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Migration and social insurance

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Abstract

A wide variety of social protection systems coexist within the EU. Some member states provide social insurance that is of Beveridgean inspiration (with universal and more or less flat benefits), while others offer a system that is mainly Bismarckian (with benefits related to past contributions). Labor mobility raises concerns about the sustainability of the most generous and redistributive (Beveridgean) insurance systems. We address this issue in a two-country setting, where individuals differ in mobility cost (attachment to their native country). A Bismarckian insurance system is not affected by migration while a Beveridgean one is. Our results suggest that the race-to-the-bottom affecting tax rates may be more important under Beveridge-Beveridge competition than under Beveridge-Bismarck competition. Finally, we study the strategic choice of the type of social protection. We show that Bismarckian governments may find it beneficial to adopt a Beveridgean insurance system.

JEL classification: H23;H70

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1 Introduction

The European Commission has designated 2006 as the European year of workers' mobility. Even though, labor mobility within Europe currently remains admittedly rather small, it is expected to gain importance in the years to come. European authorities as well as many politicians are advocating it, arguing that "job mobility is one of the crucial factors in Europe's economic success" (Špidla, 2006). Moreover, younger people are the most mobile, with 5% of the age groups 25–34 having moved at least once across EU countries. Finally, the 2004 EU enlargement permitted (or will permit after a transition period) the migration of potentially more mobile citizens. According to some estimates, 5% the new member states' nationals are expected to migrate to another EU country within the next five years (Vandenbrande *et al.*, 2006).

Mobility across countries affects the coexistence of different social insurance systems. Currently, one can find a wide variety of welfare systems in the EU countries. Some member states provide social insurance that is of Beveridgean inspiration (with universal and more or less flat benefits), while others offer a system that is mainly Bismarckian (with benefits related to past contributions). Since social contributions (payroll taxes) are related to individual incomes, Beveridgean systems imply a higher degree of income redistribution than Bismarckian schemes. Increased mobility raises concerns about the sustainability of the most generous and redistributive systems. This is because one can expect these countries to attract the lowest incomes and the highest risks and to repeal the highest incomes and the lowest risks (Sinn, 1990). Consequently, the extent of redistribution and the size of benefits is expected to decrease as workers become more mobile.

This paper examines the sustainability of redistributive social insurance systems under labor mobility in a two country setting. The novelty of our approach is threefold. First, we introduce migration costs in the analysis in view of getting more realistic interior solutions instead of the bang-bang solution where all individuals of the same type locate in a single country. While this assumption is commonly used in the tax competition literature (see, *e.g.*, Hindriks, 1999 and Leite-Monteiro, 1997) migration costs are typically ignored in social competition models.[1] Second, governments strategically choose both the type (Beveridge versus Bismarck), and the generosity of their social protection system. Third, in specifying a governments preferences we explicitly distinguish between the concern for redistribution and the concern for insurance. To be more precise, a Beveridgean government will maximize a welfare function that values both redistribution and insurance. A Bismarckian government, on the other hand, only cares about the provision of insurance. We determine the equilibria for different combinations of the two governments' prefererences (Bismarck-Bismarck, Beveridge-Beveridge and Beveridge-Bismarck).

The issue of tax competition under factor mobility has been extensively studied (see Cremer and Pestieau, 2004, for a survey). However, the implication of mobility for the sustainability of social protection has received much less attention and many questions remain open. There are three papers closely related to ours. In a two-country setting, Cremer and Pestieau (1998) study the strategic interaction between benevolent social planners regarding the choice of the type of social insurance system. They suppose a three-stage decision process where in the first stage, the constitutional stage, social planners choose the degree of redistribution of social insurance (the Bismarckian factor). At the second stage native individuals decide through majority voting on the level of payroll taxes which, in turn, determine the level of benefits. At the third stage individuals decide upon migration. Cremer and Pestieau show that if rich individuals are mobile they end up all living in the same country. This implies that one of the countries would insure but not redistribute. Another result is that when countries adopt the same level of redistribution, the level of benefits (emerging from the voting process) is larger the less redistributive (more Bismarckian) is the social insurance system. Finally, at stage one the equilibrium is symmetric, *i.e.*, the planners choose the same level of redistribution. Consequently, all countries would end up with the same Bismarckian factor in contrast to what we observe in reality.

To fill this gap, Cremer and Pestieau (2003) and more recently Rossignol and Taugourdeau (2006) have analyzed social insurance competition between asymmetric sys-

[1] The single exception we are aware of, Rossignol and Taugourdeau (2006), is discussed below.

tems, *i.e.*, Bismarckian and Beveridgean schemes. Cremer and Pestieau (2003) assume that decisions are taken in two stages: the benevolent social planner decides upon the level of benefits, anticipating the migration flows of the second stage.[2] When only the poor face a risk, all poor may end up migrating towards the Bismarckian country. This happens to be the case when income differences are sufficiently small so that the Beveridgean planner prefers not to supply any insurance (which would hurt the rich), but instead induce the migration of the poor towards the Bismarckian country where they can get actuarially fair insurance. Cremer and Pestieau (1998 and 2003) obtain solutions with all individuals of the same income class migrating towards the same country because of the absence of migration costs. Rossignol and Taugourdeau (2006) introduce migration costs in an asymmetric (Bismarck versus Beveridge) social insurance competition setting with several income groups. They study the political choice of the size of social insurance benefits (according to a citizen candidate procedure) when one country offers Bismarckian and the other Beveridgean insurance. They show that the lowest incomes tend to be attracted towards the Beveridgean country and the highest incomes towards the Bismarckian country but that the extent of migration depends on expatriation costs.

Some other papers have also studied the sustainability of social insurance under labor mobility. As Cremer and Pestieau (2003), Lejour and Verbon (1994) also obtain the result that the impact of economic integration on social insurance depends very much on the type of mobility considered. However, they assume high-risk and low-risk individuals rather then high-income and low-income individuals. Bureau and Richard (1997) get an similar result.[3]

In this paper we consider a two country setting where individuals are endowed with either low or high income and may face the risk of loosing it. They are born in one of the countries, and can choose their country of residence. However they have a preference for

[2] A countries welfare depends on the utilities of its natives (irrespectively of their countiry of residence).

[3] Another line of research has dealt with the effect of social insurance incentives on human capital investment. Poutvaara (2007) obtains the result that labor mobility increases investments in human capital in the Beveridgean country but reduces that of migrants from Bismarkian towards the Beveridgean country.

living in their home country (Leite-Monteiro, 1997 and Hindriks, 1999). This preference for the home country implies that the migration process is a continuous function of the countries' policies. It avoids the discontinuous (and obviously unrealistic) process that occurs in Cremer and Pestieau (1998, 2003) under which a small variation in tax rates can induce an entire income group to move from one country to the other.[4] National governments maximize a welfare function which depends on the utility of its natives (as opposed to its residents).

Through most of the paper (up to Section 6), we assume that a country's *type* of social insurance system (Bismarckian or a Beveridgean) is given (and reflects the preferences of the national government). The timing of the game is as follows. In a first stage governments choose the level of payroll taxes, (defining the generosity of the system). Knowing the type and size of the systems, individuals choose their country of residence. Governments care for their natives only and when setting the payroll tax they anticipate the migration equilibrium. We will consider three scenarios. In the first scenario both countries adopt a Beveridgean social policy, while both countries are Bismarckian in the second one. Finally, we consider an asymmetric setting in which one of the countries adopts a Beveridgean policy and the other a Bismarckian policy. In each case we determine the Nash equilibrium of this social insurance competition game.

An important contribution of our paper is that we justify the adoption of different types of system by considering different types of governments' preferences. Specifically, governments may care for both redistribution and insurance or for insurance only. In the first part of the paper we assume that the system in place and the governments preferences go hand in hand. Finally, we drop this assumption and allow governments to choose the type of system to be adopted in their respective countries in a strategic way. Not surprisingly, our results suggest that when both governments have identical preferences, they choose the social insurance system associated with their type. However, a more interesting and surprising outcome emerges in the asymmetric case where one government has Beveridgean preferences and the other Bismarckian ones. In this case the Nash equilibrium implies that both players choose a Beveridgean insurance

[4]This discontinuous adjustment in turn explains the bang-bang solution obtained in these papers.

policy.

Our paper is organized as follows. Section 2 introduces the model and Section 3 characterizes the solution under autarky which constitutes our benchmark. In Section 4.1 we characterize the tax competition among Bismarckian governments, in Section 4.2 between Beveridgean governments and in Section 4.3 we consider an asymmetric setting with a Beveridgean and a Bismarckian government. In Section 5 we provide numerical examples which illustrate our theoretical results and provide further insights for the cases where analytical results are ambiguous. Section 6 considers the strategical choice of the type of system.

2 Setup

There are two countries, indexed by A and B. Individuals differ in their wage, w_i, with $i = L, H$ and $w_L < w_H$. Labor supply is inelastic and normalized at one so that w_i also represents exogenous income. The size of high-income (also referred to as "rich") and low-income (also referred to as "poor") populations are each set at one. Individuals also differ with respect to their preference for living in a country. Their taste is captured by the parameter $x \in [0, 1]$ (Monsoorian and Myers, 1993, and Hindriks, 1999), uniformly distributed over $[0, 1]$ for both high- and low-income individuals. Preferences of an individual i, who lives in country A or B are respectively defined by

$$U_i^A = \ln\left[w_i^A\right] + 1 - x \tag{1}$$

$$U_i^B = \ln\left[w_i^B\right] + x, \tag{2}$$

where w_i^j, is the individual's disposable income when residing in country $j = A, B$. Country A's natives are individuals with a taste parameter $x \leq 1/2$ and country B's natives those with a taste parameter $x > 1/2$. Consequently both countries have a native population of 1, equally composed of low- and high-income individuals. Figure 1 illustrates native population of each country. Rich and poor individuals are located along a line with dimension one and those located from 0 to 1/2 are natives of country A whereas the others are natives of country B.

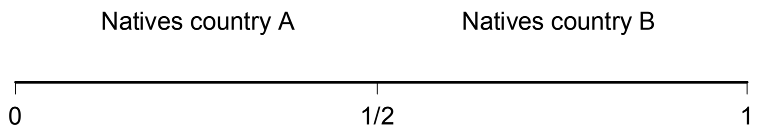

Figure 1: Native population of countries A and B.

For the ease of exposition we suppose for the time being that only low-income individuals face the risk of loosing their income with a probability of $1/2$. In Section 5 we shall relax this assumption and suppose that all individuals face the risk of loosing their income. National governments provide social insurance, which gives poor individuals a benefit in the bad state of nature (when they loose their earning ability). Social insurance is financed by taxes, with the tax base depending on the *type* of system. When the system is Bismarckian, there is no redistribution and benefits to the low-income individuals are financed by taxes levied on low-income individuals only. Under a Beveridgean system, on the other hand, the benefits to the low income individuals are financed by a proportional tax levied on *both* income classes *at a uniform rate.*

We assume, for the time being, that the system which is adopted and the preferences of the respective government go hand in hand. In other words, a Bismarckian government implements a Bismarckian system, while a Beveridgean government selects a Beveridgean system. Governments are labeled according to their preferences, which may or may not reflect a concern for redistribution.[5]

We adopt a specification of social welfare which explicitly distinguishes between redistribution across income classes and the provision of insurance (which can be thought about as redistribution between states of nature). To do so, define the certainty equiv-

[5] This assumption will be relaxed in Section 6.

alent of a low-income individual, CE_L^j, who lives in country $j = A, B$, as

$$\begin{aligned} \ln\left[CE_L^j\right] &= \frac{1}{2}\ln\left[w_L(1-t_L^j)\right] + \frac{1}{2}\ln\left[b^j\right] \\ CE_L^j &= \left(w_L(1-t_L^j)b^j\right)^{1/2}, \end{aligned} \tag{3}$$

where t_L^j is the tax rate for low income individuals in country j, and b^j the benefit they receive in case of income loss. High income individuals do not face any uncertainty, and their certainty equivalent is simply given by

$$CE_H^j = w_H(1-t_H^j), \tag{4}$$

where t_H^j is the tax rate applied to rich individuals in country j. For simplicity, we concentrate at this point on the case where no migration occurs, so that there is no need to distinguish between residents and natives. Preferences of country A's and B's governments are respectively given by

$$SWF^A = \int_0^{1/2} \frac{(CE_L^A)^{1-\rho^A}-1}{1-\rho^A} + \frac{(CE_H^A)^{1-\rho^A}-1}{1-\rho^A}dx + 2\int_0^{1/2}(1-x)\,dx, \tag{5}$$

$$SWF^B = \int_{1/2}^{1} \frac{(CE_L^B)^{1-\rho^B}-1}{1-\rho^B} + \frac{(CE_H^B)^{1-\rho^B}-1}{1-\rho^B}dx + 2\int_{1/2}^{1} x\,dx, \tag{6}$$

where $\rho^j \geq 0$ represents the government's "preference for redistribution". When $\rho^j = 0$, redistribution across income groups does not provide any social benefits (while insurance does). At the other extreme, $\rho^j \to \infty$ yields a Rawlsian social welfare function. The last term on the RHS of both expressions accounts for low and high income individuals' utility for living in the home country.

We consider two specifications of social preferences. The first assumes $\rho^j = 0$ and reflects the absence of income redistribution concern characteristic of Bismarckian countries. The second assumes $\rho^j = 1$, reflecting some income redistribution concern characteristic of Beveridgean countries (and being conveniently simplified to logarithmic). To sum up government A's preferences are given by either of the following two expressions

$$SWF^A = \int_0^{1/2} \ln(CE_L^A) + \ln(CE_H^A)dx + 2\int_0^{1/2}(1-x)\,dx, \text{ if } \rho^A = 1 \tag{7}$$

$$SWF^A = \int_0^{1/2} (CE_L^A - 1) + (CE_H^A - 1)dx + 2\int_0^{1/2}(1-x)\,dx, \text{ if } \rho^A = 0, \tag{8}$$

with analogous expressions applying for government B.[6] Observe that expression (7) can also be interpreted as a simple utilitarian welfare function (sum of individual utilities) defined without the detour of certainty equivalents. When mobility and the possibility of tax competition are introduced, three different cases can arise: *(i)* Both countries have Bismarckian type of preferences (insurance concerns only, with $\rho^A = 0$, and $\rho^B = 0$); *(ii)* Both countries have Beveridgean type of preferences (insurance and redistribution concerns, with $\rho^A = 1$, and $\rho^B = 1$); and *(iii)* Government A has Beveridgean type of preferences while Planner B has Bismarckian ones ($\rho^A = 1$ and $\rho^B = 0$).

3 Autarky

To have a benchmark we first look at the optimal choices of Bismarckian and Beveridgean governments when migration is not possible. We adopt the perspective of country A, but similar results are easily obtained for country B.

In the case of a Bismarckian system, the poor individuals insure among themselves, while rich individuals do not contribute ($t_H^A = 0$). This means that the only implicit redistribution is within the class of low income individuals, from those in the good state of nature (no income loss) towards those in the bad one (income loss). With a loss probability of 1/2, budget-balancing benefits are given by

$$b^A = w_L t_L^A. \tag{9}$$

Substituting (9) into (3) and simplifying yields

$$CE_L^A = w_L(1 - t_L^A)t_L^A,$$

while $t_H^A = 0$ implies $CE_H^A = w_H$. Substituting into (8) and rearranging we obtain

$$SWF^A = \frac{1}{2}[w_L(1 - t_L^A)t_L^A + w_H - 1] + 2\int_0^{0.5} (1 - x)\ dx. \tag{10}$$

Maximizing this expression with respect to t_L^A

$$t_L^{BIS} = \frac{1}{2}. \tag{11}$$

[6] Both of these expression are valide under autharky; they may have to be amended once mobility is introduced.

This result does not come as a surprise: under autarky, the Bismarckian planner provides full insurance at the actuarially fair price.[7]

Turning to the Beveridgean government, it provides insurance to the low income individuals financed by a tax levied on both income classes at a uniform rate $t_L^A = t_H^A = t^A$. The government's budget constraint requires

$$\frac{1}{4}b^A = \frac{1}{4}w_L t^A + \frac{1}{2}w_H t^A,$$

so that benefits are given by

$$b^A = (w_L + 2w_H)\, t^A.$$

Using this condition along with equation (7) the Beveridgean government's welfare function can be rewritten as

$$SWF^A = \frac{1}{4}\ln\left[w_L(1-t^A)\right]+\frac{1}{4}\ln\left[(w_L+2w_H)\,t^A\right]+\frac{1}{2}\ln(w_H(1-t^A))dx+2\int_0^{1/2}(1-x)\ dx.$$

Maximizing this expression with respect to t^A yields the solution $t^{BEV} = 1/4$.

4 Migration of low-income individuals

We now introduce the possibility that the poor may migrate to the other country. The timing is the following. At Stage 1 both governments simultaneously choose taxes. Then, at Stage 2 low income individuals choose their country of residence. Finally, at Stage 3 the state of nature is realized for poor individuals (who may or may not loose their earning ability).

We suppose that a country's type of system (Beveridgean or Bismarckian) is given and determined by its government's preferences. Low income individuals' migration flows are defined with respect to native populations. Consequently, as long as there is some migration flow, the low income resident populations differ from the native ones. This affects both the budget constraint and the welfare functions. Although governments only care about their natives they supply social insurance to *all* their residents. On

[7] This property holds for any (strictly) concave utility function (and not just the logarithmic specification).

the other hand, governments do care also for their natives who are living abroad and subjected to other social insurance systems.

Let $\widehat{x}_L \in [0,1]$ denote the index of the marginal individual, who is indifferent between living in country A or in country B. It is defined as solution to

$$\frac{1}{2}\ln\left[w_L(1-t_L^A)\right]+\frac{1}{2}\ln\left[b^A\right]+(1-\widehat{x}_L)=\frac{1}{2}\ln\left[w_L(1-t_L^B)\right]+\frac{1}{2}\ln\left[b^B\right]+\widehat{x}_L, \quad (12)$$

if such a solution exists. Poor individuals with a taste parameter lower than $\widehat{x}_L$ decide to live in country A. When (12) has no solution (in the interval $[0,1]$) we set $\widehat{x}_L = 1$ when $U_L^A > U_L^B$ for all $x \in [0,1]$ and $\widehat{x}_L = 0$ in the opposite case. Throughout the paper we concentrate on the case where $\widehat{x}_L$ is interior. This is necessarily true in a symmetric equilibrium, but it may or may not be true in asymmetric settings. Still, we focus precisely on interior solutions as bang-bang solutions, with all individuals migrating towards a same country, have already been addressed in the literature (see for instances Cremer and Pestieau, 2003).

We now study how the possibility of migration affects competition among different types of insurance systems.

4.1 Bismarck Bismarck tax competition

Recall that when migration is not possible, Bismarckian governments tax their low income individuals at a rate of 1/2, providing them with full insurance. Under migration a government's policy choice affects the residential decision of both countries' natives. To study a symmetric equilibrium we focus on country A's perspective and assume without loss of generality that $\widehat{x}_L \geq 1/2$.[8] The budget constraint is

$$\frac{1}{2}\widehat{x}_L b^A = \frac{1}{2}\widehat{x}_L w_L t_L^A. \quad (13)$$

As long as $\widehat{x}_L > 0$ this condition simplifies to

$$b^A = w_L t_L^A, \quad (14)$$

[8] To avoid a tedious exposition, and anticipating the migration equilibrium, we focus on $\widehat{x}_L \geq 1/2$, but the analogous exercise can be done to $\widehat{x}_L < 1/2$.

which is exactly identical to (9), the Bismarckian budget constraint under autarky. This does not come as a surprise. As low income residents insure among themselves (pay an actuarially fair rate), migration does not affect the budget constraint of the social insurance system. Furthermore, for $\widehat{x}_L \geqslant 1/2$ government A's welfare function continues to be given by

$$SWF^A = \int_0^{0.5} (CE_L^A - 1) + (CE_H^A - 1)dx + 2\int_0^{0.5} (1-x)\; dx, \tag{15}$$

which is the same as under autarky, because no native of country A has migrated to the other country. Substituting for CE_L^A and CE_H^A from equations (3) and (4), and using the budget constraint it is then plain that we return to equation (10), the expression of welfare under autarky. Consequently we obtain the same solution, namely $t_L^A = t_L^B = t_L^{BISBIS} = 1/2$, (where the subscript *BISBIS* stands for country A's and country B's type of insurance policy, respectively, Bismarckian and Bismarckian). Since $t_L^A = t_L^B$, there is no migration in equilibrium ($\widehat{x}_L = 1/2$).

4.2 Beveridge Beveridge Tax Competition

We now examine how migration affects Beveridge Beveridge tax competition. Each government charges the same tax rate to all its residents, so that $t_L^A = t_H^A = t^A$, and $t_L^B = t_H^B = t^B$. As before we focus on government A with $\widehat{x}_L \geq 1/2$. In contrast to the Bismarck Bismarck competition case, migration now affects the budget constraint

$$\frac{1}{2}\widehat{x}_L b^A = \frac{1}{2}\widehat{x}_L w_L t^A + \frac{1}{2} w_H t^A, \tag{16}$$

and benefits are now given by

$$b^A = \left(w_L + \frac{w_H}{\widehat{x}_L}\right) t^A. \tag{17}$$

Note surprisingly, for a given tax rate, the level of benefits in country A decreases as the size of the poor population increases (as $\widehat{x}_L$ raises). Substituting (17) into (12), the definition of $\widehat{x}_L$, yields

$$\begin{aligned}&\frac{1}{2}\ln\left[w_L(1-t^A)\right] + \frac{1}{2}\ln\left[\left(w_L + \frac{w_H}{\widehat{x}_L}\right)t^A\right] + (1-\widehat{x}_L) = \\ &\frac{1}{2}\ln\left[w_L(1-t^B)\right] + \frac{1}{2}\ln\left[\left(w_L + \frac{w_H}{1-\widehat{x}_L}\right)t^B\right] + \widehat{x}_L.\end{aligned} \tag{18}$$

Totally differentiating this expression and rearranging, we obtain

$$\frac{\partial \widehat{x}_L}{\partial t^A} = \frac{\frac{1}{t^A} - \frac{1}{(1-t^A)}}{4 + \frac{w_H}{\left(w_L + \frac{w_H}{1-\widehat{x}_L}\right)(1-\widehat{x}_L)^2} + \frac{w_H}{\left(w_L + \frac{w_H}{\widehat{x}_L}\right)\widehat{x}_L^2}}, \tag{19}$$

which is positive provided that $t^A < 1/2$. It can be checked that $t^A = 1/2$ corresponds to the poor individual preferred level for t^A.[9] In words, the size of the low-income population increases with the tax rate as long as it is below the individual preferred level. Conversely, when a country cuts its tax rate, it will incite some of its poor residents to move to the other country. For future reference, note that when $t^A = t^B$, we have $\widehat{x}_L = 1/2$ and expression (19) simplifies to

$$\frac{\partial \widehat{x}_L}{\partial t^A} = \frac{\frac{1}{t_A} - \frac{1}{(1-t_A)}}{4 + \frac{4w_H}{w_L + 2w_H}}. \tag{20}$$

Using the budget constraint, welfare of the Beveridgean government A (for $\widehat{x}_L \geq 1/2$), defined by equation (7), can be expressed as follows

$$\begin{aligned} SWF^A =& \frac{1}{4}\ln\left[w_L(1-t^A)\right] + \frac{1}{4}\ln\left[\left(w_L + \frac{w_H}{\widehat{x}_L(t^A, t^B)}\right)t^A\right] \\ &+ \frac{1}{2}\ln\left[w_H(1-t^A)\right] + 2\int_0^{0.5}(1-x)dx. \end{aligned} \tag{21}$$

To understand this expression, recall that with $\widehat{x}_L \geq 1/2$ all natives of country A live in country A. The first term on the RHS concerns the poor who do not experience an income loss, while the second term accounts for the poor who suffer an income loss (and receive social benefits). The third term represents the utility of consumption of the rich whereas the last terms measures the utility from living in country A, derived through the taste parameter x.

Differentiating welfare with respect to t^A yields the following FOC

$$F^{BEVBEV} = \frac{-3}{4(1-t^A)} + \frac{1}{4t^A} + \frac{w_H}{4(w_L + \frac{w_H}{\widehat{x}_L})}\frac{-\partial \widehat{x}_L / \partial t^A}{\widehat{x}_L^2} = 0. \tag{22}$$

[9] Because of the redistribution implied by the Beveridgean policy the price to be paid for insurance is below the actuarial fair price. Consequently, the poor individual's preferred value for t^A is higher than under and actuarially fair system.

Using (20), setting $t = t^A = t^B$ and $\widehat{x}_L = 1/2$, and solving shows that in a symmetric equilibrium the tax rate is given by

$$t^{BEVBEV} = \frac{1}{4}\left(\frac{4w_H + 2w_L}{5w_H + 2w_L}\right) < \frac{1}{4}. \tag{23}$$

To interpret this result, recall that the tax rate under autarky is equal to 1/4; see Section 3 . In the Beveridgean case, migration and the induced tax competition thus results in a lower tax rate and a reduced level of social insurance. Not surprisingly, this result obtains even when there is effectively no migration in equilibrium, and it is in sharp contrast to the outcome of Bismarckian systems. Observe that t^{BEVBEV} is decreasing in w_H so that a larger income difference leads to a lower equilibrium tax rate.

Summing up our results for the symmetric cases, we show that tax competition represents no threat to Bismarckian systems, while it leads to a lower (but positive) level of social protection with Beveridgean systems. These results are quite in line with conventional wisdom but they are of limited interest for practical policy issues because they only concern symmetric settings. The most interesting issues arise for the asymmetric cases to which we now turn.

4.3 Beveridge Bismarck Tax Competition

Suppose now that country A is Beveridgean while country B is Bismarckian. Benefits in country A continue to be given by equation (17) and those in country B are determined by

$$b^B = w_L t_L^B, \tag{24}$$

which is the counterpart to equation (14). The marginal individual, $\widehat{x}_L$, is then determined by the condition

$$\begin{aligned}&\frac{1}{2}\ln\left[w_L(1-t^A)\right] + \frac{1}{2}\ln\left[\left(w_L + \frac{w_H}{\widehat{x}_L}\right)t^A\right] + (1-\widehat{x}_L) = \\ &\frac{1}{2}\ln\left[w_L(1-t^B)\right] + \frac{1}{2}\ln\left[w_L t^B\right] + \widehat{x}_L,\end{aligned} \tag{25}$$

stating that he enjoys the same utility in both countries.

Differentiating this expression, we obtain

$$\frac{\partial \widehat{x}_L}{\partial t^A} = \frac{\frac{1}{t^A} - \frac{1}{(1-t^A)}}{4 + \frac{w_H}{\left(w_L + \frac{w_H}{\widehat{x}_L}\right)\widehat{x}_L^2}}. \tag{26}$$

This equation shows that country A's resident population continues to be increasing in its own marginal tax rate (for $t^A < 1/2$) like in the case where the competing country was Beveridgean. Consequently, the direction of the migration response to a country's tax increase is independent of the other country's type. However, its magnitude is larger here than it was under Beveridge-Beveridge competition. This property follows immediately from the comparison of (26) with (20) which implies

$$\left(\frac{\partial \widehat{x}_L}{\partial t^A}\right)^{BEVBIS} > \left(\frac{\partial \widehat{x}_L}{\partial t^A}\right)^{BEVBEV}. \tag{27}$$

Let us now determine the best-replies of each of the countries concentrating on the case where $\widehat{x}_L \geq 1/2$, *i.e.,* some of the poor from the Bismarckian country move to the Beveridgean country. This is the case one would intuitively anticipate to occur, and this expectation is confirmed in the numerical examples reported below. To study government B's best response we now have to write its objective explicitly (a complication we have been able to avoid in the symmetric cases above). The specification under autarky, (6) with $\rho^B = 0$, is easily generalized to account for migration and $\widehat{x}_L \geq 1/2$. Rearranging and simplifying this yield

$$\begin{aligned} SWF^B = &\left(\widehat{x}_L - \frac{1}{2}\right)(CE_L^A - 1) + \int_{1/2}^{\widehat{x}_L}(1-x)dx + (1-\widehat{x}_L)(CE_L^B - 1) + \int_{\widehat{x}_L}^{1} xdx \\ &+ \frac{1}{2}(CE_H^B - 1) + \int_{1/2}^{1} xdx. \end{aligned} \tag{28}$$

The first two terms on the RHS of this expression concerns those poor natives of B which have moved to country A (*i.e.*, poor individuals with taste parameters in the range $[1/2, \widehat{x}_L]$), while the next two terms account for the poor who remain in their native country B. Finally, there are the two terms representing the utility of the rich (who do not move, incur no risk and pay no taxes). The derivative of this expression with respect to the tax rate can be decomposed as follows:

$$\frac{\partial SWF^B}{\partial t^B} = \frac{\partial SWF^B}{\partial \widehat{x}_L}\frac{\partial \widehat{x}_L}{\partial t^B} + (1-\widehat{x}_L)\frac{\partial CE_L^B}{\partial t^B},$$

where we use the property that CE_L^A and CE_H^B do not depend on t^B. Observe that equation (25) implies $\partial SWF^B/\partial \widehat{x}_L = 0$; because $\widehat{x}_L$ is by definition indifferent between both countries of residence, a small change in this marginal individual has no first-order effect on welfare. Consequently, the first-order condition for t^B reduces to

$$\frac{\partial CE_L^B}{\partial t^B} = \frac{\partial w_L(1-t_L^B)t_L^B}{\partial t^B} = 0, \tag{29}$$

where we have used equations (3) and (24) to express CE_L^B as a function of t^B. Solving yields $t^B = 1/2$ irrespectively of the tax of the other country. In other words, providing full and actuarially fair insurance remains the dominant strategy of the Bismarckian country and we have $t_L^{B^{BEVBIS}} = 1/2$.

Turning to government A, it maximizes its natives expected utility according to Beveridgean preferences. The problem (for $\widehat{x}_L \geq 1/2$) is

$$SWF^A = \frac{1}{4}\ln\left[w_L(1-t^A)\right] + \frac{1}{4}\ln\left[\left(w_L + \frac{w_H}{\widehat{x}_L(t^A,t^B)}\right)t^A\right] \tag{30}$$

$$+\frac{1}{2}\ln\left[w_H(1-t^A)\right] + 2\int_0^{0.5}(1-x)dx, \tag{31}$$

and the FOC is given by

$$F^{BEVBIS} = \frac{-0.75}{1-t^A} + \frac{0.25}{t^A} + 0.25\frac{w_H}{w_L+\frac{w_H}{\widehat{x}_L}}\frac{-\partial\widehat{x}_L/\partial t^A}{\widehat{x}_L^2} = 0. \tag{32}$$

First-order conditions (22) and (32) are too complicated to permit a clear-cut comparison between country A's tax rate under Beveridge-Beveridge and that under Beveridge-Bismarck competition. With $\partial\widehat{x}_L/\partial t^A > 0$, equation (27) then implies that for the same migration level $\widehat{x}_L$ we have $F^{BEVBIS} < F^{BEVBEV}$. Consequently, for a given migration equilibrium ($\widehat{x}_L$), government A sets a higher tax rate when it is competing with a Bismarckian country than when the other country is Beveridgean ($t^{^{BEVBIS}} > t^{^{BEVBEV}}$, for the same $\widehat{x}_L$). This result suggests that, surprisingly, the Beveridgean country's social insurance system could be more generous when it competes with a Bismarckian country

	No Mobility		Mobility of the poor			Mobility of the rich		
Country A	BEV	BIS	BEV	BIS	BEV	BEV	BIS	BEV
Country B			BEV	BIS	BIS	BEV	BIS	BIS
t^A	0.25	0.50	0.219	0.50	0.2224	0.208	0.50	0.2223
t^B			0.219	0.50	0.50	0.208	0.50	0.50
$\widehat{x}_L$			0.500	0.50	0.74			
$\widehat{x}_H$						0.50	0.50	0.37
SWF_L^A	0.36	0.13	0.336	0.13	0.26	0.327	0.13	0.28
SWF_H^A	0.58	0.88	0.598	0.88	0.60	0.605	0.88	0.61
SWF^A	0.94	1.00	0.934	1.00	0.86	1.932	1.00	0.89
SWF_L^B			0.336	0.13	0.14	0.327	0.13	0.13
SWF_H^B			0.598	0.88	0.88	0.605	0.88	0.88
SWF^B			0.934	1.00	1.02	0.932	1.00	1.00

Table 1: Insurance for the poor

than with a Beveridgean country. Put differently, the race-to-the-bottom affecting tax rates and level of social protection could be less intense under a Beveridge-Bismarck competition than under a Beveridge-Beveridge competition.

Unfortunately the problem remains too complex to obtain analytical results beyond this somewhat speculative argument, even with our logarithmic specification. The following two sections present numerical examples to illustrate the conclusions obtained so far and to obtain some additional results.

5 Numerical examples

We now present numerical examples assuming for the time being $\{w_L, w_H\} = \{1, 2\}$. Columns 2 and 3 of Table 1 present the outcome for a Beveridgean and a Bismarckian country under autarky (no mobility). In accordance with the analytical results, the Beveridgean government imposes a uniform tax rate of 1/4, while poor residents of a Bismarckian country face a tax rate of 1/2. Observe that welfare levels among planners with different preferences are not comparable.

Columns 4–6 present the results for the three types of tax competition when low income individuals have the possibility to migrate. We can draw the following conclusions. First, *migration affects Beveridgean insurance policies only*; Bismarckian countries keep offering actuarially fair full insurance. Beveridgean countries, on the other hand, are forced to reduce their marginal tax rates. Second, the Beveridgean tax is greater when the other country is Bismarckian planner than when it is Beveridgean (0.2224 vs. 0.219). This numerical result confirms the conjecture expressed in the analytical part, that *the race-to-the-bottom affecting tax rates may be more important under Beveridge-Beveridge competition than under Beveridge-Bismarck competition.* Third, *a more significant tax-race-to-the-bottom is not necessarily bad news.* The Beveridgean country attains a higher welfare under the Beveridge-Beveridge competition than under Beveridge-Bismarck competition, even though the tax rate is lower. This is because under Beveridge-Bismarck competition the cost of receiving migrants from country B (poor individuals with a taste parameter x in the range $[0.5, 0.74]$) is not offset by a slightly higher marginal tax rate. On the other hand, under Beveridge-Beveridge competition, the symmetry of the problem ensures no migration flows in equilibrium. Fourth, competition with a Beveridgean country may *increase the welfare of a Bismarckian country*, even when the social insurance policy is unchanged. This is because the low income migrants are better off in the Beveridgean country A (recall that welfare depends on the natives). All the other low-income individuals ($x > 0.74$) are as well off as under autarky. They have the option to move to the other country but for them the benefit of a Beveridgean insurance policy does not offset the cost of migration (because the high level of x represents a large degree of attachment to the home country).

So far we have concentrated on case where only the poor face an earnings risk and are mobile. The last three columns of Table 1 present some results for the case where the rich are mobile (while the earnings risk continues to be restricted to the poor). When the high income individuals are mobile, the tax-race-to-the-bottom under Beveridge-Beveridge competition is more significant than when the poor are mobile. Consequently, at the no migration equilibrium of the Beveridge-Beveridge competition low income individuals are worse-off (0.327 in column 7 against 0.336 in column 4) and high income ones are better-off (0.605 in column 7 against 0.598 in column 4) under mobility of the rich than under mobility of the poor. However, under Beveridge-Bismarck competition the mobility of high income individuals generates a higher welfare

	No Mobility		Mobility of the poor			Mobility of the rich		
Country A	BEV	BIS	BEV	BIS	BEV	BEV	BIS	BEV
Country B			BEV	BIS	BIS	BEV	BIS	BIS
t^A	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.445
t^B			0.500	0.500	0.500	0.500	0.500	0.500
$\widehat{x}_L$			0.500	0.500	0.594			
$\widehat{x}_H$						0.500	0.500	0.417
SWF_L^A	0.130	0.125	0.130	0.125	0.123	0.130	0.125	0.119
SWF_H^A	0.303	0.375	0.303	0.375	0.296	0.303	0.375	0.345
SWF^A	0.433	0.500	0.433	0.500	0.418	0.433	0.500	0.464
SWF_L^B			0.130	0.125	0.126	0.130	0.125	0.125
SWF_H^B			0.303	0.375	0.375	0.303	0.375	0.375
SWF^B			0.433	0.500	0.501	0.433	0.500	0.500

Table 2: Insurance for all

for both the Beveridgean country income classes than the mobility of the poor (for the poor, 0.28 in column 9 against 0.26 in column 6, and for the rich 0.61 in column 9 against 0.60 in column 6). The reason is that when the high income individuals are the ones mobile, the poor natives of the Bismarckian country cannot migrate towards the Beveridgean country decreasing its insurance benefit. At the same time, high income individuals natives of the Beveridgean country can migrate towards the Bismarckian country and enjoy a higher utility where they are not affected by taxation.

Finally, let us consider the case where rich individuals also face an income risk that may be insured by social insurance. Table 2 presents the results. We suppose that all individuals may loose their entire income with probability 1/2 (the same for all). The Beveridgean country taxes low and high income individuals at the same rate and provides a flat benefit to all individuals experiencing a loss. The Bismarckian planner provides actuarially fair full insurance to each income class.

The results show that, with only one exception, there is no tax-race-to-the-bottom, so that mobility has no impact on social insurance and welfare. The only exception concerns the Beveridge-Bismarck tax competition. With low income individuals being mobile, even thought taxes do not decrease, there is migration towards the Beveridgean country. When instead high income are mobiles, the Beveridgean government is forced

	$w_L = 1,\ w_H = 3/2$			$w_L = 1,\ w_H = 2$			$w_L = 1,\ w_H = 3$		
Country A	BEV	BIS	BEV	BEV	BIS	BEV	BEV	BIS	BEV
Country B	BEV	BIS	BIS	BEV	BIS	BIS	BEV	BIS	BIS
t^A	0.220	0.50	0.2227	0.219	0.50	0.2224	0.217	0.50	0.2225
t^B	0.220	0.50	0.50	0.219	0.50	0.50	0.217	0.50	0.500
$\widehat{x}_L$	0.500	0.50	0.70	0.500	0.50	0.74	0.500	0.50	0.798
$\widehat{x}_H$									
SWF_L^A	0.281	0.125	0.22	0.336	0.13	0.26	0.419	0.125	0.326
SWF_H^A	0.454	0.625	0.45	0.598	0.88	0.60	0.802	1.375	0.798
SWF^A	0.734	0.750	0.68	0.934	1.00	0.86	1.220	1.500	1.125
SWF_L^B	0.281	0.125	0.13	0.336	0.13	0.14	0.419	0.125	0.158
SWF_H^B	0.454	0.625	0.63	0.598	0.88	0.88	0.802	1.375	1.375
SWF^B	0.734	0.750	0.76	0.934	1.00	1.02	1.220	1.500	1.533

Table 3: Effect of varying income inequality. Insurance for the poor, mobility of the poor

to lower the tax from 0.5 to 0.445 to avoid a greater migration towards the Bismarckian country. Nevertheless, the Beveridgean country attains its highest level of welfare when it competes with a Bismarckian country and when high income individuals are mobile.

Of notice that all the identified effects are robust to income inequality variation. To avoid tedious exposition, Table 3 presents the results just for the case where only the poor risk to loose their income and enjoy mobility. We normalize low income to 1 and let the high income take the values 3/2, 2 and 3. What should be remarked from Table 3 is that in the Beveridge-Beveridge competition the tax-race-to-the-bottom is more important the higher the income inequality, just as predicted in our analytical analyses in Section 4.2. Additionally, in a Beveridge-Bismarck competition, as expected migration towards the Beveridgean country increases with income inequality even though the effect on the Beveridgean country taxation is not monotonic.

6 Choice of the system

Up to this point, we have assumed that social preferences and type of system go hand in hand. We shall now explicitly separate governments' preferences from the type of system. Under autarky, such a separation is of course not very relevant. When there is no mobility it is plain that a Beveridgean government will prefer a Beveridgean social insurance system over a Bismarckian one. Similarly, a Bismarckian government would never opt for a Beveridgean system. When there is competition, the choice of the system may in itself be part of a government's strategy. The question is if a government of a given type may find it beneficial to adopt a system of the other type for strategic reasons (*i.e.*, considering the tax competition game to be played with the other country). Our analysis is purely illustrative and we make use of a numerical example developed in the previous section. Formally, we add a stage to the game where governments decide which type of system to adopt. This decision is made (simultaneously) by both governments before tax competition game considered in the previous section is played, and there is full commitment. We focus on the case where only the poor face an income risk and are mobile. Table 4 describes the four possible games that may be played, depending on the type of governments. Governments can have either Bismarckian or Beveridgean type of preferences and implement either a Bismarckian or a Beveridgean insurance policy. To be more precise, governments can both have Beveridgean preferences (Sub-game1, on the top-left), one government can have Beveridgean preferences while the other has a Bismarckian objective (Sub-game2 and Sub-game3, top-right and bottom left). Finally, they can both have Bismarckian preferences (Sub-game4, bottom right).

Our results suggest that when both governments have identical preferences, they choose the social insurance system associated with their type. A more interesting and surprising outcome emerges in the asymmetric case where one government has Beveridgean preferences and the other Bismarckian ones. In this case the Nash equilibrium implies that both players choose a Beveridgean insurance policy. Table 5 presents the detailed results for the case in which government A has Beveridgean type of preferences and government B Bismarckian ones. Since for country A the choice of a Beveridgean policy is a dominant strategy we only highlight the choice for country B between a Beveridgean or a Bismarckian policy. It shows that government B finds it optimal to adopt a Beveridgean insurance policy with a low tax (of 11% as opposed to the 22.5% tax in country A), even if harming his own rich natives. Facing such Beveridgean policy, the best response of government A is to increase slightly the tax with respect to the

		BEV B		BIS B	
		BEV	BIS	BEV	BIS
BEV A	BEV	0.934, 0.934	0.860, 0.806	0.906, 1.019	1.015, 1.016
	BIS	0.860, 0.806	0.750, 0.750	0.900, 0.103	0.750, 1.000
BIS A	BEV	1.019, 0.906	0.103, 0.900	0.994, 0.994	0.961, 1.000
	BIS	1.016, 1.015	1.000, 0.750	1.002, 0.961	1.000, 1.000

Table 4: Welfare levels (SWF^A, SWF^B) achieved under strategic choice of the type of system, given government's preferences. For instance, BEV A represents the case where the government of Country A has Beveridgean preferences and can adopt a Beveridgean system (first row) or a Bismarckian system (second row). Similarly, BIS B represents the case where the government of Country B is Bismarckian and can choose a Beveridgean system (third row) or a Bismarckian system (fourth row).

tax when competing with a Bismarckian policy (22.5% vs 22.2%). Indeed, since the threat of migration is not as strong as under competition with a Bismarckian policy, government A can afford the tax increase. Notice that for government A the equilibrium resulting from such change in government B type of policy constitutes a Pareto improvement.

7 Conclusion

We have studied the impact of costly labor mobility and social insurance systems. We have considered a two-country setting where countries choose simultaneously and non-cooperatively the payroll tax rate (which determines the generosity of the system). We have analyzed three scenarios: both governments provide Bismarck-type of insurance, both governments provide Beveridge-type of insurance, and one government provides a Beveridge-type of insurance and the other a Bismarck one. We have shown that a Bismarckian insurance policy is not affected by migration but that the Beveridgean one is. Moreover, our results suggest that the race-to-the-bottom affecting tax rates may be more important under Beveridge-Beveridge competition than under Beveridge-Bismarck competition. Nevertheless, the Beveridgean country attains a higher welfare under the Beveridge-Beveridge competition than under Beveridge-Bismarck competition. We have also considered the strategic choice of the type of the system and illustrated that,

	Type of policy implemented by each government	
Government A Beveridgean preferences	BEV	BEV
Government B Bismarkian preferences	BEV	BIS
t^A	0.225	0.222
t^B	0.579	0.736
X_L	0.110	0.500
SWF_L^A	0.312	0.265
SWF_H^A	0.594	0.596
SWF^A	0.906	0.860
SWF_L^B	0.255	0.141
SWF_H^B	0.765	0.875
SWF^B	1.019	1.015

Table 5: Beveridge Beverdige tax competition versus Beveridge Bismark tax competition, when Government A has Beverigean type of preferences and Government B has Bismarkian ones. Insurance of the poor, mobility of the poor.

when in competition to Beveridgean governments, Bismarckian governments may find it beneficially to adopt a Beveridgean policy.

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