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Aging, Factor Returns, and Immigration Policy

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Abstract

In this note we analyze how aging affects immigration policy. We set up a dynamic political-economy model of representative democracy in which the government of the destination country sets the immigration level to maximize aggregate welfare of the constituency. Aging, i.e. a decline in the growth rate of the native population, has an expansionary effect on immigration. This immigration effect may even overcompensate the initial decline in population growth such that the total labor force grows more strongly and the capital stock per worker declines. We also compare our results to the social planner allocation and to the median-voter equilibrium.

JEL classification: D78, F22
Keywords: Demographic change, political economy, immigration policy

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1 Introduction

Virtually all industrialized countries are facing a substantial aging of the native population, and immigration is often seen as one key instrument to counteract this development. Against this background, our paper analyzes how rich countries adjust their immigration policy in the wake of demographic change. Point of departure is a dynamic model of representative democracy with two overlapping generations. In each period the respective government sets the immigration level to maximize aggregate welfare of both generations, weighting each generation with its relative size. Due to its effects on factor accumulation, immigration policy constitutes a sequential game between subsequent governments. We derive the Markov-perfect equilibrium (MPE) of this game and analyze how a decline in the rate of population growth influences the equilibrium level of immigration. In our model *(i)* a MPE exists in which the number of immigrants relative to the domestic workforce is time-invariant, *(ii)* the government allows more immigration if the growth rate of the native population declines, and *(iii)* the relationship between population growth, factor intensities (and factor prices) may be non-monotonic.

Our paper builds on a few related approaches dealing with the political economy of immigration policy. Benhabib (1996) examines immigration policy in a median-voter model with heterogeneous wealth endowments, whereas Mazza and van Winden (1996) analyze redistribution and immigration policies under representative democracy. Unlike in our model, the setting in Benhabib (1996) and Mazza and van Winden (1996) is entirely static and therefore cannot account for the intertemporal effects of immigration policy we focus on. Sand and Razin (2007) consider the influence of aging on immigration and social security policies in a dynamic median-voter model.[1] In a median-voter framework with two generations, equilibrium policies are determined entirely either by the young or the old voters' preferences – depending on which generation is in the majority. In contrast to this rather extreme outcome, our paper is able to capture the gradual shift in the political weight toward the old generation which results from a decline in population growth.

[1]Other related papers that rely on the median-voter approach are Dolmas and Huffman (2004), Ortega (2005), and Haupt and Peters (1998).

2 Equilibrium Immigration Policy

Our economic framework is a standard overlapping-generations model with workers and retirees. In each period t, competitive firms produce a single aggregate good with a Cobb-Douglas technology $Y_t = K_t^\alpha L_t^{1-\alpha}$. The workforce L_t is composed of native workers N_t and immigrants, i.e. $L_t = N_t(1+\gamma_t)$, where $\gamma_t \geq 0$ is the ratio of immigrants per native worker. Capital depreciates completely after one period. With $\tilde{k}_t \equiv K_t/N_t$ as the capital endowment per native worker, factor returns are

$$w_t = (1-\alpha)\tilde{k}_t^\alpha (1+\gamma_t)^{-\alpha} \quad \text{and} \quad 1+r_t = \alpha \tilde{k}_t^{\alpha-1}(1+\gamma_t)^{1-\alpha} \, . \tag{1}$$

Young individuals in period t supply one unit of labor and allocate their wage income w_t to consumption and savings. Old individuals are retired and consume all of their wealth $s_{t-1}(1+r_t)$.[2] Utility of the old generation is given by $U_t^o = \ln c_t^o - b\gamma_t$. The term c_t^o denotes the consumption level of the old and $b\gamma_t$ are non-monetary costs of immigration. They represent, for example, an increased heterogeneity of social norms and customs that may be perceived as negative (see Hillman 2002 and Krieger 2005). For the young generation we choose a similar utility function, $U_t^y = \ln c_t^y + \beta \ln c_{t+1}^o - b\gamma_t - \beta b \gamma_{t+1}$. Note that the young generation also anticipates costs of future immigration $b\gamma_{t+1}$ in addition to immigration costs in t. We can determine individual savings and consumption as

$$s_t = \frac{\beta}{1+\beta} w_t \, , \quad c_t^y = \frac{1}{1+\beta} w_t \, , \quad \text{and} \quad c_{t+1}^o = \frac{\beta}{1+\beta} w_t (1+r_{t+1}) \, . \tag{2}$$

Since $\tilde{k}_{t+1} = s_t/(1+n)$, the capital stock per native worker evolves according to

$$\tilde{k}_{t+1} = \frac{\beta(1-\alpha)\tilde{k}_t^\alpha (1+\gamma_t)^{-\alpha}}{(1+n)(1+\beta)} \, . \tag{3}$$

Immigration in our model is permanent, and immigrants gain the right to vote after one period in the host country. Immigrants have the same number of children as natives, and the immigrants' children are fully integrated into the economy.[3] With a population growth rate of n we have $N_t = (1+n)L_{t-1} = (1+n)(1+\gamma_{t-1})N_{t-1}$.

[2]For brevity and to focus on immigration policy, we neglect social security contributions and benefits. It can be shown, however, that introducing social security does not affect our results if the government can set the level of social security transfers freely in each period.

[3]The assumption that immigrants have the same number of children as the native population considerably simplifies our analysis. Otherwise, immigration would change the relative size of both generations in subsequent periods.

To derive the political economy equilibrium, we assume a representative democracy in which the government in period t sets γ_t to maximize

$$W_t = V_t^o + (1+n)V_t^y \ , \tag{4}$$

where V_t^o and V_t^y denote the indirect utilities.[4] In (4) the size of the old generation is normalized to one, and the young generation's utility is weighted with its size relative to the old generation.

The sequence of events is as follows: at the beginning of each period t the respective government decides on the immigration rate γ_t. Production takes place after immigration, and finally young individuals decide how to allocate their wage income to consumption and savings.

We refer to the concept of Markov-perfect equilibrium to find an equilibrium of this game between successive governments (see e.g. Krusell et al. 1997 or Forni 2005). More specifically, we are searching for a policy rule $\gamma(\tilde{k})$ such that $\gamma_t = \gamma(\tilde{k}_t)$ maximizes $W(\tilde{k}_t, \gamma_t, \tilde{k}_{t+1}, \gamma_{t+1})$. The immigration rate γ_{t+1} in the following period has to be given by the same optimal policy rule, i.e. $\gamma_{t+1} = \gamma(\tilde{k}_{t+1})$, and the intertemporal accumulation of capital $\tilde{k}_{t+1} = \tilde{k}_{t+1}(\tilde{k}_t, \gamma_t)$ is determined by (3). Given our model specification we can show that a very simple policy rule with the property $d\gamma/d\tilde{k} = 0$ constitutes a Markov-perfect equilibrium.

Young and old have conflicting preferences concerning immigration: Setting $d\gamma_{t+1}/d\tilde{k}_{t+1} = 0$, we can derive

$$\frac{dV_t^o}{d\gamma_t} = \frac{1-\alpha}{1+\gamma_t} - b \qquad \text{and} \qquad \frac{dV_t^y}{d\gamma_t} = -\frac{\alpha(1+\alpha\beta)}{1+\gamma_t} - b \ . \tag{5}$$

Taking the first derivative of W_t and inserting (5) we obtain the following result:

Proposition 1 *A Markov-perfect equilibrium exists, and the immigration rate in this equilibrium is given by*

$$\gamma = \max\left(0; \frac{1-\alpha-(1+n)\alpha(1+\alpha\beta)}{(2+n)\,b} - 1\right) . \tag{6}$$

According to (6) the equilibrium policy rule satisfies our previous conjecture $d\gamma/d\tilde{k} = 0$. Equilibrium immigration policy is thus time-invariant. For all $\gamma > 0$ we find that $d\gamma/dn < 0$. This is because the weight of the old generation, which benefits from immigration in our model, declines in n.

[4] This objective function can be motivated by a probabilistic voting framework as in Lindbeck and Weibull (1987) or Coughlin et al. (1990).

Population aging – a decline in the population growth rate n – thus leads to more immigration.

From (6) we can derive the equilibrium growth rate l of the labor force in the immigration country. It is determined by $1+l = (1+\gamma)(1+n)$. Inserting for γ yields

$$\frac{dl}{dn} < 0 \quad \text{iff} \quad (2+n)^2 > \frac{1+\alpha^2\beta}{\alpha\,(1+\alpha\beta)} \;. \tag{7}$$

In the parameter range defined by (7), the immigration effect is so strong that aging causes an increase in the growth rate of the total labor force.

The capital intensity per worker (native and immigrant), i.e. $k_t \equiv K_t/L_t$ or $k_t = \tilde{k}_t/\,(1+\gamma)$, can be obtained from (3). Setting $k_t = k_{t+1}$ we can determine the steady state k^* as

$$k^* = \left(\frac{\beta(1-\alpha)}{(1+\beta)(1+l)}\right)^{\frac{1}{1-\alpha}} \;. \tag{8}$$

Figure 1 illustrates the relationship between n and k^* for $\alpha = 0.35$, $\beta = 0.75$ and $b = 0.1$. We see that this relationship is non-monotonic. For small

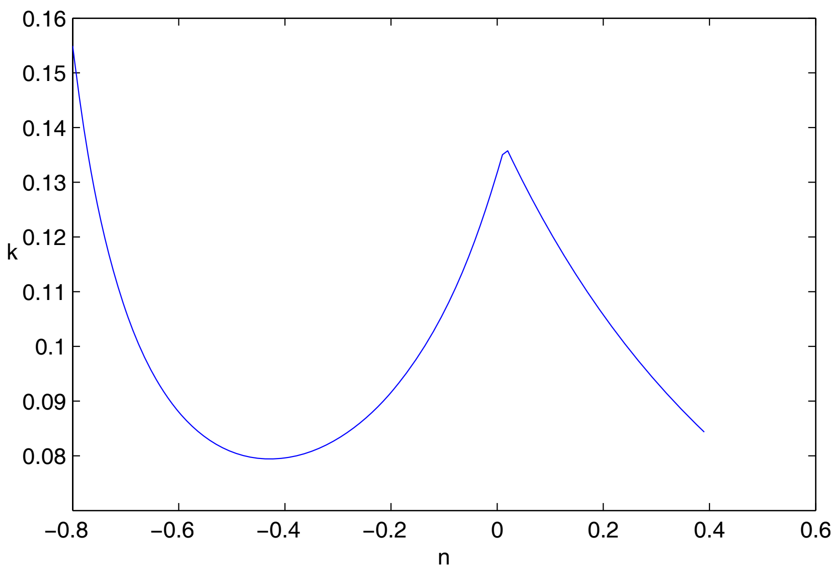

Figure 1: Population Growth and Steady State Capital Intensity

n we have $dl/dn > 0$ and consequently, $dk^*/dn < 0$. If, however, n exceeds a certain threshold value, the capital intensity increases in n. Finally, $\gamma = 0$

for large n, causing the capital intensity to fall in the population growth rate as in a world with exogenous immigration.

Note that immigration in all periods is higher than in the case of a social planner, who also accounts for the welfare effects of immigration policy on future, yet unborn generations. In period t, a benevolent social planner maximizes

$$SWF_t = \sum_{s=t}^{\infty} (1+n)^{s-t}\beta^{s-t}\{\ln c_s^o + (1+n)\ln c_s^y - (2+n)b\gamma_s\} , \qquad (9)$$

which is the discounted sum of all current and future native generation's utilities. The solution to this maximization is given by

$$1+\gamma^{SP} = \frac{1-\alpha\beta(1+n)-\alpha(2+n)}{(1-\alpha\beta(1+n))\,(2+n)b} . \qquad (10)$$

Comparing γ^{SP} with the equilibrium immigration rate γ yields $\gamma > \gamma^{SP}$.

For a further interpretation we may also compare our equilibrium with the outcome in a median-voter setting. The equilibrium policy in a median-voter model either maximizes the welfare of the young (for $n > 0$) or of the old generation. An interior solution with $\gamma > 0$ is only possible in the latter case. As long as the identity of the median-voter remains unchanged, aging does not influence immigration policy at all in such a setting.

3 Concluding Remarks

In this note we have analyzed the effects of population aging on immigration policy in a representative democracy model with two overlapping generations. We have shown that aging has an expansionary effect on the chosen immigration level. To obtain further insights, our model can be extended into various directions. For example, it may account for the fact that immigrants often have more children than natives, or it may incorporate different skill levels of workers. In addition, the predictions of our theoretical model regarding the effects of aging on immigration policy can be tested empirically.

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