NBER WORKING PAPER SERIES

MIGRATION AND PENSION

Assaf Razin
Efraim Sadka

Working Paper 6778
http://www.nber.org/papers/w6778

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
November 1998

Migration and Pension
Assaf Razin and Efraim Sadka
NBER Working Paper No. 6778
November 1998
JEL No. F22, H2, J1

ABSTRACT

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

In contrast to the adverse effects of low skilled migration in a static model, we show that in a Samuelsonian overlapping generations model that migration is a Pareto-improving measure. All the existing income (low and high) and age (young and old) groups living at the time of the migrant's arrival would be better off.

Assaf Razin
Eitan Berglas School of Economics
Tel Aviv University
Tel Aviv 69978
ISRAEL
and NBER
raxin@econ.tau.ac.il

Efraim Sadka
Eitan Berglas School of Economics
Tel Aviv University
Tel Aviv 69978
ISRAEL

I. 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.[4] 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) and by Razin and Sadka (1995) and others.

An important pillar of the welfare state that has become more and more at 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 a need for reform.[5] 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

---

[4]See, for instance, Lalonde and Topel (1997); Borjas and Trejos (1994); Borjas and Trejos (1991).

[5]For a survey of various reform proposals, see Heller (1998).

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 at 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 this concept in a dynamic model and show that even though the migrants maybe 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 needs not put any burden on future generations.

The organization of the paper is as follows: Section II develops the analytical framework. Section III describes the pension system. Section IV describes the evolution of the economy. Section V describes the main results, and Section VI concludes.

II. THE ANALYTICAL FRAMEWORK

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 possess 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 (PAYG-DB) pension system.

A. 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 becomes 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(.), 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:

$$G(1) = 1 \qquad \textbf{(1)}$$

For the sake of simplicity, 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.

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

$$(1-e^{*})w(1-t) = qw(1-t), \tag{2'}$$

so that every individual with an innate ability parameter below e* will acquire skill and become 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 :

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

B. Consumption and Saving

Devoting 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:

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

where r is the interest rate,[6] 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.[7] Note that

$$W(e) = \begin{cases} w(1-e) & for \quad e \le e^* \\ qw & for \quad e \ge e^* \end{cases} \tag{4}$$

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:

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

[6]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.

[7]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.

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

C. 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.

D. 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).

E. Labor Supply

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

$$L_o = \int_0^{e^*}(1-e)dG + q[1-G(e^*)] + qm. \tag{8}$$

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 given by

$$L_1 = (1 + m)(1 + n)\int_0^{e^*}(1 - e)dG + (1 + n)(1 + m)q[1 - G(e^*)] \tag{9}$$

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

F. The Stock of Capital

The aggregate stock of capital in period zero was denoted by K_0. 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

$$K_1 = \int_0^{e^*} [\frac{\delta}{1+\delta} w(1-e)(1-t) - \frac{b_1}{(1+\delta)(1+r)}]dG + [\frac{\delta}{1+\delta} qw(1-t) - \frac{b_1}{(1+\delta)(1+r)}][1 - G(e^*) + m], \tag{10'}$$

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

$$K_1 = \frac{\delta}{1+\delta} w(1-t)\{\int_0^{e^*} (1-e)dG + q[1 - G(e^*) + m]\} - \frac{b_1(1+m)}{(1+\delta)(1+n)}. \tag{10}$$

G. Output

In this paper, we wish to focus our analysis primarily on the attitude of the native-born population toward unskilled migration in an economy with a PAYG-DB, distributive pension system. For this reason we abstract from the effect that migration can have on relative wages and concentrate on the effect it has on the finances and the benefits of such a pension system.[8] Therefore, we model the production function in a way that freezes the returns to the factors of production as in the following linear production function:

$$F(K, L) = wL + (1+r)K, \tag{11}$$

---

[8]In other works (e.g., Razin and Sadka (1995)), we examine the effect of migration on factor prices and its implications for the attitude of the native-born population toward migration.

assuming, 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.

III. 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

$$T_0 = tw\{\int_0^{e^*}(1 - e)dG + q[1 - G(e^*) + m]\}. \tag{12}$$

Thus, the demogrant benefit b_0 is equal to

$$b_0 = (1 + n)tw\left\{\int_0^{e^*}(1 - e)dG + q[1 - G(e^*) + m]\right\}, \tag{13}$$

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

$$T_1 = tw\left\{\int_0^{e*}(1 - e)dG + q[1 - G(e^*)]\right\}(1 + m)(1 + n), \tag{14}$$

so that the demogrant benefit in period one is equal to

$$b_1 = tw\left\{\int_0^{e^*}(1 - e)dG + q[1 - G(e^*)]\right\}(1 + n), \qquad \textbf{(15)}$$

because there are 1 + m retirees in period one.

IV. 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 stylized 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.

V. THE BENEFITS FROM MIGRATION

Upon inspection of equation (13), one can observe that b_0, 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 (14), one can observe that 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_0 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 tqw. Substituting for b_1 from equation (15) we can rewrite the net benefit (denoted by NB) as

$$NB = \frac{1+n}{1+r} tw \left\{ \int_0^{e^*} (1-e) dG + q[1-G(e^*)] \right\} - tqw. \tag{16}$$

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 which assure that the wealth is unbounded.[9] 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.

---

[9]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.

VI. CONCLUSION

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 stop at a certain point in time, the young generation at that point would bear the cost of the present migration. In an ever-lasting 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. Thus, the native-born population would opt for having as many migrants as possible. However, if we allow such migration to generate a downward trend of wages, especially for unskilled workers, the distortionary effect of an intratemporal distribution policy in favor of unskilled workers aimed at offsetting this trend will increase with the number of migrants. This is exactly where the aforementioned studies by Wildasin and by Razin and Sadka can be brought in to explain limits on migration.

APPENDIX

In this appendix, we prove that NB > 0, when condition (17) holds.

Substituting (2) into (16), we can see that

$$NB = \frac{1 + n}{1 + r} tw \left\{ \int_0^{e^*} dG - \int_0^{e^*} edG + (1 - e^*)[1 - G(e^*)] \right\} - tw(1 - e^*). \qquad \textbf{(A1)}$$

Since

$$\int_0^{e^*} edG = G(e^*)e^{-}$$

and

$$\int_0^{e^*} dG = G(e^*),$$

it follows that NB > 0, if

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

Hence,

NB > 0, if

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

Thus, NB > 0, if

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

which yields condition (17).

REFERENCES

Borjas, George, 1994, "Immigration and Welfare, 1970-1990," NBER Working Paper No. 4872 (Cambridge, Massachusetts: National Bureau of Economic Research).

———, and S. Trejos, 1991 "Immigrant Participation in the Welfare System," *Industrial and Labor Relations Review*, Vol. 44, pp. 195-211.

Heller, Peter S., 1998, "Rethinking Public Pension Reform Initiatives," IMF Working Paper 98/61 (Washington: International Monetary Fund).

Hemming, Richard, 1998, "Should Public Pensions Be Funded?," IMF Working Paper 98/35 (Washington: International Monetary Fund).

Lalonde, Robert J., and Robert H. Topel, 1997, "Economic Impact of International Migration and the Economic Performance of Migrants," in *Handbook of Population and Family Economics*, ed. by Mark R. Rosenzweig, and Oded Stark, Vol. 1B (Elsevier).

Razin, Assaf, and Efraim Sadka, 1995, "Resisting Migration: Wage Rigidity and Income Distribution," *American Economic Review, Papers and Proceedings*, Vol. 85, No. 2 (May).

Samuelson, Paul A., 1958, "An Exact Consumption Loan Model With or Without the Social Contrivance of Money," *Journal of Political Economy*, Vol. 66 pp. 467-82.

Wildasin, David E., 1994, "Income Redistribution and Migration," *Canadian Journal of Economics*, Vol. 27, No. 3 (August), pp. 637-56.