp. to move abroad).

We first identify the Nash equilibrium in a baseline where countries only differ in size, while sharing the same productivity so that $\bar{w}_i = \bar{w}_j$. Then, we move to characterize the equilibrium when country i is more productive than country j so that $\bar{w}_i > \bar{w}_j$, $i \neq j, i = h, f, j = h, f$.

3 The benchmark

Let us consider first the scenario where both countries share the same technology, namely $\bar{w}_i = \bar{w}_j$, $i \neq j$. Migration takes place from the origin country i to the destination country j, whose population before migration is l_0.Notice that the last citizen's type x willing to leave from i to j, is given by $-t_i = -t_j - x$, or

$$x = t_i - t_j. \tag{1}$$

Thus, a migration from i to j is possible at a Nash equilibrium (t_i^*, t_j^*) if and only if $x(t_i^*, t_j^*) > 0$, with $x(t_i^*, t_j^*)$ satisfying equation (1) . The resulting payoffs are given by

$$\Pi_i(t_i, t_j) = t_i \left(1 - (1 - l_0)\, x - l_0\right) \text{ and } \Pi_j(t_i, t_j) = t_j \left(l_0 + (1 - l_0)\, x\right) \tag{2}$$

Using (5), one can check that the second order conditions on $\Pi_i(t_i, t_j)$ are satisfied. As a consequence, using the first order conditions, we easily obtain the optimal taxes and the flow of migrants moving from i to j, namely,

$$t_i^{*b} = \frac{2 - l_0}{3(1 - l_0)} \text{ and } t_j^{*b} = \frac{1 + l_0}{3(1 - l_0)} \tag{3}$$

and

$$x(t_i^*, t_j^*) = \frac{1 - 2l_0}{3(1 - l_0)}. \tag{4}$$

Notice that the equilibrium taxes imply a positive flow of migrants from i to j if and only if the destination country is the smaller one, namely, $l_0 < \frac{1}{2}$. Hence,

Proposition 1 *When $\bar{w}_i = \bar{w}_j$,the unique equilibrium of the tax game provides migration from the large country to the smaller one, and is given by* (3) *and* (4)*. There exists no interior equilibrium with a positive flow of migrants from the smaller to the larger country.*

Since at equilibrium the smaller country selects lower income taxes and wages are equal, it is immediate to conclude that the migration flows from the country with the lower net income to the other one. At equal wages, the direction of migration is fully determined by the relative level of taxes.

Now, we depart from the benchmark by assuming that countries enjoy different productivity so that their wages are no longer equal.

4 Different productivity (wages)

4.1 Destination country shows lower productivity: $\bar{w}_i > \bar{w}_j$

4.1.1 Equilibrium analysis

As in the benchmark case, let us again assume that migration takes place from the origin country i to the destination country j. Notice that the last citizen's type x willing to leave from i to j, obtains as the solution x of the equation $\bar{w}_i - t_i = \bar{w}_j - t_j - x$, or by

$$x = (t_i - t_j) - (\bar{w}_i - \bar{w}_j). \tag{5}$$

Thus, a migration from i to j is possible at equilibrium if and only if $x(t_i^*, t_j^*) > 0$, with $x(t_i^*, t_j^*)$ now satisfying equation (5) : clearly, the size and direction of migration now depends not only on the difference between taxes, but also on the difference between productivity, or equivalently, between wages in the two countries. The resulting payoffs are given as in (2). Using (5), one can check that the second order conditions on $\Pi_i(t_i, t_j)$ are satisfied. Using the first order conditions, we easily obtain the candidate equilibrium strategies of the Governments and the flow of migration as

$$t_i^* = \frac{\bar{w}_i - \bar{w}_j}{3} + \frac{2 - l_0}{3\,(1 - l_0)} \text{ and } t_j^* = \frac{\bar{w}_j - \bar{w}_i}{3} + \frac{1 + l_0}{3\,(1 - l_0)}, \tag{6}$$

and

$$x(t_i^*, t_j^*) = \frac{1}{3}\left(\bar{w}_j - \bar{w}_i + \frac{1 - 2l_0}{1 - l_0}\right).$$

Notice that $t_i^* > 0$ since $\bar{w}_i > \bar{w}_j$, while $t_j^* > 0$ if

$$\bar{w}_j > \bar{w}_i - \frac{1 + l_0}{1 - l_0}. \tag{7}$$

Taxes must not exceed wages: $t_i^* \leq \bar{w}_i$ and $t_j^* \leq \bar{w}_j$, which hold if and only if

$$\bar{w}_j > max\left\{\frac{1 + l_0}{2\,(1 - l_0)} - \frac{\bar{w}_i}{2}; \frac{2 - l_0}{1 - l_0} - 2\bar{w}_i\right\}. \tag{8}$$

Studying when $x(t_i^*, t_j^*)$ is positive, we observe that, if the destination country j would be the larger country, H, namely if $l_0 > 1/2$, then the flow of migration from the origin country F to H would assume a negative value, which is not admissible.Thus, we claim:

Proposition 2 *When $\bar{w}_i > \bar{w}_j$, there exists no interior equilibrium with a positive flow of migrants from the smaller to the larger country, when the latter has a lower productivity.*

It remains to study the sign of $x(t_i^*, t_j^*)$ provided that the destination country is the smaller country, namely $l_0 < 1/2$. In this case, the condition that guaranties both $t_j^* > 0$ and $x(t_i^*, t_j^*) > 0$ writes as

$$\bar{w}_j > \bar{w}_i - \frac{1 - 2l_0}{1 - l_0}. \tag{9}$$

Notice that each of the above conditions (8) and (9) determines a non empty set in the domain of parameters $(\bar{w}_i, \bar{w}_j, l_0)$. The set where a tax equilibrium lies is identified by the solution of the system involving these conditions. Indeed, condition (9) could imply *a priori* either $\bar{w}_j > \bar{w}_i$ or the reverse, namely $\bar{w}_j < \bar{w}_i$. However, the condition $\bar{w}_j > \bar{w}_i$ is not compatible with the fact that the destination country shows lower productivity $(\bar{w}_i > \bar{w}_j)$ and it will be treated in the next section.

By construction, all residents in country i belonging to the interval $\left[0, x(t_i^*, t_j^*)\right[$ are willing to move to country j, while all residents in the interval $\left[x(t_i^*, t_j^*), 1\right]$ are willing to stay in country i. Similarly, all residents in country j are willing to stay in country j. Accordingly, as long as $x(t_i^*, t_j^*) > 0$, the set of strategies selected by all players corresponds to the unique equilibrium of the game with migration from H to F. Thus, when the destination country j is the small country F and the origin country is the larger country H, we state

Proposition 3 *When $\bar{w}_i > \bar{w}_j$, there exists a unique Nash equilibrium with migration from the large to the small country if, and only if, conditions (8) and (9) are satisfied. The equilibrium values t_h^* and t_f^* are given by*

$$t_h^* = \frac{2-l_0}{3(1-l_0)} + \frac{\bar{w}_h - \bar{w}_f}{3} \qquad t_f^* = \frac{1+l_0}{3(1-l_0)} - \frac{\bar{w}_h - \bar{w}_f}{3}.$$

Furthermore, the migration flow obtains as

$$x(t_h^*, t_f^*) = \frac{1}{3}\left(\bar{w}_f - \bar{w}_h + \frac{1-2l_0}{1-l_0}\right).$$

Notice that $t_f^* < t_h^*$. Thus, combining this inequality with $\bar{w}_h > \bar{w}_f$, we immediately deduce that, at equilibrium the net wage in the destination country exceeds the net wage in the origin one. This explains why individuals flow from the country H to country F : the destination country compensates its lower productivity by taxing income to such an extent that the net wage in the destination country exceeds the net wage in the origin country. This result is in line with the existing literature on capital mobility (Bucovetsky, 1989, Wilson, 1986) and cross-border shopping (Kanbur and Keen, 1993). It is well-known in this literature that small countries undercut in taxes their larger rivals to benefit from a higher elasticity of tax receipts. It turns out that this result also holds true when labor is mobile and when the gross salary in the large country is higher.

Some comparative statics on equilibrium taxes in country $i, i = h, f$, reveals that equilibrium tax in country F negatively depends on the wage differential $\bar{w}_h - \bar{w}_f$. Further, equilibrium taxes in both countries depend positively on the size of the destination country ($\frac{\partial t_h^*}{\partial l_0} > 0$ and $\frac{\partial t_f^*}{\partial l_0} > 0$)[6]. Evidently, the higher the wage gap, the lower the possibility for the destination country to tax in order to increase the tax budget as the tax burden reduces the net wage and, as a consequence, the incentive for migrants to flow into this country. Now consider the effect of size on equilibrium taxes. As we said above, when asymmetric sized countries compete to attract mobile factors of production, like labor, then, the smallest of the countries benefits from its smallness, because this competition leads to a race to the bottom (taxes being strategic complements). Therefore, the higher l_0, the less smaller country F (which is the country of destination of migrants in Proposition 2). Consequently, the larger the country of destination, the smaller the incentive to undercut taxes, and therefore the larger equilibrium taxes.

[6] It is important to understand that taxes do not depend directly on countries' size asymmetry because taxes depend monotonically on l_0, whereas size asymmetry decreases as l_0 increases but stays below $\frac{1}{2}$, and then size asymmetry increases as l_0 increases towards the value 1. Notice also that $\frac{\partial t_h^*}{\partial l_0} > 0$.

Furthermore, the equilibrium migration flow from H to F depends negatively on the wage differential $\bar{w}_h - \bar{w}_f$ and on l_0. The higher this wage differential, the lower the incentive for a resident in H to move towards F, the size of this gap representing the intensity of repulsion for migrants to flow out from country H. Further, the larger the population in F, the lower the possibility for the Government in F to undercut, and thus, the smaller the flow of possible migrants quitting H.

Finally, it is worth to point out the type of migration flows that arises when there is no size asymmetry between countries, namely when $l_0 = \frac{1}{2}$, while keeping different income levels. The candidate equilibrium taxes are then given by

$$t_i^* = \frac{1}{3}(\bar{w}_i - \bar{w}_j) + 1 \qquad t_j^* = \frac{1}{3}(\bar{w}_j - \bar{w}_i) + 1. \tag{10}$$

Nevertheless, the corresponding value of $x(t_i^*, t_j^*)$ is negative. Hence when $l_0 = 1/2$, the above pair of taxes (10) is not a Nash equilibrium. The intuition for this result is as follows. As we know, taxes increase with the size of the destination country l_0, because as l_0 gets closer to $1/2$, tax competition to attract migrants gets milder and milder. Hence, governments fix taxes that are increasing in l_0, to the extent that if l_0 reaches $1/2$, then $x < 0$.Thus, when $l_0 = \frac{1}{2}$, there is no tax equilibrium with a positive migration flow.

Corollary 4 *When $l_0 = \frac{1}{2}$, there exists no interior equilibrium with a positive flow of migrants in neither direction.*

Notice that an equilibrium with migration from i to j cannot be simultaneously an equilibrium with migration from j to i. Indeed, the two intervals, defined by (9) for the case in which the destination country has population l_0 and by (8) for the case in which the destination country has population $1 - l_0$, are disjoint.

It remains to complete the analysis of the game when $\bar{w}_i$ and $\bar{w}_j$ lies in the complementary sets delimited by (9) and (8). The candidate equilibrium taxes strictly lying in this interval lead to $x(t_i^*, t_j^*) < 0$. Thus, these candidate equilibria cannot be equilibria because this would imply the existence of a non-null set of types who would prefer to deviate from the strategy they choose at the candidate equilibrium *stay at home* and select *move abroad.*

4.1.2 Equilibrium taxes: the benchmark case versus wages asymmetry ($\bar{w}_i > \bar{w}_j$)

In this section ,we study the effects of migration on equilibrium taxes taking as a benchmark the scenario in which the level of productivity among countries is identical. To this aim, we need to compare taxes in (3) and in (6). From easy computations, we find that

Proposition 5 *When migrants quit large countries towards small countries, migration causes a decrease in income tax in the large country but an increase in income tax in the small country, as compared with the equilibrium tax in the benchmark, when countries show the same level of wages.*

When gross wages are different, migration mitigates the difference in net wages. Further, as the tax competition takes place between countries with different wages, the race to the bottom phenomenon does no longer apply. In fact, compared with the benchmark where countries share the same productivity, countries react in the opposite way in their fiscal behavior: while the large country reduces its fiscal burden at equilibrium, the small country increases its income tax. Thus, it weakens the incentive for both countries to coordinate their fiscal regimes, thereby preventing tax harmonization measures to be adopted.

4.2 Destination country shows higher productivity: $\bar{w}_j > \bar{w}_i$

4.2.1 Equilibrium analysis

In this section, we analyze the scenario in which the destination country of migration has a higher level of wages. The marginal consumer in country i who is the last to be willing to move to j is again given as in (5). As before, the resulting payoffs for each government are given by (2). Of course, equilibrium values for taxes and migration flow are the same as in the above section, namely

$$t_i^* = \frac{\bar{w}_i - \bar{w}_j}{3} + \frac{2 - l_0}{3\,(1 - l_0)} \text{ and } t_j^* = \frac{\bar{w}_j - \bar{w}_i}{3} + \frac{1 + l_0}{3\,(1 - l_0)} \tag{11}$$

and

$$x(t_i^*, t_j^*) = \frac{1}{3}\left(\bar{w}_j - \bar{w}_i + \frac{1 - 2l_0}{1 - l_0}\right).$$

Still, differently from the above scenario in which $\bar{w}_i > \bar{w}_j$, we have now $\bar{w}_i < \bar{w}_j$, so that $x(t_i^*, t_j^*)$ can now be positive for l_0 smaller and/or larger than $\frac{1}{2}$. Hence, by contrast with the above findings, migration could take place from H to F, or *vice versa*. Indeed, we check that $t_j^* > 0$ for any value of the parameters, while easy computations show that $x(t_i^*, t_j^*) > 0$ and $t_i^* > 0$ if, and only if,

$$\bar{w}_i - \frac{1 - 2l_0}{1 - l_0} < \bar{w}_j < \frac{2 - l_0}{1 - l_0} + \bar{w}_i. \tag{12}$$

Finally, $\bar{w}_j > t_j^*$ and $\bar{w}_i > t_i^*$ if, and only if,

$$\bar{w}_j > max\left\{\frac{1 + l_0}{2(1 - l_0)} - \frac{\bar{w}_i}{2}; \frac{2 - l_0}{1 - l_0} - 2\bar{w}_i\right\}. \tag{13}$$

However, it is easy to see that conditions (12) and (13) define a nonempty set of values of $\bar{w}_j$ because $max\left\{\frac{1+l_0}{2(1-l_0)} - \frac{\bar{w}_i}{2}; \frac{2-l_0}{1-l_0} - 2\bar{w}_i\right\} < \frac{2-l_0}{1-l_0} + \bar{w}_i$. Thus, we can conclude that

Proposition 6 *When $\bar{w}_i < \bar{w}_j$, there exist a unique equilibrium with migration flow $x(t_i^*, t_j^*)$ from the less productive country to the most productive one if, and only if, conditions* (12) *and* (13) *are met. The equilibrium values t_i^* and t_j^* are given by*

$$t_i^* = \frac{\bar{w}_i - \bar{w}_j}{3} + \frac{2 - l_0}{3\,(1 - l_0)} \qquad t_j^* = \frac{\bar{w}_j - \bar{w}_i}{3} + \frac{1 + l_0}{3\,(1 - l_0)},$$

while the migration flow obtains as

$$x(t_i^*, t_j^*) = \frac{1}{3}\left(\bar{w}_j - \bar{w}_i + \frac{1 - 2l_0}{1 - l_0}\right).$$

The difference between equilibrium taxes in the destination and the origin country is given by:

$$t_j^* - t_i^* = 2\frac{\bar{w}_j - \bar{w}_i}{3} - \frac{1 - 2l_0}{3\,(1 - l_0)}$$

Therefore, the sign of this difference depends on whether the destination country is larger or smaller than the origin country. Provided that $\bar{w}_j > \bar{w}_i$, if $l_0 \geq 1/2$, then $t_j^* - t_i^* > 0$. But if $l_0 < 1/2$, then $t_j^* - t_i^* > 0$ as long as $\bar{w}_j - \bar{w}_i > \frac{1-2l_0}{2(1-l_0)}$, whereas $t_j^* - t_i^* < 0$ if $\bar{w}_i - \bar{w}_j < \frac{1-2l_0}{2(1-l_0)}$. It follows that

Corollary 7 *When $\bar{w}_i < \bar{w}_j$, a large country that is a destination country for migrants taxes more than the small one. But a small country that is a destination country for migrants can tax more or less than the larger origin country depending on the difference of $\bar{w}_i - \bar{w}_j$.*

This result departs from the existing literature on capital mobility (Bucovetsky, 1989, Wilson, 1986) and cross-border shopping (Kanbur and Keen, 1993). As, we explained above, this literature highlights the benefit of smallness: small countries gain the competition for mobile capital because they undercut in taxes their larger rivals taking advantage of a higher elasticity of tax receipts. It turns out that this result does not always hold true when labor is mobile and when the gross salary in the large country is higher than the gross salary paid in small countries. Our result is reminiscent of the results obtained in some recent papers on mobile capital as Justman *et al*, 2002, Zissimos and Wooders, 2010, Hindriks et al, 2010, or Pieretti and Zanaj, 2011. In these papers, smaller countries can fix higher capital taxes than the larger countries as long as they supply a higher level of public infrastructure that compensates for higher taxes. Similarly, in our paper, we find that a smaller country can fix higher income taxes than a larger one if it has a higher level of productivity.

4.2.2 Equilibrium taxes: the benchmark case versus wages asymmetry ($\bar{w}_j > \bar{w}_i$)

As in section (4.1.2), we analyze here the effect of migration on taxes taking as a benchmark the case in which $w_i = w_j$.

Comparing taxes in (3) with (11), we find

Proposition 8 *When $\bar{w}_j > \bar{w}_i$ and migration flows from low wage countries towards high wage countries, it causes an increase in income tax in the destination country but a decrease in income tax in the origin country, as compared with the equilibrium taxes in the benchmark.*

This scenario recalls the result in Razin *et al* (2013), namely that migrants may increase taxes in the destination country, and that this is why natives may be against migratory flows. But in our paper the mechanism is different. We identify two different drivers for migrants to move from an origin country to a destination country. First, a high relative productivity efficiency acts as a powerful attractor, as it immediately affects wages. Accordingly, the higher the productivity in a country, the stronger the incentive for native-born citizens to stay in this country and for those citizens living in the other country to migrate there. Still, migration is also affected by a second driver, namely income tax, a relative high income tax acting as a repellent for migrants. As a result, the migration flow observed between countries is dependent on the relative strength of these drivers, the net income being the decision criterion for migrants when selecting their strategy. So, a high productive country can set relatively high income tax while still being attractive for migrants whenever the net income resulting from its fiscal burden is larger than the one observed in the alternative country.

5 Conclusion

In this theoretical paper, we have analyzed the optimal taxation set by two countries with asymmetric population size and different productivity when residents in each country can freely move from a country to another depending on the net income corresponding to the optimal income taxes. Thanks to the simplicity of the model, we were able to develop our analysis explicitly computing the equilibrium values of the main variable at play: income taxes, and direction and size of migrations flows. The parameters used to obtain this description are the populations' sizes and the productivity (wage) available in each of the two countries. On one hand, the income tax values in each country mutually depend on each other since their level modifies the incentives to migrate between them. On the other hand, the migration flow determines the optimal taxation in each country. The equilibrium tax rates are then described in the whole set of possible combinations of relative size and relative wage existing in each of them.

The main restriction of our analysis consists in assuming that the governments maximize tax revenue, without explicitly describing what is done with the resulting revenue and its resulting impact on consumers' welfare. This is the object of our further research, in which we assume that the revenue collected is used to produce a public good entering in the utility function of the consumers.

Further, this model could be used to test whether its theoretical findings are indeed supported by the data. For instance, it could be interesting to analyze how the data fit the proposition 2 according to which no migration takes place from a small country to a larger one, when the wage in the former is higher. Countries like Luxemburg and Portugal, or Ireland and Poland, respectively, could be used as examples for such empirical analysis.

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