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VOTING ON PUBLIC PENSIONS WITH HAND AND FEET: HOW YOUNG MIGRANTS TRY TO ESCAPE FROM GERONTOCRACY

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Abstract

Aging changes the political power in a democracy in favor of the elder generations. Consequently, the retirees can extend the pay-as-you-go financed pensions. Under free labor mobility like within the EU, the success of gerontocracy, nevertheless, is restricted by migration of the young generations. This connection between political voting on intergenerational redistribution and voting with the feet is analyzed in a two-country model with overlapping generations. We distinguish between the case in which the young generations' migration decision takes its effect on future pensions into account (strategic migration) and the case in which it only reflects differentials in labor income (myopic migration). The paper also pays attention to the implications of common harmonization principles and to the consequences of price discrimination between natives and immigrants.

Keywords: Interregional competition on public pensions; migration; labor mobility; gerontocracy.

JEL Classification: D72, F22, H55.

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1 Introduction

In most western countries, pay-as-you-go (PAYG) financed public pensions redistribute income from the working to the retired generation. The recent demographic development makes it increasingly difficult to finance these systems. Low or even negative population growth reduces pension schemes' internal rate of return. Despite this problem, aging does not necessarily decrease the scope of intergenerational redistribution. The majority and therefore the political power in a democracy change in favor of the old generation. This process enables the retirees to exploit the working force.

But even in an aging society, the elasticity of labor supply restricts the ability to expropriate the young people. They can circumvent premium payments by reducing the working hours. Breyer and Stolte (1998) examine this aspect of distortive social taxes. The integrated European labor market provides another reason why the tax base can erode in response to higher contribution rates. The Maastricht treaty guarantees free labor mobility within the EU, which leads to competition among the social systems of the member states. Young people's opportunity to emigrate reduces the old generation's ability of rent seeking. We thus deal with two distinct votes: First, political voting which fixes the extent of intergenerational redistribution and, second, voting with the feet which enables the loosing party to cut the burden.[1] These two votes seem to create a balance of power between old and young generations.

The present paper focuses on the connection between migration and pension policy in competing democracies with an aging population. It shows how increasing mobility affects the social systems in Europe. This contribution also gives some hints on the impact of a possible decentralization of PAYG systems within a country where lingual and cultural barriers less impede labor reallocation than in the EU.[2]

The analysis is carried out in a two-country model with overlapping generations and migration. The median voter of each country who determines the contribution rate to the region's PAYG scheme belongs to the retirees. In response to a gerontocratic pension policy, young people decide on migration. In line with recent literature, we assume that this decision is not only determined by economic but also by cultural motives.[3]

[1] Goodspeed (1998) points out that models in the Tiebout tradition which incorporate both voting and migration become more and more important.

[2] In Germany, for instance, the expenditures of the social systems in some regions, particularly in the east, are partly financed by surpluses from wealthy western areas. Some politicians recently questioned this kind of subsidy and argued in favor separated systems for each state (Bundesland).

[3] See, for example, Beckmann and Papageorgiou (1989), De Palma and Papageorgiou (1988) as well as Mansoorian and Myers (1993).

The old generation of a country competes for young immigrants against the retirees of the other region. The gerontocrats make up their decision anticipating the subsequent migration of the young generations. Since they attempt to raise the budget of their pension systems as far as possible, the old generations act very like a revenue maximizing Leviathan who competes with his rivals for a mobile tax base. Keeping this in mind, it is not surprising that some basic conclusions of the current analysis are in line with results of the literature on international tax competition (see Kanbur and Keen (1993) among others). For instance, the gerontocracy with the smaller native labor force undercuts its opponent's contribution rate. This increases the retirement benefits in the less populated country at the expense of the retirees in the rival region.

However, since retirement benefits are associated with many problems and questions which are dynamic in nature, competition in public pensions implies distinct features not arising in the static analysis of tax competition. It can be shown that labor mobility causes premium payments in different countries to converge to each other. Since both regions' contribution rates and thus net wages are identical in the steady state, migration is not distorted in the long run by income differentials.

Furthermore, we explicitly examine the role which the time horizon of the labor force plays in determining the properties of the system. Most contributions of the public choice literature within an intertemporal context assume myopic agents. These individuals ignore the impact of their current decisions on future opportunities.[4] Only a few papers consider rational or strategic acting agents who anticipate their influence on future choices.[5] We compare the implications of the opposing behavioral assumptions on the agents' time horizon. It turns out that for a myopic labor force lower contribution rate results than for strategically acting young people. Hence, rationality does not establish an advantage for the working generation.

Even more important, a drop in the population growth can cause a decline in the contribution payments and retirement benefits. This conclusion sounds particularly promising for sceptics who fear ever rising pensions in aging societies. But, of course, if social competition is replaced by cooperation between the old generations, it can improve the retirees' position. Higher pensions than in the subgame-perfect Nash equilibrium can be obtained in both countries by agreeing on a minimum contribution rate which exceeds the non-cooperative level in the undercutting country. Alternatively, identical premium payments in both regions which drastically exceed the higher tax in Nash equilibrium increase benefits of all retirees. However, in-

[4] See, for example, Kolmar (1998), Konrad (1995), Scholten and Thum (1996), Meijdam and Verbon (1996) with respect to articles concerned with intergenerational redistribution.

[5] See, for example, Breyer and Stolte (1998) as well as Haupt and Peters (1998).

ternational coordination does not yield efficiency gains upon the non-cooperative solution in the long run, but drastically redistributes resources in favor of the old generations.

The impact of integrated labor markets on national public-pension systems has so far only received little attention. Like Konrad (1995) our paper considers gerontocratic regimes. Nevertheless, his article is only loosely related to ours because he is concerned with the changing mix of public expenditures when the ruling retirees of two countries compete with each other for young people. Breyer and Kolmar (1998) analyze coordination requirements for efficient PAYG systems in integrated markets. If the labor force is at least partly mobile, some kind of harmonization or centralized pension system is necessary. Otherwise, the labor force refuses to move to the places where its marginal productivity is highest. However, they ignore the aspect of political voting and do not consider equilibria resulting from non-cooperative behavior of the countries.

The literature on interregional social competition in the presence of mobile labor mainly focuses on efficiency aspects of intragenerational redistribution. Wildasin (1991) elaborates in this context that subsidies from a central government can induce regional authorities to implement efficient redistribution schemes. Moreover, in Myers (1990) and Mansoorian and Myers (1993) the opportunity of voluntary interregional transfers ensures non-cooperative solutions which are not migration-distorting.[6] Unlike these contributions, we demonstrate that, even in the absence of interjurisdictional payments, efficiency results at least in the long run. In the context of public pensions, differentiated contribution rates allow a similar fine tuning of migration flows as interregional transfers in Myers (1990), but leads to a very different result. We show that 'price discrimination' yields a discount for immigrants, i.e. lower contribution rates for them than for the native population, which in turn induces inefficiently high migration.

Hagen and Walz (1995) is most related to the present paper. Similar to us, they consider non-cooperatively acting gerontocrats when the labor force can either escape to the shadow sector or migrate. While the present model looks at asymmetric countries, their contribution focuses on the case in which the regions are completely identical. They conclude that mobility restricts exploitation of the youth. We push the analysis further emphasizing the role of the young generations' planning horizon, the long-run reallocation of the labor force, the connection between contribution

[6] Hercowitz and Pines (1991) qualify this conclusion. They consider individuals who live infinitely long and repeatedly decide on their location. In their dynamic framework without overlapping generations, the utilitarian optimum cannot be achieved without central intervention if local authorities are farsighted and migration is costly. Nevertheless, a decentralized decision making is still efficient according to the Pareto criterion.

rates and population growth as well as the impact of various harmonization strategies and differentiated contribution rates.[7]

The remainder of the paper is organized as follows: The model is described in section 2. In section 3, we deal with the voting equilibrium in the case of myopic migration and the resulting population dynamics. Subsequently in section 4, we compare the consequences of myopic behavior with the outcome when individuals make their decision fully rational. The next section provides the condition for efficient migration as benchmark. In section 6, we examine whether harmonization of pension policies can improve the retirement benefits in both countries upon the Nash equilibrium and can reduce distortive migration. A separate section is devoted to two extensions. It analyzes the implications of 'price discrimination' between natives and immigrants and briefly discusses the place-of-birth principle aiming at reducing inefficient social competition. The final section summarizes the results and concludes with some additional remarks.

2 Migration and public pensions

We consider two countries or regions, A and B, which have agreed upon free mobility of labor between them. In both regions the population consists of two living generations, the old and the young. The young people constitute the labor force and earn a gross wage w. This wage is identical in both countries and normalized to unity. The old generation has already retired and receives pay-as-you-go financed pensions. Both countries apply the place-of-residence or place-of-employment principle. The current working force of each region pays the premiums for its predecessors.

In all periods, a two-stage decision process takes place. On the first stage, the society of each country democratically decides on a contribution rate to the public-pension system, a or b respectively. Every agent is selfish and only concerned about his own income. Since the population grows with an identical, however, negative rate n in both regions, the old people have the decisive vote within the native population in each country. This majority enables the non-altruistic retirees to impose the contribution rate which maximizes their pension benefits.

Nevertheless, the success of gerontocratic votes is restricted by migration. After contribution rates have been fixed, the members of the young working generation decide on the second stage whether to stay in or to leave their country. They

[7] These aspects would be difficult to analyze in the framework of Hagen and Walz (1995), since their model involves a number of technical problems, for instance, multiple equilibria and non-existence of equilibria in pure strategies. They end up with rather unrealistic corner solutions in which the whole young generation of a country either move abroad or stay at home.

optimally adjust to the outcome of the voting on the first stage. The resulting migration between the regions has no impact on gross wages, at least in the long run.[8] However, it already determines the current replacement ratio in both countries because migration occurs immediately after the policy choice is made. At the end of the present period, the immigrants become full citizens. They and their children participate in the next election in their new home region.

The equilibrium of the two-stage game determines migration dynamics. The relocation of the labor force affects each region's young population and therefore the number of its retirees in the future. The present pension policy implies a migration equilibrium which is the starting point for the voting and migration game in the succeeding period. Thereby, today's migration determines the opportunities of the current young people to exploit the future working force when they grow old. Hence, young generations decide not only on their net wages but also on their pensions by choosing their place of residence.

The migration decision, in more detail, depends on two factors. First, each member of the young generation compares (lifetime) net income in both regions, I^A and I^B. These figures capture the economic incentive for migration. This aspect is in line with the traditional Tiebout literature which predicts migration as long as there are economic differences between regions. Second, cultural reasons in a broad sense influence the decision. These non-pecuniary arguments include psychological, cultural and lingual motives. While some people are attracted by new social and ethnic environments, others have difficulties to cope with them. A pecuniary equivalent to the benefits or costs of staying at home, s, captures these non-economic migration preferences.[9]

Integrating both arguments we can describe how each individual makes up his mind. If a citizen of type $s > 0$ expects an economic disadvantage of living in his

[8] This assumption can be justified on different grounds. For instance, if each of the two countries or regions is small in relation to the rest of the world, capital ex- or imports adjust the value of the capital's marginal product to the world interest rate. Then, we end up with the same labor intensity and thus the same gross wage before and after migration. Although this transition may last some time, the induced short-run wage changes are rather small compared with the labor income in the whole OLG period of about 25 to 30 years and can be neglected. Moreover, the assumption that wages do not depend on migration corresponds to empirical evidence. Most analysis shows a very small impact of immigrants on labor markets. See Friedberg and Hunt (1995) for a recent review of the empirical literature. Analyzing a model with two large countries and endogenous wages changes some of the underlying migration motives, but the qualitative nature of the results remains unaltered, cf. Scholten and Thum (1996) or Haupt and Peters (1998).

[9] Cf. Beckmann and Papageorgiou (1989), De Palma and Papageorgiou (1988) or Mansoorian and Myers (1993). These non-pecuniary parameters are often referred to as attachment-to-home technologies.

home country lower than s, he does not move. In contrast, a type with $s < 0$ migrates if it does not reduce his net income by more than $|s|$. Since people are not alike and their attachment-to-home varies, there are some citizens who are willing to emigrate even for non-economic reasons. Other people will stay in their mother country even if the opposite decision would be required on a pure economic basis.

The migration function for an s-type citizen born in region A is given by

$$H(I^A - I^B + s) = \begin{cases} 1 & \text{if} \quad I^A - I^B + s < 0 \\ 0 & \quad\quad\; I^A - I^B + s \geq 0, \end{cases} \tag{1}$$

where one is the character for emigration, zero shows that staying at home is favored. We obtain a similar migration function for an individual of country B.

As all individuals face the same income opportunities, I^A or I^B, they differ only with respect to their type s. We assume that these heterogeneous attachment-to-home or migration preferences are distributed according to a density $f(s)$. This function is identical for all generations and both countries.[10]

Assumption: Properties of the density function f.

i) $f(s)$ is positive and continuously differentiable on its domain,

ii) $f(s) > \left|f'(s)\right|$ holds for all s of the domain and

iii) $0 < F(0) \leq .5 < F(1)$.

The first assumption is purely technical, the second excludes drastic changes of the density f in s. Assumption iii) means that in absence of economic differences between both regions, some people but less than 50% of the population emigrate. This condition reflects a home bias of most people. If the income disadvantage is about the gross wage $w \equiv 1$, at least 50% of the young people leave their home country to avoid full appropriation of their income.[11]

Combining the distribution of migration preferences $f(s)$ with each individual's decision $H(\cdot)$ yields the percentage of emigrants among the young native people of region A

$$\int_{-\infty}^{\infty} H(s - \Delta) f(s) ds = \int_{-\infty}^{\Delta} f(s) ds = F(\Delta), \tag{2}$$

where $\Delta \equiv I^B - I^A$ denotes the income disadvantage of living in country A. Similarly, the percentage of region B's migrants is given by $F(-\Delta)$.

These aggregated responses of the young generation to income differences provide the basis for a subgame-perfect solution to the simultaneous choice of the gerontocrats on the first stage. Requiring a balanced budget of the PAYG system in each

[10] The latter assumption is only made for convenience. Introducing different densities among regions or generations leaves all results qualitatively unaltered.

[11] For almost all results we do not need assumption iii). However, it corresponds with empirical evidence.

period, the pension of each of the N^i retirees crucially rests upon the dependency ratio, i.e. the number of retirees per worker. This ratio depends on the rate of population growth n and on the migration profile of the young generation. While n is exogenously given, all movements between both regions are endogenously determined by the differences in (lifetime) net income Δ. Using (2), the PAYG financed pensions in country A and B are given by

$$\begin{aligned} P^A &= (1+n)\, a\{\underbrace{1-F(\Delta)}_{\text{natives}} + \underbrace{\theta F(-\Delta)}_{\text{immigrants}}\} = (1+n)aD^A \\ P^B &= (1+n)b\{\overbrace{1-F(-\Delta)}^{\text{natives}} + \overbrace{F(\Delta)/\theta}^{\text{immigrants}}\} = (1+n)bD^B, \end{aligned} \tag{3}$$

where $\theta \equiv N^B/N^A$ denotes the relative size of the old generations in both regions.[12] The terms in braces are similar to demand functions. They describe the relative demand of the young people for living in a region A and B, i.e. $D^A = 1 - F(\Delta) + \theta F(-\Delta)$ and $D^B = 1 - F(-\Delta) + F(\Delta)/\theta$ respectively.[13] Thus, contribution rates can be regarded as prices for living in country A and B. A cheaper price yields a higher demand. From this perspective, the retirees of both countries behave like revenue maximizing duopolists in Bertrand competition when their products are imperfect substitutes.

3 Voting and myopic migration

In this section, we assume that young people are myopic. When they decide whether to migrate or not, they calculate their economic advantage by comparing net income of the current period only. In this case, they are not concerned about their future pensions or might expect more or less identical retirement benefits in both countries in the succeeding period. A further explanation for this kind of myopic behavior can be seen in a very high individual discount rate for future pensions, i.e. future payments become quantitatively unimportant for migration.

Assuming myopic non-rational behavior can be regarded as first approach to determine the impact of migration. It enables us to provide some basic results which will be used to derive a fully rational behavior.

[12] Since both regions are subject to the same demographic development, θ can be understood as the relative size of both old generations and the relative size of their decendants as well. Thus, θ measures the young native generations ex ante, i.e. before migration has changed the composition of both regions' population. The ex post (i.e. after migration) relative size of both countries' current working generation is given by the figure θ^+ in the succeeding period.

[13] Notice that D^i can be interpreted as migration ratio. It relates the size of region i's labor force after migration to the size of the young generation born in country i. Hence, this ratio expresses the relocation of the working force.

3.1 Equilibrium under social competition

The assumption of myopic migration yields $\Delta = (1-b) - (1-a) = a - b$. The difference in the contribution rates simply determines the economic costs for staying at home as they are perceived by the short-run orientated working generation. Therefore, the following first-order conditions of the median voters' maximization problem characterize the voting equilibrium[14]

$$\begin{aligned} P_a^A &= (1+n)\left\{1 - F(\Delta) + \theta F(-\Delta) - a\left[f(\Delta) + \theta f(-\Delta)\right]\right\} \\ &= (1+n)\left(D^A + aD_\Delta^A\right) = 0 \\ P_b^B &= (1+n)\left\{1 - F(-\Delta) + F(\Delta)/\theta - b\left[f(-\Delta) + f(\Delta)/\theta\right]\right\} \\ &= (1+n)\left(D^B - bD_\Delta^B\right) = 0. \end{aligned} \tag{4}$$

Maximizing pensions, the old generation has to consider two opposing effects. First, a higher contribution rate increases the premium payments of a single worker for given gross wages and therefore retirement benefits. Second, the demand for living in country A or B decreases in its own contribution rate (price). This substitution effect describes how the induced migration increases the dependency ratio which consequently reduces retirees' pensions. Thus, each median voter solves a trade-off given his opponents strategy. Rearranging these equations yields familiar conditions. The old generation of each country maximizes revenues from premium payments, i.e. their payoff, if each region's demand elasticity, aD_Δ^A/D^A and $-bD_\Delta^B/D^B$ respectively, is equal to minus one. The resulting choices of both countries together determine the Nash equilibrium.

Proposition 1 *Existence and uniqueness.*
Under myopic migration and assumption i) and ii) there exists a unique Nash equilibrium with $(a^*, b^*) > 0$.

Proof. Assumption i) guarantees an at least twice continuously differentiable payoff. Under assumption ii) each payoff is strictly concave in the strategy of its median voter. According to Friedman (1986), this yields continuous best-response functions. Furthermore, assumption ii) implies a positive slope of the best-response function which does not exceed one. This property in connection with continuity proves existence and uniqueness. In addition, $P_a^A(0,0) > 0$ and $P_b^B(0,0) > 0$ imply positive equilibrium strategies.■

[14] We do not restrict the political choice to contribution rates between 0 and 100% explicitly. Otherwise, we would have to distinguish between interior and corner solutions in comparative statics without changing any qualitative result. Notice that subscripts indicate derivatives of a function.

After proving these technical prerequisites, we can turn to the properties of the best-response functions and the Nash equilibrium. From the first-order conditions we obtain the reaction curves of both median voters. Figure 1 depicts the best response of A's old generation to the choice of B's retirees, $r_a(b)$, and vice versa. A higher contribution rate b strengthens the young people's demand for living in region A. Furthermore, this shift reduces the demand elasticity with respect to strategy a. If region B's median voter increased his contribution rate by δ, an increase in A's response by the same amount δ would yield no change in the dependency ratio but larger premium payments. Even more, if A's response shortly undercuts B's increase he can improve his dependency ratio at the expense of his opponent. Therefore, the slope of the reaction curve $r_a(b)$ is positive but less than one. The policies in both regions are strategic complements.[15]

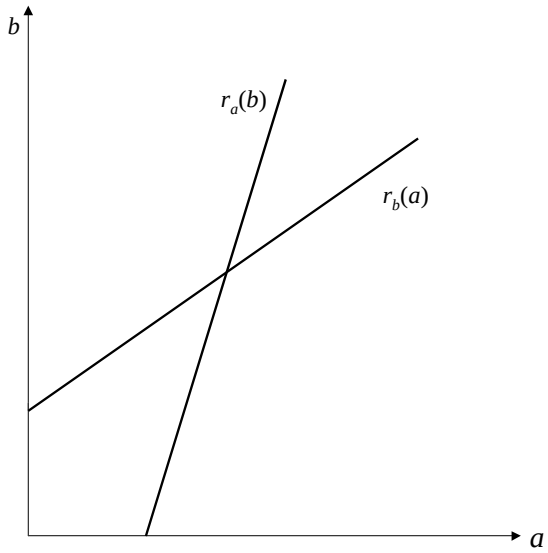

Figure 1: Reaction curves

Condition (4) reveals that the optimal contribution rates are independent of the population growth n. The demographic development does not alter the strategic interactions of both median voters. Although a drop in birth rates increases the political power of the old generation, they are not able to exploit this because the decisive vote already was with them. Furthermore, migration only depends on income redistribution in the current period which in turn is not affected by population growth. Hence, labor income does not suffer from a decline in n. The

[15] The similarity of the voting game to Bertrand price competition is obvious.

retirees bear the whole burden of a reduced population growth. A smaller working force reduces pensions in both countries.

Proposition 2 *Symmetry.*
The Nash equilibrium is symmetric, i.e. $a^* = b^*$*, if and only if either* $\theta = 1$ *or* $F(0) = .5$.

Proof. The conclusion that $\theta = 1$ implies $a^* = b^*$ follows directly from the perfect symmetry of both payoff functions and the uniqueness of the Nash equilibrium. To show the second part, we combine both conditions in (4) which yields

$$\Delta[f(\Delta) + \theta f(-\Delta)] - [1 - 2F(\Delta)] + \theta[1 - 2F(-\Delta)] = 0. \tag{5}$$

If $a^* = b^*$, then equation (5) requires $\theta = 1$ or $F(0) = .5$. Since the LHS of (5) is by assumption ii) strictly increasing in Δ, there is a unique solution for each θ. For $F(0) = .5$ it is easy to see that $\Delta = 0$ fulfills (5) independent of θ.■

Two kinds of symmetry generate a Nash equilibrium with $a^* = b^*$. First, pension policies cannot be different if the payoff functions are identical. This symmetry of the objective function requires an identical size of the population in both countries, i.e. $\theta = 1$. Second, quasi-symmetric immigration preferences, i.e. $F(0) = .5$, induce the median voters in region A and B to apply the same strategy in equilibrium. This result is independent of the natives' relative number θ and, therefore, holds even for asymmetric payoff functions. If $F(0) = .5$, the demands D^A and D^B as well as their elasticities are identical in the absence of net wage differences, i.e. for $\Delta = 0$. This similarity already implies that both voters favor the same pension policy. Moreover, for both types of symmetry we obtain the same equilibrium, $a^* = b^* = .5/f(0)$. The contribution rates only depend on the marginal propensity to emigrate in the absence of economic reasons, $f(0)$.

Proposition 3 *The smaller region undercuts the bigger one.*
In the Nash equilibrium, a^* *exceeds* b^* *if and only if* $\theta < 1$*, and vice versa.* Δ *is a decreasing function of* θ *and lies within an interval with zero in its middle. Furthermore, assumption iii) implies* $|\Delta| < 1$.

Proof. Let us start with the latter result, $|\Delta| < 1$. Equation (5) implies that Δ must have the same sign as $1 - 2F(\Delta) - \theta[1 - 2F(-\Delta)]$. We first exclude $\Delta \geq 1$ by contradiction: if $\Delta \geq 1$ assumption iii) implies $F(\Delta) \geq F(1) > .5$ and the sign of the expression above becomes negative. However, this contradicts a positive Δ. An analogous argument excludes an equilibrium with $\Delta \leq -1$. This proves $|\Delta| < 1$.

From (5) we know that for $\theta \to 0$ the Nash equilibrium converges to a $\widehat{\Delta}$ which solves $\widehat{\Delta} f(\widehat{\Delta}) - [1 - 2F(\widehat{\Delta})] = 0$. Symmetrically, for $\theta \to \infty$ the equilibrium converges

to $\tilde{\Delta}$ which solves $\tilde{\Delta}f(-\tilde{\Delta})+1-2F(-\tilde{\Delta})=0$. These limits are identical except for their sign. Furthermore, we can calculate the change of Δ in θ from (5):

$$\frac{d\Delta}{d\theta}=\frac{2F(-\Delta)-1-\Delta f(-\Delta)}{3[f(\Delta)+\theta f(-\Delta)]+\Delta[f'(\Delta)-\theta f'(-\Delta)]}. \tag{6}$$

The sign of this derivative is determined by the numerator since the denominator is always positive by assumption ii) and $|\Delta|<1$.

At least for $\theta=1$, which yields an equilibrium with $\Delta=0$, we know that the sign in (6) is negative under assumption iii). Furthermore, starting with $\tilde{\Delta}$, where the numerator becomes zero, it decreases in Δ. Thus, we can summarize the relationship between Δ and θ in figure 2.■

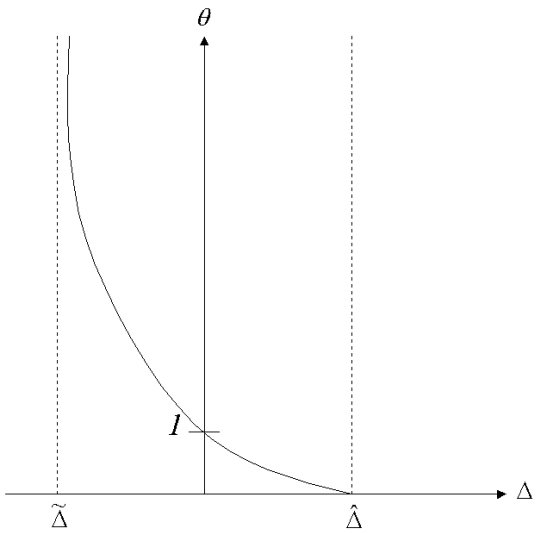

Figure 2: Contribution differences

Proposition 3 summarizes how the relative size of the retirees' population in both regions influences the economic disadvantage, i.e. the difference in net wages. The country with less citizens undercuts its opponent's choice. The intuition is straightforward. The smaller region's median voter has less to loose from his native tax base, however, much to win by attracting immigrants. His country faces a more elastic demand for living in it. Thus, the increase in the number of young employees (remaining natives plus new immigrants) outweighs the reduced revenues per capita.

Starting with the symmetric case $\theta=1$, increasing θ displaces the best-response function of A's median voter to the left. Hence, the reaction curve intersects with

the 45°-line at a lower contribution rate. Furthermore, voter B's response is shifted to the top. Since the elasticity of demand for living in B decreases in θ, he prefers a larger contribution rate b. Combining the movements of both reaction curves shows that the new equilibrium where region A is less populated than B is characterized by $a^* < b^*$. It becomes the more attractive for A's retirees to woo away young people from its neighboring region, the smaller its own native working force is. Therefore, the incentive for A's median voter to undercut the contribution rate b increases in the relative size of B's population.

3.2 Pensions and population size

It is attractive for an individual to live in the region which is less populated as long as he belongs to the labor force. The difference between the pensions describes whether the old people of the less populated country still benefit from their past migration decision. In equilibrium, this difference is given by

$$P^A(\theta, \Delta(\theta)) - P^B(\theta, \Delta(\theta)) = (1+n)\Omega(\theta, \Delta),$$

where

$$\Omega(\theta, \Delta) = \frac{[1 - F(\Delta) + \theta F(-\Delta)]^2 - \theta[1 - F(-\Delta) + F(\Delta)/\theta]^2}{f(\Delta) + \theta f(-\Delta)}. \tag{7}$$

The relative population size θ drives the difference in median voter's payoff in two ways: First, it fixes the 'natural' demand for living in the distinct regions in the absence of income differentials. Second, this figure affects the degree of social competition and the induced 'economic' migration. Both effects determine the gap in pensions $(1+n)\Omega$.

Proposition 4 shows that the payoff of the larger country's median voter falls at least locally below the pension of his opponent. The higher contribution rate cannot compensate the loss of the young people.

Proposition 4 *The smaller region is more attractive for migrants.*
i) The difference in the equilibrium payoff $(1+n)\Omega$ *is zero if the population size is identical in both countries, i.e.* $\theta = 1$.
ii) For small differences in the population size in the neighborhood of $\theta = 1$, *the median voter of the less populated region receives larger payments than his opponent. This advantage increases in* θ.
iii) Furthermore, for $\theta \to 0$ *the difference* Ω *converges to minus infinity, for* $\theta \to \infty$ *it tends to plus infinity.*

Proof. i) $\Omega(1) = 0$ is obvious since $\Delta = 0$ holds in equilibrium. ii) Calculating $\frac{d\Omega}{d\theta} = \Omega_\Delta \Delta_\theta + \Omega_\theta$ and inserting $\Delta = 0$ and $\theta = 1$ shows that $\Omega(\cdot)$ is at least locally increasing. iii) Since Δ lies within a compact interval, the limits for θ are easily to see.■

The difference Ω changes in θ through two different channels: First, Ω decreases in Δ since both payoff functions P^A and P^B are concave. The second-order conditions imply $\Omega_\Delta < 0$. Together with $\Delta_\theta < 0$ the first impact on the difference function $\Omega_\Delta \Delta_\theta$ is always positive. However, the second term Ω_θ has an ambiguous sign. Therefore, it cannot be excluded for sure that the difference function decreases at least for some θ. In the following analysis, we assume that the difference Ω has a positive slope throughout the whole domain of θ. In this case, receiving the pension from the smaller country is globally preferable for a retiree. This result can be formally proved for a uniform distribution. It seems to be plausible that this conclusion can be extended to a wide range of density functions.

3.3 Migration dynamics

The equilibrium demands for living in region A and B fix the current labor force in both countries. These young people constitute the voting old generation in their region in the next period (30 years later all immigrants will have become naturalized). Thus, present migration determines the relative size of the retirees in the future. It leads to a new population mix θ^+ at the beginning of the next period. This migration dynamics is captured by

$$\theta^+ = \theta \frac{D^B}{D^A} = \frac{\theta[1 - F(-\Delta)] + F(\Delta)}{1 - F(\Delta) + \theta F(-\Delta)} := \Phi(\theta, \Delta). \tag{8}$$

As propositions 5 shows, the induced process is locally stable and converges to the symmetric case $\theta = 1$.

Proposition 5 *Stability of the migration process.*
Migration dynamics $\theta^+ = \Phi(\theta, \Delta)$ yields an at least locally stable process in the neighborhood of $\theta = 1$.

Proof. Since Φ is continuously differentiable, it is sufficient to show that $1 > d\Phi/d\theta > 0$ holds in the neighborhood of $\theta = 1$. In general, we obtain

$$\frac{d\Phi}{d\theta} = \frac{[1 - F(\Delta) - F(-\Delta)] + [f(\Delta) + \theta f(-\Delta)] \frac{d\Delta}{d\theta} [1 + \theta]}{[1 - F(\Delta) + \theta F(-\Delta)]^2}. \tag{9}$$

For $\theta = 1$ and $\Delta(1) = 0$ equation (9) reduces to $\frac{d\Phi}{d\theta} = \frac{1}{3}[1 - 2F(0)] < 1$.■

Current voting on public pensions affects migration and thereby determines the starting point for the choices in the next period. In this sense, voting and migration are intertemporally connected. Since the home bias ($F(0) < .5$) ensures an only gradually net flow of young people to the undercutting smaller country, the movement of the relative population size θ towards its steady state is monotonic. If, in contrast, young people have wanderlust ($F(0) > .5$), the population figure θ oscillates around the steady state. In this case, the smaller region at the beginning of each period attracts huge numbers of immigrants who are keen on living abroad. It becomes the larger country after relocation of the working force takes place. However, even under these circumstances, the migration process is locally stable.

4 Voting and strategic migration

Since old-age pensions cannot be expected to be independent of migration, myopic migration behavior is inconsistent and not rational. If each regions' young generation becomes aware of the fact that their decision has an impact on subsequent voting equilibria and therefore on their own future pensions, their choices will reflect the additional (dis-)incentive. Strategic migration requires that each potential migrant compares the whole present value of his lifetime income which can be achieved in region A and B

$$\begin{aligned} I^A &= 1 - a + P^A(\theta^+)/(1+r) \\ I^B &= 1 - b + P^B(\theta^+)/(1+r). \end{aligned} \tag{10}$$

Consequently, the difference of both income positions which takes strategic migration into account yields an economic disadvantage[16]

$$\Delta = a - b - \frac{1+n}{1+r}\Omega(\theta^+). \tag{11}$$

Since migration and voting decisions are intertemporally linked, the whole sequence of choices must be solved by backward induction. This solution concept necessarily requires a starting point in the future. To simplify the analysis, we assume a 'doomsday'-scenario like Konrad (1995), i.e. we consider only two succeeding periods after which the world ends.[17] This approach is sufficient to analyze the implications of rationality for the voting equilibrium. Since no life exists after the second period, the generation born in this last phase migrates 'myopically' as

[16] Under strategic migration an individual chooses the place of residence where the net public pension wealth *NPPW* as defined by Feldstein (1974) attains its maximum.

[17] Analyzing additional periods does not really increase the economic insight.

the labor force in the previous section. In period 1, the young individuals anticipate the impact of current migration on their future pensions. This strategic behavior alters the maximization problems of the retirees, which are now given by

$$\begin{aligned} &\max_a P^A \text{ s.t. (8) and (11)} \\ &\max_b P^B \text{ s.t. (8) and (11).} \end{aligned} \tag{12}$$

The first-order conditions to problem (12) yield

$$a = \frac{1-F(\Delta)+\theta F(-\Delta)}{[f(\Delta)+\theta f(-\Delta)]\frac{d\Delta}{da}} \qquad b = \frac{[1-F(-\Delta)]\theta+F(\Delta)}{[f(\Delta)+\theta f(-\Delta)]\frac{d\Delta}{db}}. \tag{13}$$

In contrast to the equilibrium conditions under myopic migration, the expression $d\Delta/d\cdot$ is rather complicated. This term has to be derived by differentiating (8) and (11) totally. Inserting the results in equation (13) yields

$$\begin{aligned} a &= \frac{1-F(\Delta)+\theta F(-\Delta)}{[f(\Delta)+\theta f(-\Delta)]} + (1+\theta^+)\frac{1+n}{1+r}\Omega' \\ b &= \frac{[1-F(-\Delta)]\theta+F(\Delta)}{[f(\Delta)+\theta f(-\Delta)]} + (1+\theta^+)\theta^+\frac{1+n}{1+r}\Omega'. \end{aligned} \tag{14}$$

The second term on the RHS vanishes for myopic migration. It reflects the impact of the additional intertemporal link under strategic migration.

It might be expected that the young people can improve their position in relation to the retirees if they fully anticipate the impact of migration and behave rational. However, the current labor force does not benefit from strategic migration. In contrast, they suffer from their foresight at least in and close to the symmetric case $\theta = 1$.

Proposition 6 *Steady-state equilibrium.*
For $\theta = 1$, the equilibrium contribution rates in the case of strategic migration $a^{**} = b^{**} = \frac{1}{2f(0)} + 2\frac{1+n}{1+r}\Omega'(1)$. They exceed those under myopic migration.

This result follows directly from $\Omega'(1) > 0$ (see proposition 4 ii)).[18] It occurs since a small increase in contributions has not only a direct one-to-one effect on current net income of the young generation, but also an indirect impact on future pensions through its consequences on the subsequent voting equilibrium. Rising contributions in region A yield a trade-off in the economic disadvantage: While current income falls, there is a marginal decrease in the population size of A, which improves the relative income position of living in A in the future. If young people

[18] Notice that Ω definitely increases in θ on its whole domain in the case of a uniform distribution. Then, the second term on the RHS of (14) is always positive. Nevertheless, it is not straightforward to rank the contribution rates in (14) with those under myopic migration since Δ is typically different in both situations except for $\theta = 1$. Therefore, we only compare the steady-state outcomes.

anticipate the latter effect, the demand for living in a region becomes more inelastic, which necessarily leads to higher 'prices' in the revenue maximizing optimum.

Since strategic migration provides an additional intertemporal link between subsequent generations and subsequent decisions, population growth has an impact on voting. Aging of a population, which can be interpreted as a drop in birth rates n, leads to lower contributions. As pension benefits decline anyway when aging decreases the internal rate of return of the pay-as-you-go system, the impact of retirement benefits and thus migration on Δ is reduced. Hence, aging implies a slight increase in the elasticity of the demand for living in either region. In this sense, interregional competition establishes a negative relationship between population growth and contribution rates. Increasing mobility counteracts the tendency to rising premium payments in an aging society, which can be predicted in the case of separated labor markets.[19] In this sense, it qualifies most of the public choice literature on this topic.

5 Location choice and efficiency

Migration tames the gerontocratic Leviathan at least partially and thus restricts the exploitation of the working generation. Apart from this distributional effect, social competition has also efficiency implications. To discuss this aspect, we briefly characterize what an efficient allocation of labor looks like. The resulting features serve not only as a benchmark for the non-cooperative equilibrium considered above, but also for the coordinated policies analyzed in the succeeding section.

Accepting the inelastic labor supply, in each period the world's total wage sum, $(1+n)(N^A+N^B)$, is exogenously given. This aggregated income constitutes a single budget constraint for both economies. Since this figure is fixed, any regulation of the public-pension system simply reallocates consumption opportunities either between succeeding generations or between neighboring regions.[20] It increases lifetime income of some individuals at the expense of others. Retirement benefits thus involve distributional conflicts, but give no rise to inefficiencies with respect to pure economic income.

Nevertheless, social competition can induce migration distortions. In addition to wage and pensions, an individual receives 'cultural income' reflected in his migration

[19] See Marquardt and Peters (1997) for a theoretical explanation as well as Breyer and Craig (1997) for a recent survey on voting on public pensions and its empirical evidence from OECD countries.

[20] The assumption of an aging population (i.e. $n < 0$) excludes Ponzi contracts and guarantees dynamic efficiency. Thus, Pareto-optimality is reduced to a simple redistribution of current resources within each period.

preferences. Living at home instead of abroad leads to cultural benefits for people of type $s > 0$. In contrast, a citizen of type $s < 0$ raises his 'virtual' income by $|s|$ if he emigrates. Since the location choices do not affect the world's budget constraint, each distribution of pure economic income among the population in both regions can in principle be achieved independent of people's place of residence. Hence, a Pareto-optimal location is purely determined by the households' attachment-to-home. Each individual shall live in his preferred region. The conclusions about efficiency are summarized in remark 1.

Remark 1 *Efficient migration.*
i) Any arbitrary distribution of the world's total wage income among the living young and old individuals is Pareto optimal.
ii) The location choice is efficient if and only if a citizen of type $s > 0$ stays at home while an individual of type $s < 0$ moves abroad no matter where and when he is born.

Utility maximizing retirees obviously locate in their preferred region since the pensions are not affected by their place of living when they are old. Social competition can only distort the location choice of the young generation. If differentials in pure economic income induce people to emigrate, cultural benefits of some individuals are destroyed without increasing the total wage sum (which could compensate for the loss). To achieve a first-best solution, net incomes of the working generation must not respond to their location choice. Then, the analysis above directly implies the conditions for efficiency.

Remark 2 *Social competition and efficient migration.*
The solution of the sequential game is efficient (i.e. contribution payments are not migration-distorting) if and only if the net incomes in both countries as they are perceived by the young generation, I^A and I^B, are identical. A first-best solution is therefore only compatible with either $\theta = 1$ no matter whether individuals behave rational or myopic (first case) or $F(0) = .5$ if the labor force migrates myopically (second case). In the former case, the system is in the steady state, where net wages and pensions are equalized among countries. Under the very specific circumstances of the latter case, the young generations only pay attention to their net labor income, which is identical in both countries even in the short run. Apart from these two limited cases, social competition distorts migration.

Since gross wages are identical, the condition for efficiency implies that, for each generation, the burden of the social system has to be equalized among countries. This conclusion resembles previous results on migration and labor allocation (see, for

instance, Mansoorian and Myers, 1993; Wildasin, 1991). In this strand of literature, differentials in social taxes or transfers lead to an inefficient allocation of labor because people move to countries where their marginal product is lower than in competing regions. This kind of production inefficiency is excluded in the present paper as the wage sum is exogenously given. Nevertheless, location choices can be suboptimal according to the Pareto criterion if individuals differ with respect to their attachment-to-home. Both reasons imply a similar condition for efficient social systems.

6 Harmonization of pension policies

Migration and social competition is disadvantageous for gerontocracies since the extent of old-age insurance is reduced compared to a situation without labor mobility. These negative consequences of social competition from the median voters' point of view can be avoided through an interregional policy coordination.[21] Allowing unrestricted cooperation between countries, the benefits of the old generation can be maximized by levying a 100% contribution rate on labor income. Although this extreme tax burden is in the interest of purely selfish retirees, nobody really believes in its practicability. If the young generation is totally exploited, they will obviously find opportunities to opt completely out of the intergenerational contract. Consequently, a successful cooperation pays attention to feasibility constraints and yields a more moderate policy than the one mentioned above.

Since it is beyond the scope of this paper to explain these restrictions endogenously, we take them as exogenously given and refer to the observed 'rules' in the EU. Cooperation between the member states of the EU typically aims at a coordination within the given spread of non-cooperative policies. In the present case, this 'constraint' means that both gerontocracies look for a harmonization of the contribution rates in the interval (a^*, b^*). Taking the Nash equilibrium as benchmark, the range for a constrained policy coordination shrinks if regions are of similar size and thus implement similar strategies anyway. However, considering the EU with its rather different members, we focus on asymmetric cases, i.e. $\theta \neq 1$, in which a moderate harmonization of the EU type can be applied.

Typically, two strategies are of particular political interest: either a harmonization H^1 which introduces an *identical contribution rate c in all regions* or a harmo-

[21] We focus on interjurisdictional cooperation and neglect the opportunity of establishing a 'higher-level' government to which both regions are subordinated. This approach fits best to the present political circumstances in the EU with its still independent member states. For the comparison of centralized solutions and voluntary interregional cooperation with regard to social competition see, for example, Hercowitz and Pines (1991).

nization H^2 which imposes a *minimum social tax rate* β for all countries.[22] Considering these policies, it is not asked which kind of cooperation strategy the old generation finally chooses, but which type of harmonization can yield an improvement upon the Nash equilibrium for both countries' retirees. To be precise, we distinguish between unconstrained strategies and constrained or moderate coordination, i.e. $c, \beta \in (a^*, b^*)$, if necessary.

Harmonization H^1 excludes any social competition by an agreement on a uniform contribution rate ($c = a = b$). Additionally, under a constrained coordination the common policy must not exceed the highest nor fall below the lowest contribution rate of the uncoordinated benchmark case.

Proposition 7 *Identical contribution rates.*
Assume $\theta > 1$ and $F(0) < .5$ which yields a Nash equilibrium with $a^* < b^* < 1$.
i) There exists a critical value $\widehat{c} > b^*$ such that any harmonization H^1 of the pension policy which implements a common contribution rate $c > \widehat{c}$ yields an improvement for both regions' retirees.[23]
ii) A moderate harmonization $c \in (a^*, b^*)$ does never improve the retirement benefits in both countries upon the Nash equilibrium.

If we discuss figure 3 with best-response functions and the decisive indifference curves of the median voters in region A and B, a formal proof can be skipped. Since the demand for living in a region increases in the neighbor's social taxes, a higher contribution rate in a country implies a positive externality for its opponent. This is reflected by the indifference curves P^A and P^B which intersect the respective response function in NE, either horizontally (region A) or vertically (region B). Given the Nash equilibrium NE with $a^* < b^* < 1$, it is obvious that all uniform contribution rates which are improving upon the Nash equilibrium lie to the north-east of NE, because higher pension levels than in the Nash equilibrium are either to the top for region A or to the right for region B. All this information is contained in figure 3. The critical value $\widehat{c}$ is determined by the intersection of the 45°-line and the depicted indifference curve P^A, implying $\widehat{c} > b^*$. A harmonized contribution level

[22] The instruments of a policy coordination are similar to those under tax competition. Cf. Kanbur and Keen (1993), who analyze tax competition and tax coordination problems of VAT when countries differ in size. Their and our findings are closely connected because both papers analyze a policy competition with strategic complements and positive fiscal externalities. In the context of social policy, the Treaty establishing the European Community explicitly mentions harmonization as a objective of the EU and refers to minimum requirements as a possible instrument (see particularly art. 136 and 137).

[23] Notice that, if countries are very asymmetric, no critical rate $\widehat{c}$ might exist in the interval $(b^*, 1]$. We restrict our argumentation to the 'normal' case $\widehat{c} \in (b^*, 1]$.

which exceeds the critical rate $\widehat{c}$ always yields an improvement for both regions' retirees, and vice versa.

The interval for a moderate or constrained harmonization policy within the bounds of the previous non-cooperative policy choices (a^*, b^*) is the bold part of the 45°-line to the southeast of NE. Here, a retiree of region A does not gain from harmonization.

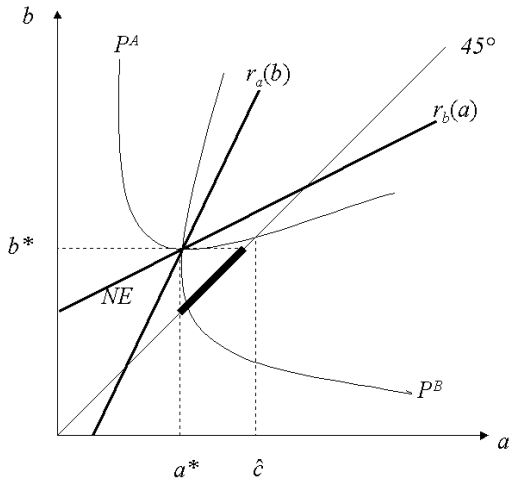

Figure 3: Identical contribution rates

A harmonized policy at the bottom, i.e. c below a^*, does not yield any improvement. No party gains from such a coordination. Even a harmonization at the top, i.e. $c = b^*$, is not successful. The bigger region B can only increase its pension benefits at the expense of the smaller region A. Since similar arguments hold for all policies between top and bottom, identical contribution rates cannot improve the pensions of both countries' old generation upon the Nash equilibrium. At least one median voter would oppose such a moderate and constrained harmonization.

The situation alters in the case of minimum standards as proposition 8 shows.

Proposition 8 *Minimum contribution rates.*
Assume $\theta > 1$ and $F(0) < .5$ which yields a Nash equilibrium with $a^* < b^* < 1$. If both parties continue in social competition except for an introduction of a minimum contribution rate $\beta > a^*$, i.e. harmonization H^2, both countries' retirement benefits exceed their levels in the uncoordinated Nash equilibrium.

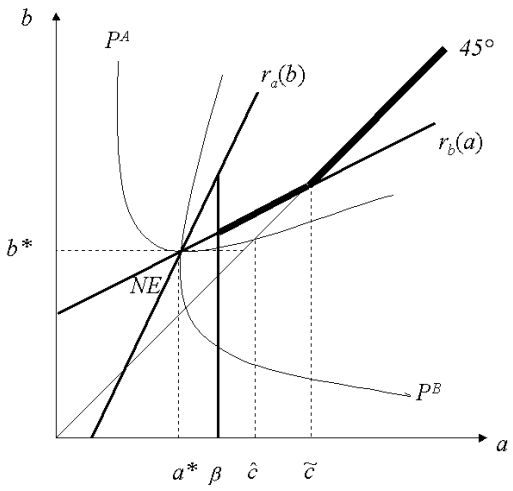

Figure 4: Minimum contribution rates

Proof. For short see figure 4.

Introducing β the response function of region A is restricted from below. The bold line in figure 4 contains all equilibria which can be obtained by harmonization at a minimum level. It is obvious that both regions' retirees are better off under this policy coordination even if the set of feasible policies is restricted to moderate changes within the natural spread $\beta \in (a^*, b^*)$.

While the harmonization policy H^1 aims at a reduction of migration to its natural level, the second policy H^2 limits the strategy space only from below. This avoids negative consequences from undercutting the neighboring region in two ways. First, the smaller region is forced by the minimum level β to increase its contribution rate and, second, the bigger region simultaneously increases its rate too.

While harmonization H^2 successfully redistributes from the young to the old generations, it does not yield Pareto-optimal location choices, at least for moderate policies $\beta < b^*$. Nevertheless, the introduction of a minimum standard $\beta > a^*$ always reduces inefficiencies, since it closes income gaps between both regions, and $|\Delta| > 0$ can be understood as a measure for migration distortion. If β is not constrained for political reasons, a relatively high minimum rate $\beta > \tilde{c} > \hat{c}$ leads to identical contributions in both regions. In this extreme case, the choices of place of residence are efficient if individuals only focus on labor income. The same outcome results from harmonization H^1, which equalizes net wages too.

7 Extensions

In the previous sections, the assumptions are in line with the public-pension systems in the member states of the EU. These systems apply the place-of-residence principle, and European regulations forbid discrimination between EU citizens living in the same country.[24] The following extensions analyze possible implications if these principles are abolished. First, we allow countries to levy differentiated contribution rates on the labor income of domestic population and immigrants. Second, the application of the place-of-birth principle instead of the current residence concept is briefly discussed.

7.1 'Price discrimination'

Natives and foreigners differ in their demand for living in a country according to their attachment-to-home. Discriminating between the contribution rates of these two groups, the gerontocracies can subtler influence the migration flows in their favor.[25] Since foreigners' demand for living in a region is more elastic than the demand of the domestic population, we expect a 'positive discrimination', i.e. immigrants are at least treated as well as natives.

Contrary to the non-discriminatory case discussed in the previous sections, it is now distinguished between two different contribution rates; a_1 and b_1 for the young natives in region A and B respectively, and furthermore a_2 and b_2 for the potential immigrants. For simplicity, we restrict the analysis to the myopic case. Then, the gerontocracies' modified payoff is given by

$$\begin{aligned} P^A &= (1+n)\,\{\underbrace{a_1[1-F(a_1-b_2)]}_{\text{natives}} + \underbrace{a_2\theta F(b_1-a_2)}_{\text{immigrants}}\} \\ P^B &= (1+n)\{\overbrace{b_1[1-F(b_1-a_2)]}^{\text{natives}} + \overbrace{b_2F(a_1-b_2)/\theta}^{\text{immigrants}}\}. \end{aligned} \tag{15}$$

A young native of region A compares the income opportunities in both regions when he decides on migration. Since he only considers net wages, the gains from emigration amount to $(a_1 - b_2)$, i.e. the difference between his contribution rate at home and abroad. Similarly, $(b_1 - a_2)$ is the benchmark for the young generation from region B.

[24] Art. 40 of the Treaty establishing the European Community excludes any discrimination based on nationality.

[25] One of the referees suggested that voluntary transfers between regions can be constructed similar as in Myers (1990) such that both regions' retirees are favored by this policy. Since the main task of such transfers can be seen in purchasing 'a preferred regional population size' (Myers, 1990, 114), the idea of these transfers is rather similar to differentiated contribution rates for natives and immigrants.

Maximizing the retirees' payoffs yields four conditions, which determine the Nash equilibrium of the gerontocratic policy choice:

$$\begin{aligned} a_1 &= \tfrac{1-F(a_1-b_2)}{f(a_1-b_2)}, \qquad & b_1 &= \tfrac{1-F(b_1-a_2)}{f(b_1-a_2)}, \\ a_2 &= \tfrac{F(b_1-a_2)}{f(b_1-a_2)}, & b_2 &= \tfrac{F(a_1-b_2)}{f(a_1-b_2)}. \end{aligned} \tag{16}$$

These equations can then be compared to the results in the previous sections.

Proposition 9 *Myopic migration and discriminatory pension policy.*
i) The equilibrium is symmetric and independent of θ.
ii) In equilibrium there is a positive discrimination of foreigners, i.e. natives pay higher taxes than immigrants. The difference in net income of the young generation Δ^d *is bigger than any difference under the non-discriminatory regime, i.e.* $\Delta^d = \widehat{\Delta} > \Delta(\theta)$ *for all* θ.
iii) The difference in regions' payoff $P^A - P^B = (1+n)\Omega(\theta)$ *is strictly and globally increasing in* θ.
iv) The migration dynamic $\theta^+ = \Phi(\theta)$ *is globally stable.*

Proof. i) The symmetry and independence of θ directly follow from (16). ii) Furthermore, $\Delta^d = a_1 - b_2 = b_1 - a_2 = [1-2F(\Delta^d)]/f(\Delta^d)$ holds. Remembering the definition of $\widehat{\Delta}$ in proposition 3 above, $\Delta^d = \widehat{\Delta} > \Delta(\theta)$ directly results. iii) Although all equilibrium strategies are independent of θ, the equilibrium payoff depends on θ. Since P^A increases and P^B declines in θ, we obtain a strictly increasing difference in regions' payoff throughout the whole domain for θ. iv) As $\Phi(\theta)$ is defined analogously to (8), and Δ^d remains independent of θ, it can easily be checked that $1 > \Phi' > 0$ holds, which directly corresponds to global stability.■

Since the gerontocracies can treat natives and immigrants differently, the relative size of the domestic and foreign population plays no role for determining the optimal policy. The contribution rates in equilibrium are therefore symmetric even if countries differ in their size.

If the regions apply a discriminatory regime, the pension systems give a discount for immigrants. The optimal price discrimination in favor of foreigners simply reflects that the demand for living abroad is more elastic than the demand for staying at home. According to an inverse elasticity rule, the home bias requires reduced fees for immigrants to attract them more intensively.

The equilibrium rates are independent of the relative size of the gerontocracies, and thus even in the symmetric case $\theta = 1$ income differentials provide incentives to migrate. Hence, a discriminatory pension system is never migration efficient. Since

the difference in contributions Δ^d does always exceed those under a uniform contribution rate, price discrimination even enhances the income-motivated movements of young people and therefore the distortions of the location choice.

Like in the non-discriminatory case, the retirees of the smaller country receive a higher payoff than their counterparts in the other region. In contrast to the former case, we explicitly prove that this conclusion holds globally, i.e. for all θ, and not only locally around the steady state.

7.2 Place-of-birth principle

A more radical deviation from present regulations than price discrimination would be the abolition of the place-of-residence principle. Sinn (1990, 2000) suggested to apply the place-of-birth or home-country principle instead of the current concept. According to his proposal, birth determines the regional pension system to which an individual belongs. Then, people cannot opt out of their systems through migration. This rule eliminates social dumping associated with interjurisdictional competition at its origin. Since pensions do no longer depend on the place of residence, the resulting equilibrium is clearly migration efficient.

However, this efficiency is not free of charge. In a broader context, the price might be a distortion in the labor market. Labor supply depends on net wages. If the working force differs with respect to their place of birth, employees with lower contribution rates accept lower offers than their competitors with high tax burdens. These wage differentials split the working force. Since an identical gross productivity does not coincide with identical net labor income, the place-of-birth principle probably disrupts the labor market more than distortive social taxes do anyway. However, the same criticism can be applied to the above system of price discrimination, which not even guarantees migration efficiency in the present simple framework.

8 Concluding remarks

The main results of our analysis can be summarized as follows: first, the smaller country undercuts the premiums of its opponent. It is advantageous for the region with less natives to attract immigrants and increase its tax base. This strategy enables the payment of higher retirement benefits in the smaller country. These conclusions resemble the results in the literature on international tax competition.[26]

[26] Cf. Kanbur and Keen (1993). Despite the similarities of some results in the international tax literature and in our contribution, the point of departure and the detailed mechanisms at work are

The induced migration dynamics lead to a locally stable steady state with identical contribution rates.

Second, strategic migration behavior leads to higher contribution rates at least for a nearly identical population size in both regions. Rational people anticipate that net migration towards the smaller country decreases the future pensions in this region. This reduces the economic incentives to leave the larger country and therefore weakens regional competition. Moreover, labor mobility in connection with rationality establishes a negative relationship between contribution rates and population growth, since aging intensifies competition for young people.

Third, both countries' retirees can improve their payoff upon the Nash equilibrium by introducing a minimum contribution rate. This harmonization of the pension systems softens social competition. However, an agreement on a common contribution rate for both countries does not increase the retirement benefits in both regions if the coordination has to meet political feasibility constraints.

Fourth, gerontocracies offer potential immigrants reduced contribution rates if price discrimination between the native and the foreign population is allowed. This policy enables the old generations to exploit differences in the demand elasticities of these two groups.

Fifth, migration efficiency is compatible with social competition only in the long run and not at all with discriminatory regimes. Harmonizations reduce distortions as a by-product, but at the price of a massive redistribution from the young to the old generation.

The assumption that the median belongs to the retirees might seem to be strict on a first glance. Even in aging societies, the retirees do normally not have the absolute majority of votes. This paper certainly overstates the argument to highlight the basic impact of aging on political power. Nevertheless, the derived qualitative conclusions remain valid under laxer assumptions on the age structure of society. More seriously, the model's concept of citizenship might be open to dispute because some countries naturalize immigrants when these new citizens are still working. However, applying more liberal regulations only alters the qualitative results if these rules significantly erode the political power of a region's old generation. Immigration laws which have such far-reaching consequences are rather unlikely.

However, the present analysis pays no attention to some important features. For instance, the discussed extensions show that reforms of the public-pension system might have unpleasant side effects on the labor market. We have only slightly sketched problems that could arise. In this context, it might be worth to study the interaction between public pensions and other social-security systems in more detail,

rather different.

particularly with respect to unemployment insurance and imperfect labor markets. This subject is left for further research.

References

Beckmann, M.J. and Y.Y. Papageorgiou (1989), Heterogeneous tastes and residential location, *Journal of Regional Science* 29, 317–323.

Breyer, F. and M. Kolmar (1998), The optimal structure of public-pension systems in integrated markets when labor is (un-)restrictedly mobile, Discussion Paper, University of Konstanz.

Breyer, F. and B. Craig (1997), Voting on social security: Evidence from OECD countries, *European Journal of Political Economy* 13, 705-724.

Breyer, F. and K. Stolte (1998), Demographic change, endogenous labor supply and the political feasibility of pension reform, Discussion Paper, University of Konstanz.

De Palma, A. and Y.Y. Papageorgiou (1988), Heterogeneity in tastes and urban structures, *Regional Science and Urban Economics* 18, 37–56.

Feldstein, M. (1974), Social security, induced retirement, and aggregate capital accumulation, *Journal of Political Economy* 82, 905-926.

Friedberg, R.M. and J. Hunt (1995), The impact of immigrants on host country wages, employment and growth, *Journal of Economic Perspectives* 9, 23-44.

Friedman, J. (1986), Game theory with applications to economics, Oxford.

Goodspeed, T.J. (1998): On the importance of public choice in migration models, *Economic Letters* 59, 373–379.

Hagen, J. von and U. Walz (1995), Social security and migration in an ageing Europe, in B. Eichengreen, J. Frieden and J. von Hagen, *Politics and Institutions in an integrated Europe*, Berlin, 177-192.

Haupt, A. and W. Peters (1998), Public pensions and voting on immigration, *Public Choice* 95, 403-413.

Hercowitz, Z. and D. Pines (1991), Migration and fiscal externalities, *Journal of Public Economics* 46, 163-180.

Kanbur, R. and M. Keen (1993), Jeux sans frontieres: Tax competition and tax coordination when countries differ in size, *American Economic Review* 83, 877–892.

Kolmar, M. (1998), Optimal intergenerational redistribution and strategic incentives with two countries and endogenous fertility: Theory and application to the European Union, Discussion Paper, University of Bonn.

Konrad, K.A. (1995), Fiscal federalism and intergenerational redistribution, *Finanzarchiv NF* 52, 166-181.

Mansoorian, A. and G.M. Myers (1993), Attachment to home and efficient purchases of population in a fiscal externality economy, *Journal of Public Economics* 52, 117–132.

Marquardt, M. and W. Peters (1998), Collective madness: How aging influences majority voting on public pensions, Discussion Paper, University of Bonn.

Meijdam, L. and H.A.A. Verbon (1996), Aging and political decision making on public pensions, *Journal of Population Economics* 9, 141-158.

Myers, G.M. (1990), Optimality, free mobility, and the regional authority in a federation, *Journal of Public Economics* 43, 107-121.

Sinn, H.-W. (1990), Tax harmonization and tax competition in Europe, *European Economic Review* 34, 489-504.

Sinn, H.-W. (2000), EU enlargement and the future of the welfare state, CESifo Discussion Paper 307, Munich.

Scholten, U. and M. Thum (1996), Public pensions and immigration policy in a democracy, *Public Choice* 87, 347-361.

Wildasin, D.E. (1991), Income redistribution in a common labor market, *American Economic Review* 81, 757-774.