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ABSTRACT

In a static setup, migration of unskilled labor may be resisted by the entire native-born population because, being relatively low earners, migrants are net beneficiaries of the fiscal system. However, the paper shows that with a pay-as-you-go pension, an important pillar of the welfare state, the dynamics are such that migration is beneficial to low and high income groups and the old and the young, provided that the economy has a good access to the world capital markets. This overall gain holds even though the migrants are net consumers of the pension system; they give to it less than they take from it. The pro-migration feature of the dynamic model is however weakened and possibly overturned when access to the world capital market is limited. In the case of low elasticity of substitution between capital and labor, earnings of native-born may be significantly affected, and the factor price effects can dwarf the effects of the migrants' giving to or taking from the welfare state on the native-born population.

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1 Introduction

The flow of unskilled, low-earning migrants to developed states with a comprehensive welfare system, including old-age security, has attracted both public and academic attention in recent years. Being relatively low earners, migrants are typically net beneficiaries of the welfare state.[1] Therefore, there may arise an almost unanimous opposition to migration at the potential host countries. This host-country resistance phenomenon was modeled by Wildasin (1994), Razin and Sadka (1995), and others.

An important pillar of the welfare state that has become more and more the focus of attention in recent years is the pension system. It is commonly agreed that this system is heavily burdened in most countries and is in need for reform.[2] Migration may have important implications for the financial soundness of the pension system. As the **Economist** succinctly put it: "Demography and economics together suggest that Europe might do better to open its doors wider. Europeans now live longer and have fewer babies than they used to. The burden of a growing host of elderly people is shifting on to a dwindling number of young shoulders" (February 15, 1992). While it is common sense to expect that young migrants, even if low-skilled, can help society pay the benefits to the current elderly, it may nevertheless be still reasonable to argue that these migrants would adversely affect the current young, since the migrants are after all net consumers of the welfare state.

Indeed, the aforementioned theoretical studies by Wildasin (1994) and by Razin and Sadka (1995) show how all income groups in a **static environment** may lose from migration and may therefore opt to restrict it. But here comes into play the ingenuity of Paul Samuelson's concept of the economy as an everlasting machinery even though each one of its human components are finitely lived (Samuelson (1958)). In this paper we employ

[1] See, for instance, Lalonde and Topel (1997); Borjas (1994); Borjas and Trejos (1991).
[2] For a survey of various reform proposals see Heller (1998).

this concept in a dynamic model and show that even though the migrants may be low-skilled and net beneficiaries of a pension system, nevertheless all the existing income (low and high) and age (young and old) groups living at the time of the migrants' arrival would be better off. Therefore, the political economy equilibrium will be overwhelmingly pro-migration. Furthermore, this migration need not put any burden on future generations.

This unequivocally positive effect of migration on our welfare state is obtained in a fixed factor price environment which is typical for a small open economy due to either capital mobility or factor-price-equalizing trade in goods. However, when migration affects factor prices[3], particularly depressing wages of unskilled labor, it may create some anti-migration elements that may counterbalance the initial positive effect on the pension system. Indeed, with a sufficiently small substitution between capital and labor the factor price effect may well inflict losses on some income groups and generations.

The organization of the paper is as follows. Section 2 develops the analytical framework and examines the effect of migration on a pay-as-you-go pension system in a fixed factor price environment. Section 3 reexamines this effect with variable factor prices. Section 4 concludes.

2 Pension and Migration: Fixed Factor Prices

Consider an overlapping-generations model, where each generation lives for two periods. In each period a new generation with a continuum of individuals is born. Each individual possesses a time endowment of one unit in the first period (when young), but no labor endowment in the second period (when old). There is a pay-as-you-go, defined-benefit

[3]This factor price effect of migration arises either when there is an inadequate inflow of capital in conjunction with the influx of labor or when the economy is large enough so as not to be a price taker in the global economy.

(PAYG-DB) pension system.

2.1 Innate Ability and Schooling

There are two levels of work skill, denoted by "low" and "high". A low-skill individual is also referred to as unskilled and a high-skill individual as skilled. Born unskilled, she can nevertheless acquire skills and become a skilled worker by investing e units of time in schooling. The remainder of her time is spent at work as a skilled worker.

The individual-specific parameter e reflects the innate ability of the individual in acquiring a work skill. The lower is e, that is, the less time she needs for acquiring a work skill, the more able is the individual. The parameter e ranges between 0 and 1 and its cumulative distribution function (c.d.f.) is denoted by $G(\cdot)$, that is $G(e)$ is the number of individuals with an innate ability parameter below of or equal to e. For the sake of simplicity, we normalize the number of individuals born in period zero when we begin our analysis of the economy, to be one, that is:

$$G(1) = 1. \tag{1}$$

For the sake of simplicity again, we model the difference between skilled and unskilled workers by assuming that a skilled worker provides an effective labor supply of one unit per each unit of her working time; while an unskilled worker provides only $q < 1$ units of effective labor per each unit of her working time.

In the first period of her life, the individual decides whether to acquire skill, works, brings $1 + n$ children, consumes a single all-purpose good, and saves for retirement which takes place in the second period. In the latter period she only consumes her retirement savings and her pension benefit.

Consider the schooling decision of the individual. If she acquires a skill by investing e units of her time, she will earn an after-tax income of $(1-e)w(1-\tau)$, where w is the wage rate per unit of effective labor and $\tau > 0$ is a flat social security contribution (tax) rate. If she does not acquire a skill, that is, spends all of her time endowment at work, she earns an after-tax income of $qw(1-\tau)$. Thus, there will be a cutoff level of e, denoted by e^* and given by,

$$(1-e^*)w(1-\tau) = qw(1-\tau), \tag{2'}$$

so that every individual with an innate ability parameter below e^* will acquire skill and become a skilled worker, while all individuals with innate ability parameters above e^* will not acquire education and remain unskilled. Rewriting (2′), we explicitly define e^* by,

$$e^* = 1 - q. \tag{2}$$

2.2 Consumption and Saving

Denoting first-period and second-period consumption by c_1 and c_2, respectively, an individual born at period zero and onward faces the following intertemporal budget constraint:

$$c_1 + \frac{c_2}{1+r} = W(e)(1-\tau) + \frac{b_1}{1+r}, \tag{3}$$

where r is the interest rate,[4] $W(e)$ is the before-tax wage income for an individual with an innate ability parameter of e, and b_1 is the social security demogrant benefit paid to retirees at period one.[5] Note that:

$$W(e) = \begin{cases} w(1-e) & \text{for} \quad e \leq e^* \\ qw & \text{for} \quad e \geq e^* \end{cases} . \tag{4}$$

We assume that preferences over first-period and second-period consumption are identical for all individuals and given by a Cobb-Douglas, log-linear utility function:

$$u(c_1, c_2) = \log c_1 + \delta \log c_2, \tag{5}$$

where $\delta < 1$ is the subjective intertemporal discount factor. These preferences give rise to the following saving and second-period consumption functions for a young individual of type e:

$$S(e) = \frac{\delta}{1+\delta} W(e)(1-\tau) - \frac{b_1}{(1+\delta)(1+r)} \tag{6}$$

and

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[4] One could have also introduced an income tax, in addition to the social security tax, whereby interest income would be taxed too without affecting the results.

[5] Strictly speaking, a DB program links benefits to wages before retirement. However, the link is very loose and there is a clear redistributive element in most publicly funded DB plans. In order to highlight the distributive nature of the DB program, we simply assume that the benefit is in a form of a demogrant.

$$c_2(e) = \frac{\delta}{1+\delta}\left[W(e)(1-\tau) + \frac{b_1}{1+r}\right](1+r). \tag{7}$$

2.3 The Current Old

At period zero there are also $1/(1+n)$ old (retired) individuals who were born at period -1. The consumption of each one of them is equal to her savings from the first period, plus the social security benefit, denoted by b_o. In each period the aggregate savings of the old (retired) generation constitutes the aggregate stock of capital. Denote the aggregate stock of capital at period zero by K_o.

2.4 Migrants

At period zero, m migrants are allowed in. It is assumed that these migrants are all young and unskilled workers and they possess no capital. Once they enter the country, they adopt the domestic norms of the native-born population. Specifically they grow up at the same rate (n), they have the same preferences (as given by (5)), and the ability index of their offspring is distributed similarly (according to the c.d.f. G).

2.5 Labor Supply

The aggregate supply of effective labor in period zero is given by:

$$L_o = \int_o^{e^*}(1-e)dG + q\left[1 - G\left(e^*\right)\right] + qm. \tag{8}$$

The first term on the right-hand side of (8) is the effective labor supply of the native-born skilled workers. The second term is the effective labor supply of the native-born unskilled workers (note that there are $1 - G(e^*)$ of them), and the last term is the effective labor supply of the unskilled migrants.

The aggregate supply of effective labor in period one is giben by:

$$L_1 = (1+m)(1+n)\left\{\int_o^{e^*}(1-e)dG + q\left[1 - G(e^*)\right]\right\}. \tag{9}$$

(Note that due to migration and natural growth there are altogether $(1+m)(1+n)$ young individuals born in period one.)

2.6 The Stock of Capital

The aggregate stock of capital in period zero was denoted by K_o. The aggregate stock of capital in period one consists of the savings of both the native-born young generation of period zero and the migrants. Thus, it is equal to:

$$\begin{aligned} K_1 \;=\; & \int_o^{e^*}\left[\frac{\delta}{1+\delta}w(1-e)(1-\tau) - \frac{b_1}{(1+\delta)(1+r)}\right]dG \\ & + \left[\frac{\delta}{1+\delta}qw(1-\tau) - \frac{b_1}{(1+\delta)(1+r)}\right]\left[1 - G(e^*) + m\right], \end{aligned} \tag{10'}$$

where use is made of the saving and earned income equations (6) and (4). (Note again that due to migrations there are $1 - G^*(e) + m$ unskilled individuals in period zero.) Upon some rewriting (10′) becomes:

$$K_1 = \frac{\delta}{1+\delta} w(1-\tau) \left\{ \int_o^{e^*} (1-e)\, dG + q\,[1 - G(e^*) + m] \right\} - \frac{b_1(1+m)}{(1+\delta)(1+r)}. \qquad (10)$$

2.7 Output

In a small economy with a free access to the world capital markets the domestic return to capital will converge to the world rate of interest. Thus, migration has no effect on the domestic rate of interest. When furthermore the technology exhibits constant returns to scale, migration will have no effect on wages as well. Thus, gross national output (denoted by $F(K, L)$) is given by:

$$F(K, L) = wL + (1+r)K. \qquad (11)$$

We assume, with no loss of generality, that capital fully depreciates at the end of the production process. In this setup, w is the (fixed) marginal product of labor and r is the (fixed) net-of-depreciation marginal product of capital.

2.8 The Pension System

As was already mentioned, we consider a pay-as-you-go, defined benefit (PAYG-DB) pension system. The pensions to retirees are paid entirely from current contributions made by workers and the benefit takes the form of a demogrant. In period zero, total contributions amount to:

$$T_o = \tau w \left\{ \int_o^{e^*} (1-e)dG + q\left[1 - G(e^*) + m\right] \right\}. \tag{12}$$

Thus, the demogrant benefit b_o is equal to:

$$b_o = (1+n)\tau w \left\{ \int_o^{e^*} (1-e)dG + q\left[1 - G(e^*) + m\right] \right\}, \tag{13}$$

because there are $1/(1+n)$ retirees at period zero. Total contributions in period one are equal to

$$T_1 = \tau w \left\{ \int_o^{e^*} (1-e)dG + q\left[1 - G(e^*)\right] \right\} (1+m)(1+n), \tag{14}$$

so that the demogrant benefit in period one is equal to:

$$b_1 = \tau w \left\{ \int_o^{e^*} (1-e)dG + q\left[1 - G(e^*)\right] \right\} (1+n), \tag{15}$$

because there are $1+m$ retirees in period one.

2.9 Dynamics

The dynamics of this economy is quite simple. Due to the linearity of the technology, the economy converges to a steady state within two periods. The pension benefit in period two is going to be equal to b_1, the pension benefit in period one, because the characteristics of the offspring of the migrants and of the offspring of the native-born population of period zero are stationary. Thus, the pension benefits will equal b_1 from period one onward. The stock of capital will stabilize from period two onward because in period one it is still affected by the contribution to savings of the migrants who arrived in period zero.

In this stylzed model, the impact of migration on the economy is manifested through the pension benefit only. This is because factor prices are constant and schooling decisions are unaffected by migration.

2.10 The Benefits from Migration

Upon inspection of equation (13), one can observe that b_o, the pension benefit to retirees at period zero in which the migrants arrive, increases in the number of migrants. Thus, as expected, the old generation at period zero is clearly better-off with migration. Upon inspection of equation (15), one can observe that b_1, the pension benefit paid to retirees in period one and onward, is unaffected by migration. In particular and somewhat surprisingly, the young generation at the time in which the migrants arrive (both its skilled and unskilled members), is not adversely affected by migration. Thus, the existing population (both young and old) in period zero will welcome migration.

Furthermore, by creating some surplus in the pension system in period zero (that is, by lowering b_o somewhat), the gain that accrues only to the old in our setup could be spread over to future generations as well. Thus, migration is a Pareto-improving change with respect to the existing and future generations of the native born.

We should emphasize that this result obtains even though the unskilled migrants may well be **net beneficiaries** of the redistributive pension system, in the sense that the present value of their pension benefits exceeds their pension contributions. To see this, let us calculate the net benefit to an immigrant. The present value of her benefit is $b_1/(1+r)$.

The contribution is $\tau q w$. Substituting for b_1 from equation (15) we can rewrite the net benefit (denoted by NB) as:

$$NB = \frac{1+n}{1+r}\tau w \left\{ \int_o^{e^*} (1-e)dG + q\left[1 - G(e^*)\right] \right\} - \tau q w. \tag{16}$$

Employing (2) one can show (see the appendix) that $NB > 0$, if:

$$\frac{G(e^*)(e^* - e^-)}{1 - e^*} > \frac{r-n}{1+n}, \tag{17}$$

where e^- is the mean ability parameter of the skilled workers. Note that $e^* > e^-$, because e^* is the upper bound of the ability parameter of skilled individuals, while e^- is its mean. Thus, the left-hand-side of (17) must be positive. Hence, if $r < n$, then (17) is certainly satisfied and the migrants are net beneficiaries of the pension system. However, it is typically assumed that $r > n$ (dynamic efficiency considerations).[6] Nevertheless, if a large share of the population is skilled, then condition (17) will be satisfied. To see this, observe that when the share of the skilled population (e^*) approaches one, then the left-hand-side of (17) increases without bound. Hence, the left-hand-side of (17) will exceed its right-hand-side. In this case, migrants are net beneficiaries of the pension system.

As expected, when unskilled migrants come to a country whose pension system redistributes income from the (skilled) rich to the (unskilled) poor, they net benefit from this system. But what we have established is that even though migrants are net consumers of the pension system, all existing and future generations may gain from migration.

[6] See also the discussion in Hemming (1998) about the role of r and n in the transition from a pay-as-you-go, defined-benefit pension system to a fully funded, defined-contribution system.

2.11 Interpretation

An important lesson from this work is that in a static setup, one cannot fully grasp the implications of migration for the welfare state. Earlier studies by Wildasin (1994) and Razin and Sadka (1995), among others, emphasize the burden that low-skill migration imposes on the native-born population. However, in a dynamic context, this net burden could change to a net gain because the burden imposed by the migrants, who typically are net beneficiaries of the welfare system may be shifted forward indefinitely. If hypothetically, the world would come to a full stop at a certain point in time, the young generation at that point would bear the cost of the present migration.

To illustrate this point we construct in the next subsection a finite-time (two-period) modified version of our model.

2.12 A Two-Period Example

Suppose the young generation of period zero and the migrants that arrive then bear no children and the world ceases after period one. Suppose further that the social security contribution (tax) rate remains τ in period zero. Hence, b_o does not change (see equation (13)) and, as before, the old living in period zero benefit from migration.

In period one, the last period, there will be no young people, no labor supply and no social security benefits. National output is $(1+r)K$. The young born in period zero and the migrants live off their period-zero savings (namely, $(1+r)K$). Obviously, the young of period zero are not affected by migration. The migrants paid their social security taxes in period zero, receiving no benefits in return in period one. That is, the migrants are net contributors to the pension system (which ceased after period zero); they helped finance the increased benefit to the old of period zero with no compensation to themselves. In sum, the effect of migration is as follows: The old of period zero benefited; the native-born young generation was not affected, and the migrants financed in full the gain to the old. In essence, it is a zero-sum game. If, in this zero-sum environment, the migrants are compensated in period one in some way or another for their social security contributions in period zero, it must be at the expense of the native-born old of period one (the native-born young of period zero).

3 Pension and Migration: Variable Factor Prices

We have shown in the preceding section that in an everlasting economy, the migrants have a positive contribution to the existing old and possibly all other generations as well. In this simplified account of migration, the larger the number of migrants the better-off everyone is. This can be seen from equation (13) where the larger the m, the larger is b_o. Thus, the native-born population would opt for having as many migrants as possible. However, when factor prices are variable, migration will generate a downward pressure on wages. This may overturn the welfare calculus of the preceding section.

3.1 The Dynamics of the Model

Formally, national output is now given by a constant-returns-to-scale production function:

$$F(K_t, L_t) = L_t F(K_t/L_t, 1) \equiv L_t f(k_t), \tag{11a}$$

where $k_t = K_t/L_t$ is the capital-labor ratio.

This production function gives rise to the following factor price equations:

$$1 + r_t = f'(k_t), \tag{18}$$

and

$$w_t = f(k_t) - (1 + r_t)k_t. \tag{19}$$

At period zero, the capital-labor ratio is given by:

$$k_o = K_o/L_o, \tag{20}$$

where L_o is given by (8). At period one, the stock of capital (K_1) consists of period-zero savings (of the native-born young and the migrants). This K_1 is given by equation (10) with w_o replacing w. Thus, the capital-labor ratio is hence:

$$k_1 = L_1^{-1}\frac{\delta}{1+\delta}w_o(1-\tau)\left\{\int_o^{e^*}(1-e)dG + q\left[1 - G(e^*) + m\right]\right\} - L_1^{-1}\frac{b_1(1+m)}{(1+\delta)(1+n)}. \tag{21}$$

The supply of labor is given by:

$$L_t = (1+m)(1+n)^t\left\{\int_o^{e^*}(1-e)dG + \left[1 - G(e^*)\right]q\right\}, \quad t \geqq 1. \tag{22}$$

Henceforth, the capital-labor ratio is given by:

$$k_t = \frac{1}{(1+n)(1+\delta)} \left[\delta(1-\tau)w_{t-1} - \frac{\tau w_t(1+n)}{1+r_t} \right], \quad t \geqq 2. \tag{23}$$

Note that the dynamics of k_t from $t = 2$ and on is different from the earlier periods ($t = 0, 1$) because the composition of the skilled-unskilled population, which affects the savings of each period, does not depend on m for $t \geqq 2$ as the offspring of the migrants are fully integrated in society.

The social security benefit in period zero, b_o, is given by (13) with w_o replacing w, that is:

$$b_o = (1+n)\tau w_o \left\{ \int_o^{e^*} (1-e)dG + q[1 - G(e^*) + m] \right\}. \tag{13a}$$

Similarly, b_t for $t \geqq 1$ is given by the right-hand-side of (15) with w_t replacing w, that is:

$$b_t = \tau w_t \left\{ \int_o^{e^*} (1-e)dG + q\,[1 - G(e^*)]\, q \right\} (1+n), \; t \geqq 1. \tag{15a}$$

Finally, the net benefit from the redistributive pension system is given by:

$$NB = \frac{b_1}{1+r_1} - \tau q w_o. \tag{24}$$

3.2 Simulation Results

We resort to numerical simulations in order to illustrate the gains and losses from migration. The results are shown in Tables 1 and 2.

Suppose first that the economy is in a steady state with no migration, i.e., $m = 0$. This is described in the first row of the two tables as period -1. Then, at period zero, the economy is shocked by an influx of m low-skilled migrants. We describe the path of the economy until it reaches a steady state again in period ∞. Note that this new steady state is identical to the original one, as can be seen from the absence of m from (23), the dynamic equation of the model; compare the first and last rows in each table. The path of the capital-labor ratio (k), the social security benefit (b), and the welfare loss to members of each generation are presented for $m = 0.1$ and $m = 0.2$. This loss is measured as the percentage increases in life-time consumption that will restore utility to its pre-migration level.

The calculations were carried out for a Constant Elasticity of Substitution (CES) production function. Table 1 presents the results for the Cobb-Douglas case (i.e., for $\sigma = 1$, where σ is the elasticity of substitution). The labor share is assumed to be 2/3. The distribution of e is uniform over the intereval $[0, 1]$. Productivity of unskilled labor is one-half that of skilled labor, i.e., $q = 0.5$. The subjective discount rate is 5% annually; each period lasts 25 years. The social security contribution rate is 30%. The annual population growth rate (n) is 2%.

Table 1: The Effects of Migration with $\sigma = 1$.

Period	*Capital Labor Ratio*		*Social Security Benefit*		*Welfare Losses of Highest Skilled* (%)		*Welfare Losses of Unskilled* (%)	
	m=0.1	m=0.2	m=0.1	m=0.2	m=0.1	m=0.2	m=0.1	m=0.2
-1(m=0)	0.0096		0.0444		0		0	
0	0.0088	0.0082	0.0468	0.0491	1.99	3.89	2.09	4.06
1	0.0091	0.0088	0.0438	0.0432	1.23	2.34	1.23	2.34
2	0.0094	0.0093	0.0442	0.0440	0.40	0.77	0.40	0.77
3	0.0095	0.0095	0.0443	0.0443	0.13	0.25	0.13	0.25
4	0.0095	0.0095	0.0444	0.0444	0.04	0.08	0.04	0.08
5	0.0095	0.0095	0.0444	0.0444	0.01	0.03	0.01	0.03
6	0.0096	0.0095	0.0444	0.0444	0	0.01	0	0.01
:	:	:	:	:	:	:	:	:
∞	0.0096	0.0096	0..0444	0.0444	0	0	0	0

$$NB = \begin{cases} -0.0162 & \text{for} \quad m = 0.1 \\ -0.0159 & \text{for} \quad m = 0.2 \end{cases}$$

As migrants come in, the capital labor ratio (k_o) falls naturally. Also, the pension benefit to the old (b_o) rises. The old of period zero gains on two grounds: First, b_o rises; and second, the rate of return to her capital ($1+r_o$) rises, because k_o falls. Thus, the old in period zero always gains from migration. Thereafter the capital-labor ratio rises monotonically back to its steady-state level. The pension benefit at period one falls below the steady-state level but then rises monotonically to its steady-state level.

In contrast to the fixed factor price case (i.e., $\sigma = \infty$), with variable factor prices and $\sigma = 1$, **all** income groups in every generation (except, of course, the retirees at period zero) lose from migration, as can be seen from the last four columns of Table 1. Furthermore, their loss is an increasing function of m. Notice that the migrants are net contributors to the pension system, as $NB < 0$. Thus, their contribution could not even enhance the welfare of the old at the time of the migrants' arrival without hurting any other generation.

For a higher value of σ than in the Cobb-Douglas case, some income groups in some generations may still gain. Table 2 presents simulation results for $\sigma = 3.33$. Here again the retirees at period zero naturally gain from migration. But in this case the highest skilled people in the generation born at period zero (i.e., when the migrants arrive) also gain. This group, which owns a larger share of the capital stock, is less affected than others by the downward pressure on wages exerted by migration. Unskilled people in all generations lose. Here again, the migrants are net contributors to the pension system as $NB < 0$. But their net contribution does not suffice to support the gain to the retirees at period zero and to the skilled people born at that time, so that all other people in all other generations are worse off.

Table 2: **The Effects of Migration with** $\sigma = 3.3$.

Period	*Capital Labor Ratio*		*Social Security Benefit*		*Welfare Losses of Highest Skilled* (%)		*Welfare Losses of Unskilled* (%)	
	m=0.1	m=0.2	m=0.1	m=0.2	m=0.1	m=0.2	m=0.1	m=0.2
-1(m=0)	0.0032		0.1595		0		0	
0	0.0030	0.0028	0.1721	0.1848	-0.09	-0.18	0.09	0.16
1	0.0031	0.0030	0.1594	0.1594	20.50	37.53	20.25	37.08
2	0.0032	0.0032	0.1595	0.1595	0.29	0.53	0.29	0.52
3	0.0032	0.0032	0.1595	0.1595	0	0.01	0	0.01
4	0.0032	0.0032	0.1595	0.1595	0	0	0	0
5	0.0032	0.0032	0.1595	0.1595	0	0	0	0
6	0.0032	0.0032	0.1595	0.1595	0	0	0	0
:	:	:	:	:	:	:	:	:
∞	0.0032	0.0032	0.1595	0.1595	0	0	0	0

$$NB = \begin{cases} -0.0173 & \text{for} \quad m = 0.1 \\ -0.0173 & \text{for} \quad m = 0.2 \end{cases}$$

4 Conclusion

Migration has important implications for the financial soundness of the pension system which is an important pillar of any welfare state. While it is common sense to expect that young migrants, even if low-skilled, can help society pay the benefits to the current elderly, it may nevertheless be reasonable to argue that these migrants would adversely affect the current young, since the migrants are after all net beneficiaries of the welfare state.

In contrast to the adverse effects of migration in the static model, we employed Samuelson's concept of the economy as an everlasting machinery, even though its human components are only finitely lived, and show that migration is a Pareto-improving measure. That is, all the existing income (low and high) and age (young and old) groups living at the time of the migrants' arrival would be better-off. This result obtains when the economy has good access to international capital markets, so that migration exerts no major effect on factor prices. The effect of migration in this case is manifested entirely through the PAYG-DB pension system.

Therefore, in a dynamic model, the political economy equilibrium will overwhelmingly support migration. Evidently, this pro-migration feature can be weakened and possibly overturned when capital inflows are not sufficient to peg factor prices. In this case even if migrants are net contributors to the pension system, their contribution does not suffice to support the increased benefit to the old at the time of the migrants' arrival; other people are worse off.

APPENDIX

In this appendix we prove that $NB > 0$, when condition (17) holds. Substituting (2) into (16), we can see that:

$$NB = \frac{1+n}{1+r}\tau w \left\{ \int_o^{e^*} dG - \int_o^{e^*} edG + (1-e^*)[1-G(e^*)] \right\} - \tau w(1-e^*). \tag{A1}$$

Since

$$e^- = [G(e^*)]^{-1} \int_o^{e^*} edG$$

and

$$\int_o^{e^*} dG = G(e^*),$$

it follows that $NB > 0$, if:

$$\frac{1+n}{1+r}\left\{G(e^*) - G(e^*)e^- + 1 - e^* - G(e^*) + e^*G(e^*)\right\} > 1 - e^*, \tag{A2}$$

Hence,

$NB > 0$, if:

$$\frac{1+n}{1+r}\left[(e^{*}-e^{-})G(e^{*})+(1-e^{*})\right]>1-e^{*}. \tag{A3}$$

Thus, $NB > 0$, if:

$$(e^{*}-e^{-})G(e^{*})>(1-e^{*})(\frac{1+r}{1+n}-1), \tag{A4}$$

which yields condition (17).

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