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## Migration Challenge for PAYG

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## Migration Challenge for PAYG

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### Abstract

Immigration has been popularised in the economics literature as a tool to balance the troubled PAYG pension systems. A pivotal research by Razin and Sadka showed that unskilled immigration can surmount the pension problem and, further, boost the general welfare in the host economy. However a large strand of current economics literature is engaged in identifying mechanisms through which unskilled immigration, while solving the pension problem, causes undesired shifts in general welfare. This work shows that actually recurring unskilled immigration may challenge the entire pension system and decrease the pension benefits themselves.

**JEL :** J18, F22, H55, E61

**Keywords:** Public Pensions, PAYG, Unskilled Migration

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# Migration Challenge for PAYG

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## Abstract

Immigration has been popularised in the economics literature as a tool to balance the troubled PAYG pension systems. A pivotal research by Razin and Sadka showed that unskilled immigration can surmount the pension problem and, further, boost the general welfare in the host economy. However a large strand of current economics literature is engaged in identifying mechanisms through which unskilled immigration, while solving the pension problem, causes undesired shifts in general welfare. This work shows that actually recurring unskilled immigration may challenge the entire pension system and decrease the pension benefits themselves.

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## 1 Introduction

Decreased fertility, in tandem with increased longevity, challenges the sustainability of the unfunded pay-as-you-go (PAYG) pension systems in most developed economies: Decreased fertility shrinks the contribution base while the increased longevity burdens the system with more pension claims. Thus, sustainability of the system requires urgent reforms: parametric, demographic, or a combination of the two. Parametric reforms include increased pension contributions (tax rates, or late retirement), decreased benefits, or a combination of the two. Alas, those reforms

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are welfare impairing: increased contributions harm the working-age population, while the old-age suffer from decreased benefits.

Demographic reforms are the theoretical alternative to (the above-described) parametric reforms. The most popular, and perhaps the only practicable, demographic reform is an increase in the immigrant population. A strand of economics literature is employed in studying the welfare effects of immigration reforms. The current paper, however, is to show that immigration reform is oftentimes ‘equivalent’ to parametric reforms in sense that it decreases the pension benefits (and thus is not a meaningful alternative): The focus will be on unskilled immigration to an economy with unfunded defined-contribution Beveridge-type (redistributive) PAYG pension system installed (such as the United Kingdom). Moreover, the current paper does not employ the idea that the unskilled immigrants ‘drain’ the redistributive pension system.

Already Razin and Sadka (1999) showed that the unskilled immigration can surmount the PAYG challenge: The unskilled immigrants don’t merely pay the required contribution but, potentially, increase the welfare to everyone. Thus, the immigrants come in and pay the missing part of contributions that the system needs for sustainability. When they age, they increase the claims on benefits; however, their children support the pension system then (while bringing the old equilibrium back).

Since Razin and Sadka (1999) much has been written to show that there are numerous ways the general welfare is impaired by the increased unskilled immigration (hence showing that demographic reforms are not preferred to parametric reforms). Thus, Razin and Sadka (2000) claim that the pension benefits are increased with increased unskilled immigration but, in case of closed economy, the wages will decline and thus hurt those who mostly rely on labour for income.

Casarico and Devillanova (2003) noted that the wage decline caused by influx of unskilled immigrants will change the skill distribution among the natives in the host economy. They showed the changes that come with the possibility of endogenous skill upgrade cause many inter- and intra-generational welfare re-distribution conflicts. Jinno (2011) develops the idea further incorporating a possibility of endogenous skill upgrade for the immigrants as well while noting that there are some assimilation costs. The results suggest further re-distributional conflicts. Krieger (2004) claimed that, in case high fertility of the immigrants and low skill level of the immigrant children are accounted for, welfare impairment and re-distribution occurs.

Kemnitz (2003, 2008) introduces the problem of unemployment into the analysis. He claims that unskilled immigration increases unemployment and harms the native unskilled even though there is a boon to general welfare. Muysken, Cörves and Ziesemer (2011) in a similar manner showed that unskilled immigration increases unemployment and unless there is an upgrade for their skill level they may impair the general welfare.

Meanwhile, there is a strand of literature claiming that only an excessively large inflow of immigrants can help the pension system sustainability: For instance, Übelmesser (2004) claims that the EU cannot accommodate as many migrants as is needed for the pension system sustainability, and claims that parametric reforms are also necessary. Blake and Mayhew (2006) study combination of parametric reforms with immigration, claiming that the need for immigrants into the UK will be constantly growing if the pension system is not reformed. Serrano, Eguía and Ferreiro (2011) claim that even the recent vast immigration is not enough for sustainability of the Spanish pension system and the reforms are inevitable.

The current paper, claiming that under certain conditions unskilled immigration

may result in lower pension benefits (with pension contributions being fixed), shows that increased immigration is not desirable. The paper utilises the idea of multi-period immigration policy, *i.e.* the immigrants enter the economy each period, as opposed to one-time-migrant-inflow framework of Razin and Sadka (2000). While in Razin and Sadka model the old equilibrium is restored after number of periods, the multi-period immigration results in a new equilibrium, distinct from the initial one: That allows studying the reaction of the economy in full, *i.e.* both the new equilibrium and the transition path. An important channel that links the unskilled immigration to pensions is studied. The paper employs the framework of several recent publications by Fanti and Gori (2010, 2012) that follow the dynamics of per-capita capital in a Diamond-type overlapping-generations model. Thus the paper connects unskilled immigration to distortions in the savings, that result in lower capital per capita and thus in generally lower wages. Hence, even though the pension benefits grow compared to wages (as in Razin and Sadka (1999)), the wages may decrease so that the benefits are less than they would be without the immigrants.

The rest of the paper is organised as follows: Section 2 describes the economic environment. Section 3 describes the equilibrium and the pension system analysis under migration. And the concluding remarks are in the final section.

## **2 The Economic Environment**

A two overlapping generations exist in a closed economy environment. During the first period of their life the agents work (for a remuneration), save and consume. For the second period the agents consume their pension benefits and savings. The firm organises the production by hiring labour and capital from the households. The government collects the pension contributions from the young and distributes

among elders. All markets clear.

## 2.1 Population

Each period young migrants are allowed into the country equal to  $\mu$  share of the native young. Thus the total working-age population in the economy is:

$$T_t = N_t (1 + \mu) \quad (1)$$

where  $N_t$  is the size of the native born population with the following dynamics:

$$N_t = N_{t-1} (1 + \mu) n \quad (2)$$

where it is assumed that immigrants and their descedants have the same fertility rate  $(n - 1)$ . However, the immigrants have only  $\varepsilon$  of the skill level of the native population. Thus the efficient labour in the country at any time is:

$$L_t = N_t (1 + \mu \varepsilon) \quad (3)$$

and is different from the total size of the population.

## 2.2 Household

Each household is represented by a single agent that solves a lifetime utility maximisation problem:

$$\max (\ln c_t + \beta \ln c_{t+1}) \quad (4)$$

subject to the budget constraints:

$$c_{i,t} + s_{i,t} = w_t \varepsilon_i (1 - \tau) \quad (5)$$

$$c_{i,t+1} = p_{t+1} + s_{i,t} (1 + r_{t+1}) \quad (6)$$



where  $i$  shows the status in the country (native born or migrant),  $c_{i,t}$  and  $s_{i,t}$  are, respectively, the consumption and savings of type  $i$  agent at time  $t$ ,  $\varepsilon_i$  shows the efficiency of the worker (is unity for native born and  $\varepsilon$  for immigrants),  $\tau$  and  $p_t$  are, respectively, pension contribution and benefit at time  $t$ .

In the optimum of the household problem the savings take the value

$$s_{i,t} = \frac{w_t \varepsilon_i (1 - \tau) \beta}{1 + \beta} - \frac{p_{t+1}^e}{(1 + \beta) (1 + r_{t+1}^e)} \quad (7)$$

where  $p_{t+1}^e$  and  $r_{t+1}^e$  are the expected values of the pension benefits and interest rate respectively.

### 2.3 Firms

There is one firm that uses Cobb-Douglas production function with an  $\alpha$  share of capital. Hence the usual optimality conditions hold:

$$w_t = (1 - \alpha) A k_t^\alpha \quad (8)$$

$$r_t = \alpha A k_t^{\alpha-1} - 1 \quad (9)$$

where  $k_t$  is the capital per effective labour.

### 2.4 Pension system

The pensions run on a periodically balanced budget, *i.e.* the contributions collected are given out as benefits to all current old:

$$p_t T_{t-1} = \tau w_t L_t \quad (10)$$

Using (1) and (3) the pensions benefits can be calculated:

$$p_t = \tau w_t (1 + \mu \varepsilon) n \quad (11)$$

i.e., as in Razin & Sadka (1999) the first order effect of the immigrants on the pensions is strictly positive.

### 3 Equilibrium

Given the parameter values,  $\alpha, \beta, \varepsilon, \mu, \tau$ , and the initial values  $K_o, N_o$  the Equilibrium is an allocation  $\{c_{i,t}, s_{i,t}, p_t\}$  and a price vector  $(w_t, r_t)$ , such that the population follows the dynamics given by (1) and (3), the households optimise their problem (4)-(6), the firm optimises so that (8) and (9) hold, the pension budget (10) is balanced, and the capital market clears, *i.e.*

$$K_{t+1} = N_t s_{n,t} + N_t \mu s_{m,t} \quad (12)$$

Substituting for (2) and (7), (12) can be rewritten as:

$$K_{t+1} = N_t \left( (1 + \mu\varepsilon) \frac{w_t (1 - \tau) \beta}{1 + \beta} - (1 + \mu) \frac{p_{t+1}^e}{(1 + \beta) (1 + r_{t+1}^e)} \right) \quad (13)$$

Using (8), (9), and (11) and assuming that agents have rational expectations, the dynamics of the capital per effective labour can be obtained:

$$k_{t+1} = \frac{\alpha A (1 - \alpha) (1 - \tau) \beta}{n (1 + \mu) (\alpha (1 + \beta) + (1 - \alpha) \tau)} k_t^\alpha \quad (14)$$

that solves for the steady state equilibrium value for the capital per effective labour:

$$k^* = \left[ \frac{\alpha A (1 - \alpha) (1 - \tau) \beta}{n (1 + \mu) (\alpha (1 + \beta) + (1 - \alpha) \tau)} \right]^{\frac{1}{1 - \alpha}} \quad (15)$$

As it can be immediately observed the capital per effective labour decreases with the size of (and is immune to the skill level of) the immigration.

### 3.1 Pension Benefits in the Equilibrium

The equilibrium value of the pension benefits is easily obtained by substituting the equilibrium wage rate into (11):

$$p^*(\mu) = B \cdot \frac{1 + \mu\varepsilon}{(1 + \mu)^{\frac{\alpha}{1-\alpha}}} \quad (16)$$

where

$$B = (1 - \alpha) \tau n^{\frac{1-2\alpha}{1-\alpha}} A \left( \frac{\alpha(1 - \tau)\beta}{\alpha(1 + \beta) + (1 - \alpha)\tau} \right)^{\frac{\alpha}{1-\alpha}} \quad (17)$$

does not change with the size or skill level of immigration. Thus, to understand the effect of immigration on the pension benefits suffices to find the sign of the derivative of (16):

$$\frac{d}{d\mu} p^*(\mu) = \frac{B}{(1 - \alpha)(1 + \mu)^{\frac{1-2\alpha}{1-\alpha}}} (\varepsilon(1 + \mu)(1 - \alpha) - \alpha(1 + \mu\varepsilon)) \quad (18)$$

**Proposition 1** (a) *If the elasticity of (capital-to-labour) substitution  $\alpha > 1/2$  then any immigration decreases the pension benefits, and (b) in case of  $\alpha < 1/2$ , immigration decreases the pension benefits if the skill level of immigrants (compared to natives) is*

$$\varepsilon < \frac{\alpha}{1 - \alpha + \mu(1 - 2\alpha)} \quad (19)$$

**Proof.** The pension benefits decrease if the derivate (18) is negative. The first part (the ratio) of the product on the right-hand side of (18) is a positive constant, and the second part can be re-written as  $\varepsilon(1 - \alpha + \mu(1 - 2\alpha)) - \alpha$  which is always negative if  $\alpha > 1/2$ , and in case  $\alpha < 1/2$  (19) suffices for the derivative to be negative. ■

The first part of the proposition effectively claims that if capital is more important for production compared to labour, then the inflow of immigrants pushes the wages down so much that the savings for the next period do not generate enough

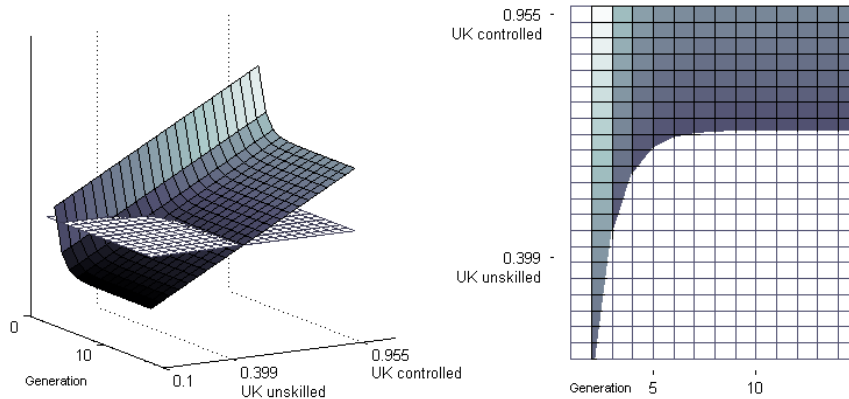


Figure 1: Transition dynamics for pension benefits

contribution base, and thus the pension benefits go down. The logic for the result in the second part is similar, however, the (not-that-strong) substitutability is also supported with the discounted income of the immigrants, that also in sum do not generate enough capital. For example, if  $\alpha = 0.4$  and the immigration is under five per cent  $\mu < 0.05$ , then immigrants with sixty-five per cent of local efficiency already will force the pension benefits to decrease.

### 3.2 Pension Benefits in Transition

To follow the dynamics of the pension benefits, (8), (11), and (14) can be combined to obtain:

$$p_t = \tau n (1 + \mu \varepsilon) (1 - \alpha) A k_t^\alpha \quad (20)$$

that shows the direct dependence of pension dynamics on the dynamics of per-labour-capital.

In equilibrium each generation's accumulated capital is used by  $n(1 + \mu)$ -times more workers as opposed to the pre-migration  $n$  and thus there is less per-labour-capital compared to the pre-migration level. Hence the capital undergoes a smooth transition to the new, lower level. The pensions follow. However, pensions also

depend on the size of tax base, i.e. migration on one hand decreases the capital, and thus the wage, and on the other hand increases the number of tax payers: Thus, for the first generation the migrants cause certain increase in the pension benefits, however, from the second generation on the total effect of migration depends on the skill-level of migrants. If the migrant skill-level is not enough to cover for capital dilution, the pensions decrease.

*Figure 1* shows the dynamics of pensions for different levels of migrant skill-level. On the left-hand side, the case of  $\alpha = 1/3$  is presented, while on the right-hand side  $\alpha = .4$ . The above described pattern can be observed in both cases. As the figure shows, a skill level of  $\varepsilon = .4$  guarantees that the pension benefits will be below the pre-migration level already for the second generation of the post-migration population.

The figure also illustrates the effects of UK migration policy. Thus, Algan, Dustmann, Glitz & Manning (2010) table 1 claims that the native hourly wage in the UK is 11.12 while the immigrants make on average 11.48, which combined with the data that only 73.1 per cent of the immigrants are employed as opposed to the native 79 per cent, gives  $\varepsilon = .955$ . Meanwhile, the same table shows that the lowest skilled immigrant group has an hourly wage of 6.26 and only 55.7 per cent of them are employed, that produces  $\varepsilon = .399$ . Hence, *Figure 1* illustrates the fact that the point-based immigration policy of the UK actually guarantees high pension benefits, while the unskilled immigration, though increases the pension benefits to the first post-migration cohort (the case discussed in Razin and Sadka, 2000), in fact decreases the pension benefits for all the subsequent cohorts.

## 4 Conclusion

The ageing challenge for unfunded public pensions (increasing pension benefit claims and decreasing pension contribution base) has long been studied in economics. The oft-repeated measures are lesser pension benefits, larger contributions (including late retirement), and replacement immigration (i.e. young immigrants compensate for missing native-born). A vast literature now exist dealing with the last.

At the height of the discussion Razin and Sadka (1999) introduced the idea of unskilled immigration surmounting the ageing challenge in an infinitely living economy. The idea is simple: The unskilled immigrant workers enter the economy and together with the native-born working-age population contribute for the old-age pensions. When those immigrants age, the natives have to share their pensions with them, however, a new cohort of working-age immigrants comes in and contributes for the pensions of the old-age immigrants. Effectively, the economy borrows from the very last generation (absurd in an infinitely-living economy) and elevates the welfare of all the involved parties.

Many (including the mentioned authors themselves) rebelled at the idea of pure benefit of unskilled immigration and proposed various mechanisms that challenge the general welfare of the involved parties. Prices, unemployment, child-costs and the like have been proposed as possible challengers. However, the current work challenges the very idea of unskilled immigrants serving for the sustainability of the pension system.

It is shown that, though the unskilled immigration increases the pension benefits compared to wages, it affects the savings in the economy. Low savings in their turn result in low capital per capita, and thus lower wages. As a result the pension benefits decrease. This reveals the unskilled immigration's inherent chal-

lenge for unfunded pension systems: The pension benefits shrivel with unskilled immigration, and thus immigration serves not for achieving the pension system sustainability (an initial parametric reform that decreases pension benefits will have the same result from the very start).

## References

- Algan, Y., Dustmann, C., Glitz, A. & Manning, A. (2010). The economic situation of first and second-generation immigrants in France, Germany and the United Kingdom. *The Economic Journal*, 120, F4-F30.
- Blake, D., & Mayhew, L. (2006). On the sustainability of the UK state pension system in the light of population ageing and declining fertility. *The Economic Journal*, 116, F286-F305.
- Casarico, A., & Devillanova, C. (2003). Social security and migration with endogenous skill upgrading. *Journal of Public Economics*, 87, 773-797.
- Fanti, L., & Gori, L. (2012). Fertility and PAYG pensions in the overlapping generations model. *Journal of Population Economics*, forthcoming.
- Fanti, L., & Gori, L. (2010). Increasing PAYG pension benefits and reducing contribution rates. *Economics Letters*, 107, 81-84.
- Jinno, M. (2011). Assimilation, immigration, and the welfare state. *FinanzArchiv: Public Finance Analysis*, 67, 46-63.
- Kemnitz, A. (2008). Can immigrant employment alleviate the demographic burden? The role of union centralization. *Economics Letters*, 99, 123-126.
- Kemnitz, A. (2003). Immigration, unemployment and pensions. *Scandinavian Journal of Economics*, 105, 31-47.
- Krieger, T. (2004). Fertility rates and skill distribution in Razin and Sadka's migration-pension model: A note. *Journal of Population Economics*, 17, 177-182.



- Muysken, J., Cörvers, F., & Zieseimer, T. (2011). Immigration can alleviate the ageing problem. *Netspar Discussion Papers*, DP07/2011-058.
- Razin, A., & Sadka, E. (2000). Unskilled migration: A burden or a boon for the welfare state? *Scandinavian Journal of Economics*, 102, 463-479.
- Razin, A., & Sadka, E. (1999). Migration and pension with international capital mobility. *Journal of Public Economics*, 74, 141-150.
- Serrano, F., Eguía, B., Ferreiro, J. (2011). Public pensions' sustainability and population ageing: Is immigration the solution? *International Labour Review*, 150, 63-79.
- Übelmesser, S. (2004). *Unfunded Pension System: Ageing and Migration*. Amsterdam: Elsevier.