

Public pensions and immigration policy in a democracy*

ULRICH SCHOLTEN¹ and MARCEL THUM²

¹*Lehrstuhl für Nationalökonomie und Finanzwissenschaft, University of Munich, Schackstrasse 4, 80539 München, Germany;* ²*Princeton University, Princeton, New Jersey 08544, U.S.A.*

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Abstract. The paper analyzes the link between the public pension system and the immigration policy. In a pay-as-you-go system, the incentives for immigration vary significantly between individuals at different lifetime periods. In the framework of an overlapping generations model, we show that the median voter's choice in general leads to inefficient levels of immigration. The median voter neglects the effects of the externalities within the pension system on other generations. An immigration policy that is not affected by the median voter's choice but instead is constitutionally determined will avoid welfare losses. The expected lifetime income of each generation can be increased by applying a rule of steady immigration.

1. Introduction

The importance of public pension systems as an instrument to cover old age income for a great part of the population is enormous. All member states of the OECD have such a system, and expenditures on pensions are the most important item in the budget of almost every industrialized country (Holzmann, 1990). In 1989, for instance, the average share of expenditure of public pensions in all EU member states was 11 percent of GNP; for the United States and Japan it is 7.0 and 5.7 percent respectively (OECD, 1991; Statistisches Bundesamt, 1992).

The financing of public pension systems is usually organized according to the pay-as-you-go principle.¹ The working generation pays contributions to the public pension system out of its labour income. Old people receive their pensions from the public pension system financed by the current young generation. How much every old generation receives as a payment from the public pension system during the retirement period may be fixed in absolute terms or may depend on the individual contributions during the active period. During the retirement period, pensions are adjusted according to the changes in wages or prices.²

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When the retirement income is linked to current wages, e.g. with a constant ratio between the pension and the gross wage, contributions have to be adjusted accordingly in order to finance the social security system. It is, therefore, one of the characteristics of such a public pension system that the contribution rate of the working generation can be reduced when additional people start to work. The net wage increases *ceteris paribus* as the burden of finance is spread out over more people paying their contributions. The additional workforce, however, lowers the gross wage for a given capital stock, and, in addition, the net wage is lowered *ceteris paribus*. Hence, the effect on net wages is ambiguous. A larger labour force depresses gross wages but also reduces the contribution rate. Current pensions, however, will unambiguously be reduced; the old generation is worse off.

The above mentioned effects on wages, pensions and contributions rates are not only induced when the age structure varies due to long run changes in domestic fertility or labour supply. These adjustments also become effective, and may be even more important, when immigration takes place. Immigration reduces gross wages, at least in the short-run, and as a consequence, pensions will be reduced, and contribution rates will be lowered. The wide-spread public discussion on the appropriate immigration policy shows how important this issue has become in most industrialized countries. While the United States, Canada, Australia or New Zealand set rules for economically valuable immigration, the European countries still lack such an immigration law.³ Germany, for example, had an active immigration policy from the late 50s until the early 70s in that foreign workers were hired from southern Europe. However, this was only a temporary measure to fill the gap in the labour supply during the German *Wirtschaftswunder*. The hiring of foreign workers stopped with the onset of the first severe post war recession in 1973. Germany did not return to an active immigration policy even during phases of economic upswing. Today the attitude towards immigration for economic reasons is even more negative.⁴

The paper analyzes this link between the public pension system and the immigration policy. It investigates the incentive effects of a pay-as-you-go pension system on the immigration policy. The incentives for immigration vary significantly between individuals in different lifetime periods. Young workers appreciate the benefits of additional contributors to the public pension system more highly than workers who are close to retirement. Older workers can disregard the improvements in the old age dependency ratio but are interested in high pensions. The latter can be achieved by keeping wages up, i.e. by restricting immigration. Effective immigration is determined by the median voter and the voting mechanism selects an individual who is already well along life cycle and who, therefore, will disregard some of the effects

over a full life cycle. Furthermore, a current median voter has no influence on the immigration policies in previous and following periods. So there is no hope that intergenerational externalities being internalized by a temporary median voter. The median voter's immigration policy obviously differs from the one derived from an individual who maximizes his income over the full life cycle. To avoid the inefficiencies resulting from the median voter's period to period decisions, it is possible to define a policy of steady immigration. This policy can make every generation better off by increasing the lifetime income. In the formal analysis in this paper, it turns out that the median voter pursues a too restrictive immigration policy. Lifetime income could be increased by fixing a higher but steady immigration rate.

The paper is organized as follows. Section 2 sets up a simple model with overlapping generations and public pensions. In Section 3, we analyze the median voter's incentives for immigration resulting from the existence of the public pension system. Section 4 describes the optimal policy with a steady immigration rate derived from the calculus of a person who maximizes lifetime income. Section 5 concludes the paper.

2. The model

To analyze the incentives for immigration in a pay-as-you-go system we have to set up a simple overlapping generations model. Furthermore, we have to specify labour demand, immigration and population reproduction.

2.1. *Time structure*

In a model of overlapping generations, each generation lives for three periods. An individual who is born at the beginning of period $t - 2$ works during his youth ($t - 2$) and middle years ($t - 1$). During these two periods, the individual pays contributions to the social security system out of his labour income. In period t , the individual is old and receives payments from the public pension system. The contributions are now paid by the generations born in $t - 1$ and t which form the labour forces then current. This can be regarded as a stylized form of an unfunded pay-as-you-go system.

The time structure within each period is as follows. Before a new generation starts to work, the population decides on the immigration policy, i.e. how many foreign workers are allowed to immigrate and take a job on the domestic labour market. When immigration has taken place according to the agreed policy, production is carried out with middle aged workers, young native workers and immigrants. Labour receives its marginal product and transfers

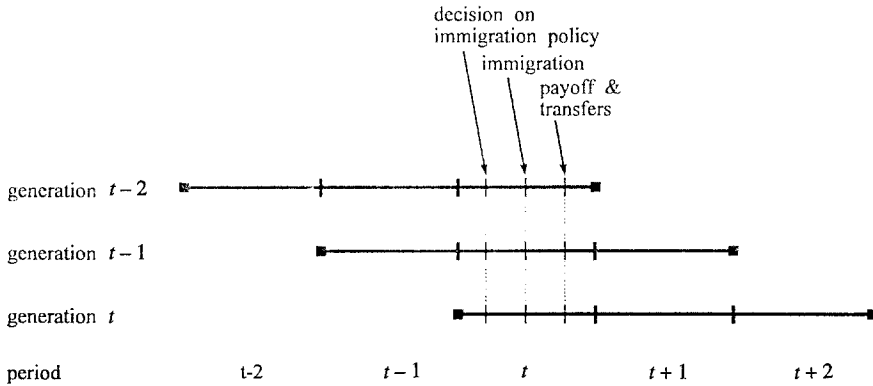


Figure 1. Time structure.

are made to the older generation via the social security system. The complete time structure of the game is summarized in Figure 1.

2.2. Labour supply

For simplicity, we assume that the individual labour supply is inelastic with respect to wages. Therefore, the total labour supply coincides with the number of young and middle aged workers. Let z_t denote the size of the generation born in period t . The labour supply in period t can then be expressed as $L_t = z_{t-1} + z_t$. The generation born in $t - 2$ has already retired and, hence, is not considered in the labour supply.

As we are interested in the effects of immigration on the pension system, we have to split up the population in native and migrant workers. We, therefore, have to define immigration as a source for external growth of the labour force. The reproduction behaviour of the domestic population can be seen as the internal growth of the labour force.

Let m_t be the number of immigrants in period t ($m_t \geq 0$). All immigrants are assumed to be young at the time of immigration, i.e. they are born in period t . The generation born in period t consists of n_t domestic workers and m_t new immigrant workers: $z_t = n_t + m_t$. Using this definition we can rewrite the labour supply as $L_t = z_{t-1} + n_t + m_t$. To simplify analysis later, it is convenient to capture immigration as the ratio of the labour supplies after and before migration:

$$\gamma_t = \frac{z_{t-1} + n_t + m_t}{z_{t-1} + n_t}. \tag{1}$$

To put it differently: $\gamma_t - 1$ is the growth rate of the labour supply due to immigration in period t . For convenience, we shall refer to γ_t as (gross) “immigration rate”.

The second influence on the size of the labour force comes from the reproduction behaviour of the domestic population. This element constitutes the link between two subsequent generations. The number of people born in period $t - 1$ is z_{t-1} . All immigrants of this previous period ($t - 1$) are treated as domestic in the next period (t). Having immigrated, they then remain in the country for the rest of their lives and adopt the same reproduction behaviour as the native population. The z_{t-1} people produce a native population of n_t in period t . Therefore, the rate of reproduction is defined as

$$x_t = \frac{n_t}{z_{t-1}}. \quad (2)$$

These two definitions of internal and external population growth allow us to rewrite the labour supply in period t as

$$L_t = z_{t-2} \cdot [\gamma_{t-1} \cdot (1 + x_{t-1}) - 1] \cdot \gamma_t \cdot (1 + x_t). \quad (3)$$

The labour force in period t consists of generations $t - 1$ and t . Each active generation has experienced internal growth (x) and external growth (γ). The size of generation $t - 2$ is z_{t-2} and it has dropped out of the active labour force.

2.3. Labour market equilibrium

The labour market is perfectly competitive. Each firm faces a decreasing marginal product of labour. In equilibrium, the whole work force is employed and the wage reflects the productivity of the marginal worker. As immigration is the only choice variable in our model, the labour supply varies solely with the inflow of new workers. Hence, the gross wage is a function of the immigration rate: $w_t(\gamma_t)$ with the usual property $\partial w_t / \partial \gamma_t < 0$. The growth of the labour force due to immigration lowers the marginal productivity of labour and, therefore, negatively effects the gross wage.

Two arguments can be used here to justify the assumption of decreasing marginal productivity of labour. Firstly, an increased labour force reduces the wage in the short run as other factors, e.g. capital, are fixed. In the long run, however, the endowment with these factors can be adjusted to the new size of the labour force. For simplicity, we assume that the adjustment of endowments takes place at the beginning of each period. The endowment is oriented towards the current size of the labour force. In the short run, i.e. within one period, the endowments are given and have to be distributed over more workers when additional immigration takes place.

Secondly, adopting a wider interpretation of “wages”, non-market goods such as common-property resources with congestion effects can also be seen as part of the workers’ income. Additional immigrants will increase the use of public transport, roads or recreational facilities, for instance. As the capacity of these goods is given in the short run, immigrants will cause additional crowding externalities. Therefore, native workers obtain less benefits from these goods which can be interpreted as a “wage” reduction. As we solve the model for a steady state immigration rate we will in the following adhere to the first interpretation, namely that the amount of factors, other than labour, is fixed in the short run.

With capital the only factor other than labour, investment takes place up to the point where the marginal product of capital equals the rate of interest for the given initial labour force ($z_{t-1} + n_t$). If the rate of interest is constant over time, the capital endowment per capita will be the same in each period (i.e. we assume a linear homogeneous production function). Hence, the wage only depends on the gross immigration rate γ :

$$w_i(\gamma) = w_j(\gamma) \text{ for all periods } i, j. \quad (4)$$

With constant returns to scale, the initial endowment is the same in each period – no matter how big the absolute size of the labour force. Therefore, it is only the *percentage* of the initial endowment that has to be given up for the additional migrant workers that matters.⁵

2.4. Pension system

The pension system promises a fixed percentage of current wages to every member of the old generation. If the relation between the pension and the gross wage is fixed by q , the retirement income of an old person amounts to $q \cdot w_t$. In period t , there are z_{t-2} retirees. To balance the pension system, the total expenditure $z_{t-2} \cdot q \cdot w_t$ has to be covered by the active workforce’s payments $b_t \cdot w_t \cdot L_t$. The contribution rate has to adjust to $b_t = q \cdot z_{t-2} / L_t$. Therefore, the net income of a worker reduces to

$$w_t^n \equiv w_t(\gamma_t) \cdot \left(1 - q \cdot \frac{z_{t-2}}{L_t} \right). \quad (5)$$

The contribution to the pension system obviously depends on the relative size of the two generations. Using (3) as an expression for the active labour force, the net wage can be written as

$$w_t^n = w_t(\gamma_t) \cdot \left(1 - q \cdot \frac{1}{[\gamma_{t-1} \cdot (1 + x_{t-1}) - 1] \cdot \gamma_t \cdot (1 + x_t)} \right). \quad (6)$$

The relation between the active labour force and the retirees $1/\{\gamma_{t-1} \cdot (1 + x_{t-1}) - 1\} \cdot \gamma_t \cdot (1 + x_t)$ is determined by the immigration in both periods and also depends on the reproduction of the domestic population. A higher immigration rate reduces the gross wage in the respective period but also improves the old age dependency ratio.

Having completed the description of the model, we can analyze the immigration policy that is effectively carried out by the median voter who maximizes his own income while in power. His incentives towards immigration can then be contrasted with a policy of steady immigration rules where the lifetime income of each generation is maximized and the collective irrationality of the median voter policy is overcome.

3. The median voter's immigration policy

Over the lifetime, the incentives in favour of immigration change. In a system with gross wage adjustments of the pensions, young workers view an additional immigrant as relatively beneficial, as the additional worker will help them to finance the burden of the social security system for the long time of their working life. In contrast, the disadvantage of temporarily decreased wages is of minor consequence. When an individual becomes older and the retirement period comes closer, the wage depressing effect becomes more and more important compared to the financing effect. In the extreme, a retiree is no longer interested in the financing of the public pension system because he no longer pays contributions. Every additional worker, however, reduces the wage level in the short run. As pensions have a fixed relation to the gross wage, no immigration at all would maximize the retiree's income from the public pension system.

The incentives for immigration vary continuously with the worker's age. We can, therefore, rank the members of the population in terms of their desired immigration policy. If politics can decide on immigration period by period, the median voter will determine the actual policy. In our model with three generations, the middle aged population provides the median voter.⁶ We will now solve for the median voter's optimal immigration policy as a description of the actual policy.⁷

In period t , the generation born in $t - 1$ can collect the majority of votes. The median voter representative of this generation will maximize his income for the rest of his life by choosing the optimal immigration policy γ_t^* :

$$\max_{\gamma_t} w_t^n(\gamma_t) + q \cdot w_{t+1}(\gamma_{t+1}). \quad (7)$$

The income is composed of the current wage income and the future pension payments.⁸ The future pension payments will depend only on the future median voter and his immigration policy; it will not depend on the current immigration policy. The rate of immigration today has no influence on the level of tomorrow's pension income. Therefore, the young generation chooses the immigration rate Y_t , in order to maximize the present net wage (6). To find the optimal immigration policy for the median voter generation we take the first derivative of the net wage with respect to the immigration rate:

$$\begin{aligned} \frac{\partial w_t^n}{\partial \gamma_t} &= \frac{\partial w_t}{\partial \gamma_t} \cdot \left(1 - q \cdot \frac{1}{[\gamma_{t-1} \cdot (1+x_{t-1}) - 1] \cdot \gamma_t \cdot (1+x_t)} \right) \\ &+ w_t(\gamma_t) \cdot q \cdot \frac{1}{[\gamma_{t-1} \cdot (1+x_{t-1}) - 1] \cdot \gamma_t^2 \cdot (1+x_t)} = 0. \end{aligned} \quad (8)$$

The gross wage in the economy is always reduced by additional immigration but the worker has only to bear a fraction of this wage decrease. Part of the wage decrease can be shifted onto the pensioners whose old age income is linked to the gross wage. This effect is described by the first term in (8). The second term reflects the worker's advantage from additional immigration. Immigration increases the work force and makes it possible to spread the burden of the social security system onto more contributors. The contribution rate per worker can be reduced.⁹

To solve explicitly for the immigration, we make three further simplifying but not very restrictive assumptions. Firstly, the elasticity of the wage with respect to the immigration rate may be constant:

$$\eta \equiv \frac{\partial w_t}{\partial \gamma_t} \cdot \frac{\gamma_t}{w_t} = \text{const.} \quad (9)$$

This requirement is, for instance, fulfilled for an underlying Cobb-Douglas production function. Secondly, we focus on the symmetric solution, i.e. all generations behave in the same way taking the decisions of all previous and all succeeding median voters as given. In equilibrium, the immigration rate is the same in each period ($\gamma^* = \gamma_t^* \forall t \in Z$). Thirdly, the reproduction behaviour stays constant over time ($x = x_t \forall t \in Z$). These three assumptions allow the first order condition (8) of the median voter's maximization problem to be solved. The optimal immigration rate in period t is given by

$$\gamma_t^* = \frac{1 + \sqrt{1 - 4 \cdot q \cdot (1 - \eta) / \eta}}{2 \cdot (1 + x)}. \quad (10)$$

The immigration rate γ_t^* maximizes the net income of a middle-aged individual in period t . Higher relative pensions (higher q) strengthen the incentives for the median voter for a more liberal immigration policy. (Recall that the

elasticity η is negative.) Higher fertility x , i.e. higher internal growth of the labour force, tends to reduce the necessity of immigration.

So far we have derived an optimal immigration policy for the median voter which can serve as a description of the effective policy when we focus on the effects on the public pension system. As the median voter neglects the effects on the older and younger generations, there are grounds for supposing that this kind of policy is suboptimal. We shall, therefore, describe the optimal immigration policy that maximizes lifetime income of each generation by applying a steady rule for immigration.

4. Steady immigration policy

So far we have considered the case where each median voter decides on immigration independently. However, there are immigration rules that will increase the expected income of each generation within the given social security system. To be effective, such an immigration rule has to be fixed in intergenerationally binding contracts. These contracts can hardly ever be observed, as each generation is afraid that the next generation will deviate from the social contract once it is in power. However, there are at least simple forms of intergenerational contracts, e.g. in pay-as-you-go systems. We shall, therefore, look for a simple immigration rule that can be written down in a kind of constitutional act.

If intertemporally binding contracts are feasible, a uniform immigration policy might improve the expected income of each generation. First of all, we analyze the decision problem of a representative generation that can fix the immigration rate for all future periods. In a second step, we compare the immigration rates under the steady policy with the median voter policy.

4.1. *Optimal immigration policy*

In the new scenario, the immigration rate in the previous and in the next period is no longer exogenously given, but it is determined simultaneously with current immigration. This decision could be viewed as the optimization problem of a potential median voter who is still ignorant relative to the generation he will belong to in the future. What immigration rate would this potential median voter choose in the ex ante position, if he could fix a uniform immigration rate for ever?

The lifetime income of an individual born in period $t - 1$

$$LI_{t-1}(\gamma) = w_{t-1}^n(\gamma) + w_t^n(\gamma) + q \cdot w_{t+1}(\gamma) \quad (11)$$

consists of the net wage income in the two active phases of his life and the pension income during the retirement period. With a constant immigration rate γ , the gross wage will be the same in each period and the lifetime income can also be written as

$$LI(\gamma) = w(\gamma) \cdot \left[2 - 2 \cdot q \cdot \frac{1}{[\gamma \cdot (1+x) - 1] \cdot \gamma \cdot (1+x)} + q \right] \quad (12)$$

where all time indices are suppressed for notational convenience. The first order condition for a maximum lifetime income is obtained by taking the derivative of (12) with respect to the immigration rate γ :

$$\begin{aligned} \frac{\partial LI}{\partial \gamma} = \frac{\partial w}{\partial \gamma} \cdot \left[2 - 2 \cdot q \cdot \frac{1}{[\gamma \cdot (1+x) - 1] \cdot \gamma \cdot (1+x)} + q \right] \\ + w(\gamma) \cdot \frac{2 \cdot q}{(1+x)} \cdot \frac{2 \cdot \gamma \cdot (1+x) - 1}{(1+x)[\gamma \cdot (1+x) - 1]^2 \cdot \gamma^2} = 0. \end{aligned} \quad (13)$$

The solution to this problem delivers the optimal steady immigration rate γ^{opt} . As we are less interested in the absolute level of optimal immigration than in the relation to the median voter solution, we do not have to solve explicitly for this immigration rate. Instead we will compare the income maximizing policy with the effective immigration resulting from independent median voter decisions.

4.2. A comparison of immigration under the two policy regimes

In order to compare the two different policies, we take a closer look on the first derivative of the lifetime income. If the first derivative is still positive at the median voter's immigration rate, this will indicate that the median voter decision leads to a socially too small immigration. If the first derivative is already negative at γ^* , the median voter allows for an excessive inflow of foreign workers. To carry out this evaluation we can rewrite the first derivative of the lifetime income from (13) as

$$\begin{aligned} \frac{\partial LI}{\partial \gamma} = 2 \cdot \left\{ \frac{\partial w}{\partial \gamma} \cdot \left[1 - \frac{q}{[\gamma \cdot (1+x) - 1] \cdot \gamma \cdot (1+x)} \right] \right. \\ \left. + w(\gamma) \cdot \frac{q}{[\gamma \cdot (1+x) - 1] \cdot \gamma^2 \cdot (1+x)} \right\} \\ + \left\{ \frac{\partial w}{\partial \gamma} \cdot q + w(\gamma) \cdot \frac{2 \cdot q}{[\gamma \cdot (1+x) - 1]^2 \cdot \gamma} \right\}. \end{aligned} \quad (14)$$

The expression in the first brackets corresponds to the median voter's calculus and, therefore, is zero at the immigration rate γ^* . Whether lifetime income is maximized by an immigration rate higher or lower than γ^* depends only

on the sign of the second term. The median voter will choose the lifetime income policy only accidentally, i.e. when the second term is equal to zero. In general the two calculuses differ.

Where does this inefficiency come from? Each median voter trades off perfectly the costs and benefits of immigration *within* each period. Additional immigrants reduce the gross wage but this disadvantage is balanced by sharing the burden of the pension system with more contributors. The median voter, however, neglects the intertemporal (or intergenerational) effects *between* periods. Firstly, the young immigrants will also contribute to the social security system in the next period and thus then cushion the burden of the pension system. At that time, the current median voter will already have retired and, therefore, will not benefit from the improved old age dependency ratio. The median voter neglects this benefit of immigration in his calculus. Secondly, higher immigration reduces the marginal labour productivity and, hence, harms the retirees whose pensions are linked to the gross wages. The median voter does not care about the current pensions but, when he is old and has lost his median voter position, he will feel the same effect. As each median voter cannot hope to influence future decisions by changing his own policy, these costs of immigration are neglected.

Both intertemporal externalities can be seen in the derivative of the lifetime income (14). From the welfare point of view, it pays to expand immigration beyond the median voter optimum as long as the benefit from the improved dependency ratio $\left[2 \cdot w \cdot q / \left\{ \left[\gamma \cdot (1+x) - 1 \right]^2 \cdot \gamma \right\} \right]$ exceeds the cost of a lower pension income $\left[q \cdot \partial w / \partial \gamma \right]$.¹⁰ In each case, the intertemporal externality is neglected by the respective median voter. Such a policy of fixed immigration rates would make every generation better off in terms of lifetime income.

Can we say anything about whether the optimal immigration rate will be smaller or greater than the median voter's choice? Using the elasticity definition (9) and rearranging the expression leads to the following relation between the immigration rate of the median voter on the one hand and the lifetime income maximizing immigration rate on the other:

$$\gamma^{opt} \{ \geq \} \gamma^* \Leftrightarrow \eta + \frac{2}{\left[\gamma^* \cdot (1+x) - 1 \right]^2} \{ \geq \} 0. \quad (15)$$

The median Voter's immigration rate γ^* is already known from (10); so we get

$$\gamma^{opt} \{ \geq \} \gamma^* \Leftrightarrow \eta \cdot \left[\sqrt{1 - 4 \cdot q \cdot \frac{1-\eta}{\eta}} - 1 \right]^2 + 8 \{ \geq \} 0. \quad (16)$$

As the elasticity η is strictly negative, the left hand side is decreasing in q . It is reasonable to assume an upper bound for the relation between pensions and

wages, e.g. suppose that pensions never exceed wages. Then it is sufficient to analyze (16) at this upper bound $q = 1$; for all lower q , the left hand side will strictly be greater. Furthermore, empirical investigations suggest values for the elasticity of $\eta \in (-1, 0)$.¹¹ As the first expression on the left hand side of (16) is negative and concave in η , it is sufficient to evaluate the function at the margins $\eta \rightarrow 0$ and $\eta \rightarrow -1$. In both cases, the value of the left hand side is strictly positive. For all values of η in between, the left hand side is even greater and, therefore, always positive. Hence, the median voter's immigration is too restrictive compared to an immigration policy that maximizes the lifetime income of a native worker.

5. Conclusion

A social security system that links pension income to wages creates detrimental incentives for immigration policy. If the immigration policy is left to discretionary decisions, the actual immigration policy will lead to an inefficient work force size. In particular, the model suggests that the median voter pursues a too restrictive immigration policy. The expected lifetime income of each generation can be increased by stabilizing the inflow of foreigners. This result favours a steady and persistent immigration.

The recommendation of fixed immigration rates raises two important questions. Firstly, why do we not observe the implementation of a steady immigration policy? Even if explicit intergenerationally binding contracts cannot be observed, it is quite common to accept some rules, such as the public debt or the public pension system in general, as constitutional and so to speak irreversible. Besides the time consistency problem and possible political constraints, however, there is a loss for the introductory generation from fixed immigration rates. The benefits of higher immigration accrue in the early phases of life when additional immigrants improve the old age dependency ratio and, hence, reduce the burden of the pension system for the workers. Once in the median voter position, this period of life where there is a benefit from steady immigration rates has already passed. The median voter is already close to the retirement period where an increase in immigration incurs the cost of lower pensions. Therefore, it cannot be hoped that the self interest of the median voter will result in the introduction of the steady immigration policy.

Secondly, how are the results affected by changing the pension system? The paper only deals with a fixed relation between the gross wage level and the pension income. This seems to be a good description for many social security systems. However, public pension systems where the pension is fixed in absolute terms and not adjusted according to the wage level could also be

analyzed. In the same way, the contribution rate can be fixed regardless of the number of retirees. We cannot discuss all possible alternative systems in this paper but the intergenerational externalities in general will distort the median voter's choice away from the welfare maximizing immigration. With a fixed contribution rate, for instance, the median voter has no incentive at all for immigration as any immigrant decreases his net wage. The benefits for the retirees due to the higher revenue are neglected by the median voter.

The link between the social security system and immigration policy leads to interesting conclusions and we feel that the distorting effects on immigration policy have been unjustly neglected in the past.¹² However, it should be mentioned that the approach of this paper also has its weaknesses. In particular, an empirical analysis would require some modifications.

Firstly, the stock of capital is fixed for the working period of one generation. It is appropriate to assume that the capital stock is fixed in the short run. For simulations or econometric analysis, however, an explicit adjustment function for capital would be needed. Moreover, factor incomes other than wages are neglected in the analysis. The elimination of these incomes is justified by the paper's aim of isolating incentive effects from the pay-as-you-go system on immigration policy. The consideration of several income sources would blur the original purpose. A more sophisticated model would, e.g., have to take into account the domestic distribution of capital incomes.

Secondly, the link between immigration and the social security system is only one very particular aspect of mobile labour. Immigration is not only determined by the financial burden on the national pension system. Immigration is very often limited by arguments of social integration and limited national factors such as housing.

Notes

1. Many public pension systems also contain elements of a funded system. However, the characteristics of the pay-as-you-go system are dominant (Besseling and Zeeuw, 1993: 8). Surveys of existing pension systems in different countries are given by, e.g., Battis et al. (1988), Besseling and Zeeuw (1993), Casmir (1989), Holzmann (1990) and Verband Deutscher Rentenversicherungsträger (1989).
2. Among all OECD members (without Mexico), there are only three countries where the level of public pensions is independent of the contributions made during the working period. In 12 member countries, the pension payments are linked to the contributions. Nine countries have a public pension system containing both elements, a base pension and an income dependent pension. The change in the level of pensions during the retirement period is determined by a price index in 11 countries, a wage index in 6 countries and a wage-price index in 5 countries. If the level of pensions is changed by a wage index, the ratio between pensions and wages stays constant. See Holzmann (1990).
3. There are two exceptions to this rule. Switzerland allows for a limited stay of immigrants due to economic reasons (Zimmermann, 1993: 23ff.). Britain permits foreign job-creators

- to settle if they bring a minimum of £200,000 of their own money to invest in a business. However, the success of this policy is not overwhelming. In 1992, less than 200 were allowed in (*Economist*, 1994: 32).
4. An overview is given by Zimmermann (1993).
 5. Capital and other factor incomes are not considered in the model. The reason is that we want to isolate the incentives for immigration in a pay-as-you-go system. Allowing for capital income would mix up the effects of the PAYG system with the effects of a funded system. Therefore, capital is treated in the model as if it were fully owned by foreigners and no domestic capital income accrues.
 6. Except for tremendous fertility shocks where one generation outweighs in size the other two generations put together.
 7. For a discussion of the median voter position in intertemporal models, see Rizzo (1990).
 8. Discounting is neglected for simplicity.
 9. Börsch-Supan (1993: 18–19) gives an estimate of the effects on gross and net wages due to immigration within a more general model of the German economy.
 10. The benefit from an increased immigration rate in every period enters twice. By maximizing the lifetime income, one has to consider two intertemporal externalities that improve the old age dependency ratio for an individual born in period $t - 1$. Workers who immigrate in $t - 2$ improve the dependency ratio in the individual's first work period ($t - 1$). And immigrants in $t - 1$ create a benefit in the individual's second work period (t).
 11. See e.g. Bean et al. (1986: S9) for the long-run wage elasticity. For Germany, De New and Zimmermann (1994: 190) estimate the wage elasticity with respect to immigrants at -0.35% .
 12. Felderer (1994) asks to what extent immigration policy can help to stabilize social security systems. In contrast to this paper, Felderer's view is less on the political economy of immigration policies and more on immigration as a substitute for a declining and ageing domestic population. Hagen and Walz (1994) also link immigration and social security systems. They foresee a competition for contributors to the national pension systems in an ageing Europe.

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