Immigration and Social Security Policies and Reforms

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Abstract

Recent demographic developments have been challenging the national budgets in most of the developed economies: Ageing, increased longevity and decreased fertility, shrinks the tax base while increasing the number of beneficiaries of the existing social security systems. Thus the governments of those countries are facing policy sustainability problems. The problem is more severe in social economies, such as Germany, where the social spending is large and the welfare enhancing policies are prioritized. Economic literature offers several possible solutions to the problem. This work concentrates on immigration policies (inclusive and exclusive, selective and free) and hypothetical social security reforms in an open economy model with overlapping generations of heterogeneous agents. Increased immigration policy is under concern. It is shown that the increased immigration is welfare improving and that the selective immigration policy brings further welfare benefits. The paper suggests also that exclusive immigration policy (i.e. the case when immigrants are not allowed to participate in Social Security schemes) bring welfare gains to the native population.

1 Introduction

Germany faced two major demographic changes in the last half a century: significant decline in mortality and fertility rates. At present the total fertility rate is half its level in the 1960s: Currently it is 1.4 while it used to be more than 2.5 in 60s (FSO, 2006). In other words, fewer children are currently born compared to their parents' generation (the replacement rate - the amount needed to repeat the size of the parents' generation - is 2.1). This pushes the average age of the population up. Simultaneously, life expectancy in Germany has steadily been increasing: If in the 1960s a newborn female was expected to live 72.4 years and a newborn male 66.9, nowadays these numbers have increased to 81.5 and 75.9,

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respectively (FSO, 2006). Thus, the overall proportion of the old aged (and the oldest-old) is continuously increasing. This process has pulled up the average age of the population and has changed the age distribution in Germany.

While it is expected that the total population will decrease by 16.6 percent in Germany by 2050, most of the loss will be among youngsters and working age adults. Thus in 2050 the share of population aged 60 and above increases to 40.4 percent from the current 24.9, while the working age population decreases to 44.5 percent from 55.1 (FSO, 2006). Hence by 2050 there will be almost one old-age person per working age adult. It is obvious that this type of demographic development directly challenges the unfunded social security system. The problem is more prominent in case of Germany as it has one of the highest pension expenditure to GDP ratio (12 percent) among developed countries (Uebelmesser, 2004).

The unfunded social security system assumes distributing contributions collected from working-age to the old-age population as social security benefits each period. Thus in case of the above mentioned demographic developments either the contributions should grow or the benefits should be cut in order to sustain the system. This idea made German government undergo several stages of reforms (last being in 2002). The reforms were intended to keep the generous social insurance in Germany; however they failed to guarantee the sustainability of the reform.

Many economic studies have been devoted to the social security reforms in Germany: A detailed analysis of various types of parametric reforms is presented in Fehr (2000). Fehr's paper preceded the actual German reform and discussed the distributional and efficiency of the proposed reform *vis-à-vis* some alternative ones. He models three separate cases, an increase in retirement age, a moderate benefit reduction and a radical reform. First he discusses the macroeconomic consequences of the reforms and then compares the utilities in those cases. The mainly he seeks to find who the winners and the losers of the particular reforms are. For that reason Fehr uses computational general equilibrium overlapping-generations model with heterogeneous agents. The main findings are that all the reforms are re-distributive in favor of future generations, and that the current elderly suffers the most and that none of the reforms leads to a Pareto improvement.

Meanwhile, Boersch-Supan et al. (2003) studied 'more decisive reforms' *vis-à-vis* the ongoing one. However, their main concentration was the capital market and the rate of return. Thus while they showed that the rate of return is not being affected much in a modeled closed-economy, they failed to report the welfare

effects of the reforms (which might be the most important part for the German reforms given the 'social' character of the German economy).

Similar study had been conducted by Miles and Iben (2000). They identify the gainers and losers from hypothetical radical pension reform in the UK and Germany. They concluded that the reforms necessarily bring losses to the current cohorts and that the current cohorts will support the reforms only if they are 'persuaded that the benefits to future generations are large.' Basically the Miles and Iben result is similar to Fehr (2000) in that there is no Pareto-improvement in reforms. However, as opposed to Fehr(2000), Miles and Iben (2000) study radical reforms where they had chances to avoid a double-paying transition generation according to Joines (2007).

Hence, Joines (2007) brings the idea of flexible government budget. Joines claims that the government can redistribute the gains from the future generations in favor of the reforming cohort and thus even generate Pareto-improvements. However, in practice it is not always possible to conduct totally flexible budget: In case of Germany, where the pension system constitutes big part of the GDP, terminating the existing unfunded system would generate huge public debt which would be against Maastricht criteria of stability.

Indeed, Maastricht criteria do not allow the local governments go into high debt. However, the governments can accumulate some debt which can be used as a smoothing mechanism during the reform. Another possibility to mitigate the burden of the transition cohorts is using increased migration policy. The immigrants entering to the economy after the reform will be net payers and thus will ease the transition. Furthermore, the immigration will support further GDP growth and will give more opportunities for the government usage of flexible budget.

However, up to date in the economic literature has discussed the effect of immigration on the social security only in the context of sustaining the existing unfunded system (*e.g.* Storesletten, 2000; Lee and Miller, 2000). In a recent study Akin (2007) discussed the effects of the increased immigration policy on the welfare of German population. Her paper is motivated by the fact that the German government at last made an official policy on immigration in 2005: Being the major immigrant country in Europe (Krieger, 2004) German government used to refuse acknowledging the fact and shaping policy before (Schily, 2007). Akin (2007) showed that the increased immigration policy brings higher welfare to everyone, with minor exceptions.

Meanwhile Sainsbury (2006) elaborates on the topic of the immigration reforms. She points out one more dimention of the immigration reforms: Aside from the procedures of letting new people into the economy (Canada style point-based or otherwise) it is important to distinguish and study the level of participation of the immigrants in the welfare states. The examples are Sweden with all-inclusive policy and pre-reform Germany with exclusivity and the US between.

Thus the current paper will study the welfare effects of immigration supported social security reform. Combinations of possible immigration policies and social security reforms will be compared. In a semi-open overlapping-generations heterogeneous-agent economy two versions of government policies are considered: usual immigration supported unfunded social security and immigration supported social security reform. Under both cases the welfare of agents across and within the cohorts are calculated and compared the welfare level of the unaltered (unfunded social security without immigration) economy.

The paper is very careful with the demographic side of the model. Krieger (2004) showed how the seemingly unimportant assumptions on demography can reverse the results of the study. The special importance is given to the future generations of the immigrant. The economic literature (e.g. Storesletten, 2000; Akin, 2007) seem to neglect the role of the immigrant generations and assume them to be equal to natives. However, Aslanyan (2008) in a theoretical study shows that the welfare of the cohorts depend on the assimilation process the immigrant generations undergo. The welfare difference is shown to be more dramatic when the government is not able to use flexible budget.

Given extraordinary position of Germany as a welfare economy with severe aging problem, and as an economy where immigration policy is still being shaped, it is believed that the current study will have high practical value. Besides it has a theoretical value as a study of immigration supported social security reform. In the next sections the model is presented to resemble German economy.

2 The Model

2.1 The Economic Environment

The economy is characterized with open capital market and closed labor market. Hence the price of capital good is being taken from the world market as given while the price of the labor is being determined in the economy. However for now

CRS production function will be assumed which is identical to having open labor market and importing the wages from the world labor market.

The economy starts with installed pay-as-you-go (PAYG) unfunded social security scheme, as it is the case in Germany now. Two alternative social security policies will be studied - maintaining PAYG or terminating PAYG and starting a fully funded system. On the other hand increased immigration policy will be under concern. As opposed to most of the economic literature (*e.g.* Akin, 2007; Storesletten, 2000) the immigrant generations will be considered different from natives.

2.1.1 Demographics

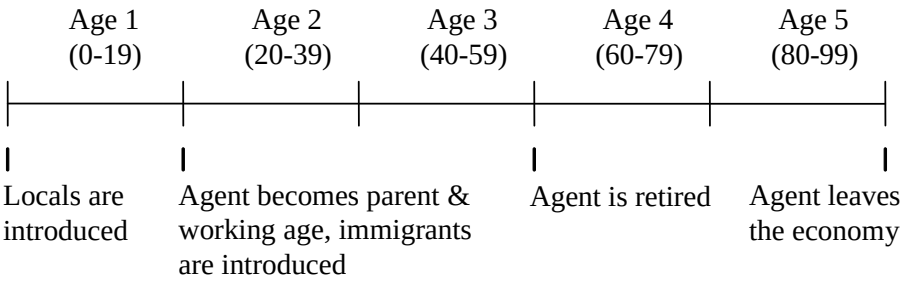
The economy is populated with agents who differ in age (i), generation in the economy (g), and level of education (e). There is a measure $\mu^t_{i,g,e}$ defined on the age i population of generation g with level of education e at time t.

Individuals start their life at age $i = 0$ and live at most I years. The probability of surviving to age i, given that the agent of generation g is alive at age $i-1$, is denoted by $\pi_{i,g}$. The probability of surviving depends on the generation in the economy, as the immigrants grew in a different environment and more often had worse medical treatment and nutrition before migration which negatively influences their survival probability. However second and subsequent generations of immigrants already are disposed to better treatment and in this are identical to natives: $\pi_{i,1} \leq \pi_{i,g\neq 1}$.

Agents live maximum of 5 periods during their lifetime (Fig.1). In the first period after they are born they basically do nothing but getting education and consuming transfers from the government. During the period $i = 2$, Age 2, agents start working and make decisions on the levels of savings and consumption of goods and leisure. At the same period the immigrants are being introduced to the economy.[1] Also the agents are fertile only during the period $i = 2$. At the period $i = 3$ the agents conduct the same economic activities as in the previous period. At periods $i = 4$ and $i = 5$, if survived, the agents are retired, they get pension benefits and make decisions on consumption and savings (given that there cannot be negative asset possession when retired). All the agents should have left the economy by the end of period $i = 5$: $\pi_{6,g} = 0$.

[1] This is a technical assumption to avoid (a) the issue of 1.5 generation in case the immigrants are possibly introduced during Age 1; (b) childlessness of the immigrants in case introduced in Age 3; (c) total inactivity of the immigrants in case introduced in Age 4 or 5.

Figure 1: A lifespan of an agent with highest survival probability



The immigrants are allowed to enter the country when they are at the beginning of the age $i = 2$. They represent the generation $g = 1$. The future generations of immigrants, $g = 1, 2, ...$, are born in the economy; however the generations slowly undergo some assimilation: The more generations of the ancestors have been in the economy, the more similar to natives the agent is. The natives themselves represent generation $g = 0$.

When born the level of education, e, that agents 'attain' during the period $i = 1$ of their life is revealed. Each generation g has its own distribution for the level of education $H_{g,t} = (\eta_{g,e,t}|e = 1, 2, ...)$ where $\eta_{g,e,t}$ is the probability of having education level e for an agent from generation g at time t. It is most often assumed that the immigrants on average have lower education, or in other words, their distribution is skewed towards lower educational levels. However, if the immigration policy is designed to select the desired type of immigrants, as the 'point' system of immigration in some countries, it is possible to have the immigrants' distribution of education level skewed towards higher educational level.[2]

Following Card (2005), rate of assimilation is defined as '1 minus the intergenerational correlation (p.320),' where the intergenerational correlation shows the

[2]This model does not include the possibility of educating the young immigrants, which may be studied in somewhat extended model.

effect of the parent's education on the child's education for generation $g > 0$:

$$H_{g+1,t} = \rho H_{g,t} + (1 - \rho)\, \dddot{H}_t \tag{1}$$

where $(1 - \rho)$ is the rate of assimilation, and $\dddot{H}_t$ is the mean of the distribution. Thus it is assumed that the immigrant generations necessarily assimilate and that all the generations have the same rate of assimilation.

The education level is one of the determinants of the efficiency level $\varepsilon_{i,g,e}$ of the type (i, g, e) agent in the labor market. The efficiency also depend on the age (usual Mincerian model), and generation: Generation $g = 1$ will have different productivity as the education in the home country of the immigrants is supposedly worse than in the host economy. Low efficiency level of immigrants compared to the locals with the same education can be explained also with existing bureaucracy and discrimination against immigrants in the host economy (Krieger, 2005, p.91).

The immigrants, natives and immigrant generations also differ in their fertility rates (*e.g.* Lee & Miller, 2000). As in the case of labor efficiency, fertility $\varphi_{g,e}$ is also affected by the other individual characteristics: As it was already mentioned above it is assumed that the agents are fertile only during the period $i = 2$ of their lifespan (that is why the subscript for the age of the agent is omitted). It is also well established fact in the demographic (and economic) literature that the fertility rate is decreasing with the education: $\frac{\partial}{\partial e}\varphi_{g,e} < 0$.

However, the demographic literature still has not reach to a conclusion on the fertility rates of the immigrant generations. Though it is largely accepted that the immigrants have higher fertility rates than natives, the most recent studies (*e.g.* Milewski, 2007) claim that the second and subsequent generation of the immigrants have the same fertility rate as the natives if it is controlled for the individual characteristics, including level of education and marriage. Nevertheless, they also claim that the immigrant generations still have higher levels of nuptiality compared to the natives, *viz.* higher fertility rates per immigrant. Basing on the idea of Hill and Johnson (2002) that the generation 'serves as a proxy for changes in other personal characteristics (p.59)' (1) type of assimilation rule will be used in this model for the fertility levels of the immigrant generations:

$$\varphi_{g+1,e} = \hat{\rho}\varphi_{g,e} + (1 - \hat{\rho})\, \varphi_{0,e} \tag{2}$$

where $(1 - \hat{\rho})$ is the rate of assimilation in fertility rates.

Depending on the generation agents are differently introduced to the economy. While the government chooses the type and age of immigrants, the others are

being born at the beginning of Age 1 and draw their level of education from the distribution H_g :

$$\begin{aligned} \mu^t_{1,0,\tilde{e}} &= \sum_e \mu^t_{2,0,e} \cdot \varphi_{g,e} \cdot \eta_{0,\tilde{e}} \qquad \text{for} \quad g = 0 \\ \mu^t_{1,g+1,\tilde{e}} &= \sum_e \mu^t_{2,g,e} \cdot \varphi_{g,e} \cdot \eta_{g+1,\tilde{e}} \qquad \text{for} \quad g > 0 \end{aligned} \tag{3}$$

and each period immigrants are allowed with a size of a fixed percentage, ψ, of the age $i = 2$ agents in the economy:

$$\mu^t_{2,1,\tilde{e}} = \psi \cdot \sum_{g \neq 1} \sum_e \mu^t_{2,g,e} \cdot \eta_{1,\tilde{e}} \qquad \text{for} \quad g = 1 \tag{4}$$

On the other hand some agents of different ages will leave the economy based on the survival probability:

$$\mu^{t+1}_{i+1,g,e} = \mu^t_{i,g,e} \cdot \pi_{i,g} \tag{5}$$

2.1.2 The Preferences and Household's Problem

Each agent in this economy comprises a household whose preferences are represented by a time-separable, nested CES utility function. Thus a type (g, e) agent born at time $t-1$ has the following utility function:

$$\mathbb{U}_t = \max \frac{1}{1-\gamma} \sum_{i=2}^{I} \beta^{i-1} \left[c_{t,i}^{1-\nu} + \alpha \left(1 - n_{t,i}\right)^{1-\nu} \right]^{\frac{1-\gamma}{1-\nu}} \prod_{j=0}^{i-1} \pi\left(j, g\right) \tag{6}$$

where $c_{t,i}$ is the consumption of the agent at age i at time t, while $n_{t,i}$ is the time spent in the labor market. Here, the parameters β, ν, γ and α represent rate of time preference, the intra- and intertemporal elasticity of substitution, and the leisure preference, respectively.

The utility function does not include any activity done at the age $i = 1$. There are two main reasons for it: First, as the first generation immigrants are absent from the economy during period $i = 1$ of their lifespan then by default they would have lower level of utility compared to the local born agents, and, second, the agents do not optimize at the age $i = 1$ but rather they consume the government transfers.

As it is mentioned before the agents do consume in the first period: Their consumption is, however, mere the government transfers, $c_1 = \chi_{1,g,e}$, which are age, generation and type specific. Thus the higher the education, the more spent

on the agent in the period $i = 1$ of the lifespan. Government gives transfers also in other periods of the lifetime which, together with the labor income, $w\varepsilon n_i$, in each period, public pension benefits when retired, and interest on savings if made, are the only income sources for the agents. On the other hand the income is spent on consumption of goods, savings, taxes and contributions to public pension:

$$c_i\left(1+\tau_t^c\right)+a_{i+1} \leq w\varepsilon n_i\left(1-\tau^n\right)+\left(1+r\right)a_i-T_t\left(h_i\right)+P_t\left(h^i\right)+\chi_i \qquad (7)$$

where a_i is the savings (debts) made in period $i-1$, τ_t^c and τ^n are the taxes payable to government for consumption and income; w and r are the prices from the world markets of labor and capital, respectively.

Interaction with the social security system shows up in the household budget constraint (7) with two terms - the contribution $T_t\left(h_i\right)$ which is a function of the agent's labor market participation at period i, $h_i = w\varepsilon n_i$, and the pension benefit $P_t\left(h^i\right)$ which is a function of the history of the agent's social security contributions up to period i, $h^i = \left\{T\left(h_j\right)\right\}_{j<i}$. The pension benefit is nonzero if the agent is retired and had ever contributed to the social security system: $P_t\left(h^i\right) = 0$ if $i < 4$, or $T\left(h_j\right) = 0$ for all j. In case of social security reform $T_t\left(h_k\left(i,m,g,e\right)\right) = 0$, *viz.* all who already contributed to the system will get benefits, others do not contribute and thus do not get any benefit in future.

2.1.3 The Production and Firm

As it was mentioned above there is a representative firm in the economy, which produces one final good using the production function

$$Y_t = F\left(K_t, N_t\right) \qquad (8)$$

where N_t is the total effective labor offered in the economy for the price w_t

$$N_t = \sum_{i=2}^{3}\sum_{g,e} n_{i,g,e}\varepsilon_{i,g,e}\mu_{i,g,e} \qquad (9)$$

and K_t is the capital borrowed from the world capital market with the offered price.

The firm maximizes its profit subject to paying for the capital and labor resources as well as for the depreciation of the capital. Initially Cobb-Douglas production function will be assumed with capital share θ.

2.1.4 The Fiscal Policy and Government

The role of the government is to maintain fiscal and immigration policies. For the fiscal policy the government is using two separate units - the social security and general government budget. Social security budget is being balanced each period by collecting public pension contribution to distribute pension benefits. Possible deficit or the proficit of the social security budget is being controlled by the interacting term with the general government budget. Thus the social security budget is

$$\sum_{i=4}^{5}\sum_{g,e} P_t\left(h^i\left(i,g,e\right)\right)\mu_{i,g,e}^t = \sum_{i=2}^{3}\sum_{g,e} T_t\left(h_i\left(i,g,e\right)\right)\mu_{i,g,e}^t + B_t \tag{10}$$

and the general budget of the government is

$$\sum_{i=1}^{5}\sum_{g,e}\chi_{i,g,e}\mu_{i,g,e}^t + B_t + D_t = \sum_{i=1}^{5}\sum_{g,e}\left(\tau_t^c c + \tau^n w\varepsilon n\right)\mu_{i,g,e}^t + D_{t-1}\left(1+r\right) \tag{11}$$

Here D_t represents government savings or assets. The possibility of having assets (or debt) gives dynamic (unbalanced) nature to the general budget of the government. The definition of unfunded public security system requires the social security budget be balanced each period (Uebelmesser, 2004), conversely D_t and B_t in the general budget of the government virtually make the social security budget unbalanced via 'consolidated' budget. However, as Linbeck & Persson (2003) claim all the governments do violate the balancing condition to some extent. In order to keep the consolidated government, and thus social security, budget balanced it will be assumed that ratio of the government assets to total production is constant over time:

$$D_t = \delta Y_t \tag{12}$$

and will allow the consumption tax to balance the budget.

On the other hand if the PAYG system is terminated the implicit debt of the system turns into an explicit government debt. In this case if the government budget is balanced there will be a transition generation which will experience huge losses. To mitigate the losses of the transition generation Joines (2007) idea will be used to allow government to generate a debt with an upper limit connected to the size of the economy (total production):

$$|D_t| \leq \hat{\delta} Y_t \tag{13}$$

and again allowing the consumption tax to balance the budget.

2.2 The equilibria

In this section two alternative equilibria will be discussed. The main difference in these equilibria is the type of social policy the government conducts. On the other hand there are also subcategories of the equilibria differing in the conducted immigration policy.

2.2.1 The PAYG Economy

In the PAYG equilibrium all the parameters of the economy stay at the current level except of the immigration rate that is higher.

Given the world price for the capital good, r, the initial distribution of assets a_0 and population μ_0, the government transfers $\chi_{i,g,e}$, tax rate τ^n, the social security contribution and benefit functions $T_t(\cdot) = T_0(\cdot)$ and $P_t\left(h^i\right) = P_0\left(h^i\right)$ for any $t \geq 0$, and old and new immigration policy $\bar{\psi}$ and $\tilde{\psi}$, an *equilibrium is* a sequence $\left\{w_t, \tau_t^c, N_t, K_t, B_t, D_t, \left\{c_{i,g,e}, n_{i,g,e}, a_{i,g,e}, \mu_{i,g,e}^t\right\}_{i,g,e}\right\}_{t=0}^{\infty}$ such that

a. $\left\{c_{i,g,e}^t, n_{i,g,e}^t, a_{i,g,e}^t, \mu_{i,g,e}^t\right\}_{i,g,e}$ solves type (i,g,e) household's problem each time,

b. $\{N_t, K_t\}$ solve the firm problem,

c. the labor market clearing condition (9) holds,

d. the government budget constraints (10)-(11) hold,

e. the population sequence $\mu_{i,g,e}^t$ evolves according to (3)-(5).

A version of PAYG equilibrium is the *Status quo* economy where $\bar{\psi} = \tilde{\psi}$, *i.e.* the immigration policy is also untouched. The Status Quo economy presents the original economy with none of the government policies altered, thus it is a good benchmark to compare any policy change to.

2.2.2 The Funded Economy

In the funded equilibrium the government reforms both of the policies, *i.e.* increases the immigration policy and terminates the collection of the social security contributions, at the same time honoring all the pension benefit claims from those agents who entitled to it, *i.e.* the benefit function is not altered.

Given the world price for the capital good, r, the initial distribution of assets a_0 and population μ_0, the government transfers $\chi_{i,g,e}$, tax rate τ^n, the old and new social security contribution and benefit functions $T_0(\cdot), T_t(\cdot) = 0$ for any $t > 0$ and $P_t\left(h^i\right) = P_0\left(h^i\right)$ for any $t \geq 0$, and old and new immigration policy $\bar{\psi}$ and $\tilde{\psi}$, an *equilibrium is* a sequence $\left\{w_t, \tau_t^c, N_t, K_t, B_t, D_t, \left\{c_{i,g,e}, n_{i,g,e}, a_{i,g,e}, \mu_{i,g,e}^t\right\}_{i,g,e}\right\}_{t=0}^{\infty}$ such that

a. $\left\{c_{i,g,e}^t, n_{i,g,e}^t, a_{i,g,e}^t, \mu_{i,g,e}^t\right\}_{i,g,e}$ solves type (i,g,e) household's problem each time,

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e. the population sequence $\mu_{i,g,e}^t$ evolves according to (3)-(5).

3 Parameterization (or the German Economy)

In this section some particularities of German economy, such as public pension contribution and benefit schedules, will be presented to the model discussed in the previous section. German data is already calibrated for a similar type of model by Akin (2007) and thus most of the parameters will be transferred from there.

3.1 Individuals: Demographics and Preferences

The population distribution, fertility rates and other demographic indicators are present in Akin (2007). The main difference from Akin model is the existence of the future generations of immigrants. In order to approximate the data for those generations, the results of Card (2005) is used. Thus Card claims that both macro and micro level data shows that on average the next generation's characteristics

can be explained by thirty percent of the parents characteristics, i.e. the rate of assimilation is $(1-\rho) = .7$.

With this specification agents of generations $g \geq 5$ have their characteristics more than 99 percent converged to the natives. Thus, for the rest of the paper, only natives, immigrants and up to the fifth generation will be discussed; the sixth generation already will be native. Effectively this means that the generation can take values $g = \{1, 2, ...5\}$. Hence, (3) holds for generations $g \in [1, 4]$ and for $g = 5$ the following is true:

$$\mu^t_{1,0,\tilde{e}} = \sum_e \left(\mu^t_{2,0,e} \cdot \varphi_{o,e} + \mu^t_{2,5,e} \cdot \varphi_{5,e}\right) \cdot \eta_{0,\tilde{e}} \tag{14}$$

As there is no definite information on the rate of assimilation for the fertility rates, and *ad hoc* assumption of $\hat{\rho} = \rho$ will be used.

To keep in line with Akin (2007), and many other contributions to the field, two levels of education will be considered: $e = \{h, l\}$, where h stands for high education and l for low. Further, in order to match Akin model the survival probability is actually removed from the model, making the lifespan of the agents deterministic. At the same time in order to eliminate misbalance of working and retired life all the agents are required to leave the economy after being retired for one period. Thus only four periods remaining in the lifespan, $i = \{1, 2, 3, 4\}$ and the survival probability is $\pi_{i,g} = 1$ for $i < 5$ and $\pi_{6,g} = 0$.

For the sake of simplicity α in the utility function is taken to be zero. As a result the agents will not derive utility from leisure and will devote all the available time to working. Though this is divergence from Akin (2007) it is not a particularly strong assumption, as in case of open economy there is neither general equilibrium effect of increased immigration or increased savings on the wages, nor the labor leisure decision will be distorted in case of removing the almost actuarial social security system of Germany. The preference parameters β and γ take the value of 0.98 and 2, respectively, as in Akin (2007). The value of intratemporal elasticity of substitution δ is irrelevant now as the assumption $\alpha = 0$ cancels ν out of the utility function.

The wages are used to find the efficiency level $\varepsilon_{i,g,e}$: the wage of high skilled age $i = 2$ natives is taken as numéraire and ε calculated accordingly. The data provided by Akin once again has been used in this case. A working assumption that the migrant descendants have the same efficiency level as the natives is used.

3.2 Government: Taxes and Social Security System

The government interaction is designed so to match the existing German system: The social security contribution is 9.75 percent of gross wage earnings with special ceilings for the highest earnings group. There is a progressive formula based income tax, payable after the social security contributions, culminating at around 42 percent for the highest earnings group (overall there are 4 bracket groups with the breaks being 7,665, 12,740 and 52,152 euros of after-social-security-contribution wages). German workers pay sickness, unemployment and long term care insurances as well.

The pension benefits of the agents are 'point'-based which reflects their relative earnings position in the economy. During each life-period agent's earning is being compared to the nationwide average earning: The national average is considered one point and the agent is getting points according to:

$$\vartheta = \sum \frac{h_i}{\overline{h_i}} \tag{15a}$$

where $h_i = w\varepsilon n_i$ as before , and

$$\overline{h_i} = \frac{\sum h_i \mu}{\sum \mu} \tag{15b}$$

Next each year pension point ϑ is assigned a value Π_t, the 'pension point value' which is calculated (as simplified in Akin, 2007):

$$\Pi_t = \Pi_{t-1} \cdot \frac{\overline{h_{t-1}}}{\overline{h_{t-2}}} \cdot \left(1 + \kappa \left(1 - \frac{ISR_{t-1}}{ISR_{t-2}}\right)\right) \tag{15c}$$

where $\kappa = .25$ is the allocation factor, and the inverse support ratio is

$$ISR_t = \frac{\sum\limits_{g,e} \mu^t_{4,g,e}}{\sum\limits_{g,e} \left(\mu^t_{2,g,e} + \mu^t_{3,g,e}\right)} \tag{15d}$$

And finally the pension benefit for an agent is calculated as

$$P_t\left(h^i\left(i,g,e\right)\right) = \vartheta \cdot \Pi_t \tag{15e}$$

For the reformed economy, the agents will stop contributing to the social security system and thus stop generating pension points. In some of the experiments some agent's would be opt out from the Social Security system. In this case they will neither contribute nor collect any benefits through the system.

4 Experiments and results

The paper intends to report on several experiments conducted. First, basic increased immigration will be studied. Second experiment will consider introduction of skill control for immigrants similar to the practice in Canada, New Zealand and some other countries. The other experiments will be following Sainsbury (2006) and considering different levels of immigrants' participation in the public finances. And finally another group of experiments studies the economic and welfare effects of privatising the Social Security (i.e. terminating existing unfunded system) in combination with changes in immigration policy. All the results of the experiments are compared to the *Status quo* (SQ) economy (no changes in either Social Security system or the Immigration policy) as well as to each other.

In the first experiment the immigration policy is increased and the economy now accommodates immigrants with a size equivalent to 0.5 percent of the current population in each period, while the Social Security is intact.

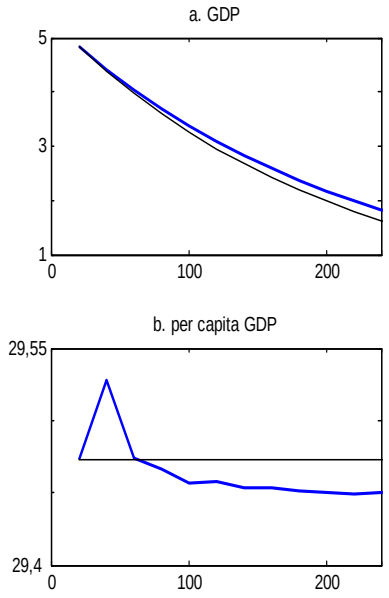

Figure 2. GDP and per capita GDP

The fertility and the education level of the new immigrants are assumed to be identical to the current immigrants: they are on average less educated compared to the natives and have higher fertility. However, only the low skilled immigrants have fertility rate high enough to reproduce equal (and more) to their number children, and as a result the overall population in the economy is still decreasing. As the model does not have any other source of growth but labor, the decreasing population results in a decreasing production though the extra migration guarantees higher production compared to the SQ economy (Figure **??**).

On the other hand, due to qualitative changes in the labor the per capita production has different path when SQ is compared to the reformed economy. While the SQ economy is in a steady state, the introduction of new immigrants brings a leap up which is followed by constant decrease to a below SQ level: In the

reformed economy the average agent has lower productivity, and thus the lower level of per capita production, while the leap is generated by the change in the proportion of working age population. Once the initial immigrants get older, retire and produce generations, the source of high per capita production disappears.

As for the welfare: All types of agents of all the generations are better off under reformed economy. There are two channels for the increased welfare, the social security system and the decreased consumption tax. The increased immigration of (on average) low-skilled immigrants decreases the 'pension-point-value' in the economy, however on the other hand it decreases the average wage and thus increases 'individual points' collected by the agents. Overall the social security benefits grow higher for each and all agents.

The consumption tax also goes down with the extra immigrants introduced to the economy. This decrease also result from two almost orthogonal sources: first though there are more people to share the burden of the public budget debt, the immigrants increase the burden itself with ageing and producing (costly) children. On the other hand, the immigrants make the social security system less costly for the government. In result, the consumption tax decreases from 17.5 per cent to 16.9.

Figure 4 illustrates an experiment where 'point-system' is used to choose the immigrants' skill level. In this case the number of immigrants are allowed in, however, half of them are skilled as opposed to the previous 10 per cent only. The 'points system' is beneficial to all the groups. However the mechanism of generating the welfare gains is slightly different, though the sources are still the same social security benefits-*vs.*-contribution and the consumption tax. The effect on the social security is the opposite of the previous case. Here agents collect less points however the value of each point is higher, resulting again in high benefits. The high skilled immigration contribution to the social security is comparable to the previous case of with the lower skilled immigrants (as the social security system mostly generates losses due to population misbalance (Aslanyan, 2008)) . The 'point system' also mitigates the burden on the public budget as the skilled migrants pay more taxes and collect less benefits.

The last experiment conducted (illustrated in Fig. 5) compares the economy described in the first experiment, i.e. increased (mostly low-skill) immigration, to an economy where those immigrants are not allowed to participate in the Social Security system. (Note that the natives and future generations of the immigrants do participate in the system, as well as the immigrants still use other public funds.

This case also guarantees higher welfare to all the agents if compared to SQ. The new policy is also beneficial to almost all the agents with the exception of high skilled immigrants. The low-skilled immigrants are benefiting as they do not participate in the costly Social Security scheme. The natives' welfare increase is mostly coming from eliminating costly participation of the immigrants from the Social Security system, while they still pay for it via consumption tax.

The high-skilled immigrants almost are unaffected by this change. However they are suffering a very small welfare losses: Before the tax on labor income and the like were calculated based on the after-social-security-contribution income, while in this case the high-skilled is paying the highest taxes.

5 Conclusion

The world economy is more and more characterised with free movements of goods and services. Production resources are not exception either. While the free movement of the goods and services are all beneficial, the inflow of production resources, especially labor, can hurt the locals. While trying to protect locals governments usually tightly control the borders and allow inflow of labor only by choice.

This paper is devoted to welfare analysis of possible immigration policies in a European welfare state which also faces the problem of population ageing. The German economy is studied as a typical example of such a state. The paper bases on Sainsbury (2006) in identifying possible immigration-public finance relationships.

Results on several experiments are reported: economy with larger number of immigrants, with chosen immigrants, immigrants who are not allowed to use specific government institutions (such as Social Security) and all of those are compared to the case of no changes at all. The results suggest that it is all beneficial to allow more immigrants in, and it is better for all to control the immigrants and to choose the higher qualified immigrants. The effects are due to internal arrangements of the Social Security system, and of immigrants being able to contribute to the public finances more than what they get.

The result on an experiment where the immigrants are not allowed to participate in Social Security are noteworthy. All the agents but high-skilled immigrants are being better off. Given that the immigrants are not directly participating in an arrangement which is inefficient by construction, and the fact that the other immigrants did not make the losses of the system larger, it might be expected that the high skilled immigrants would also be better off. However in this case the fact

that the social security contribution is deductible for the other taxes plays crucial role.

On the next stage of the research the results on the termination of the existing Social Security system will be presented. In this case the non-willingness of the government to increase the size of public debt makes the presence of immigrants much valuable.

Appendix A.

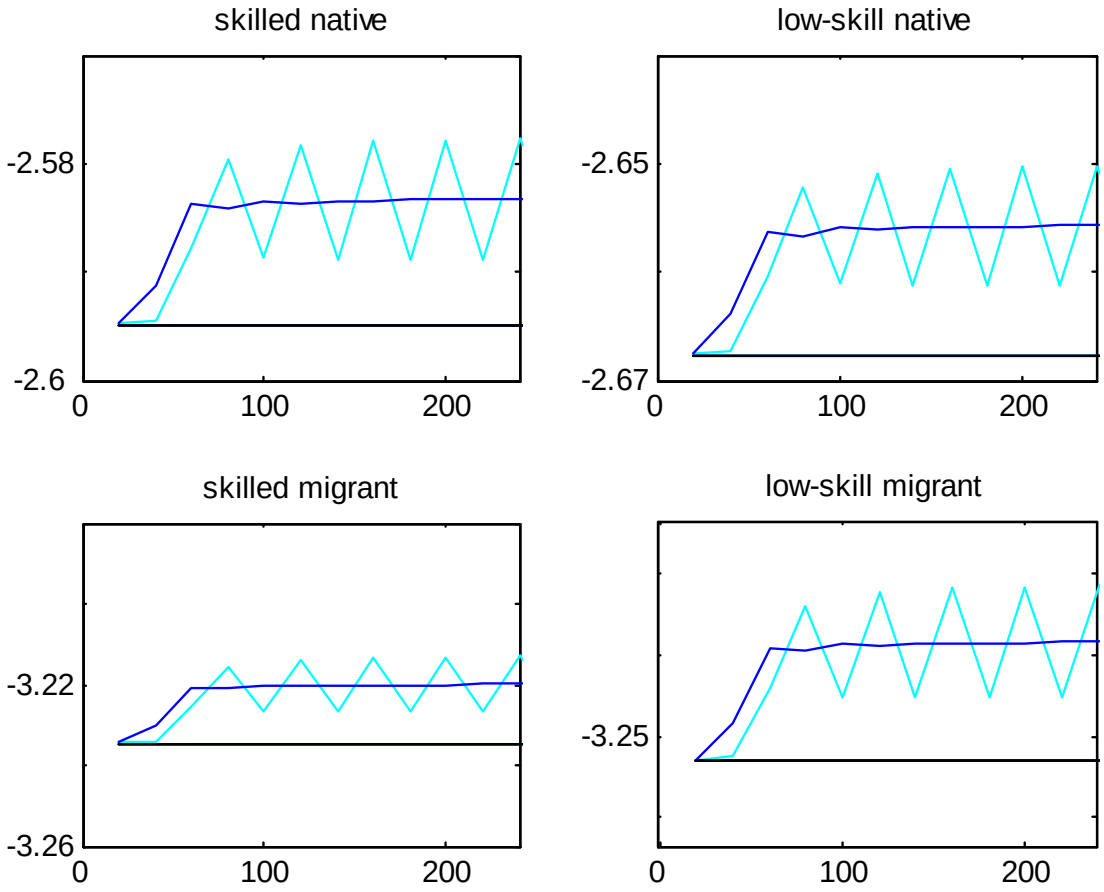

Figure 2: Figure 2. The welfare of (g,s) agents in SQ economy (in black) and reformed economy (in blue, cyan is the unadjusted version)

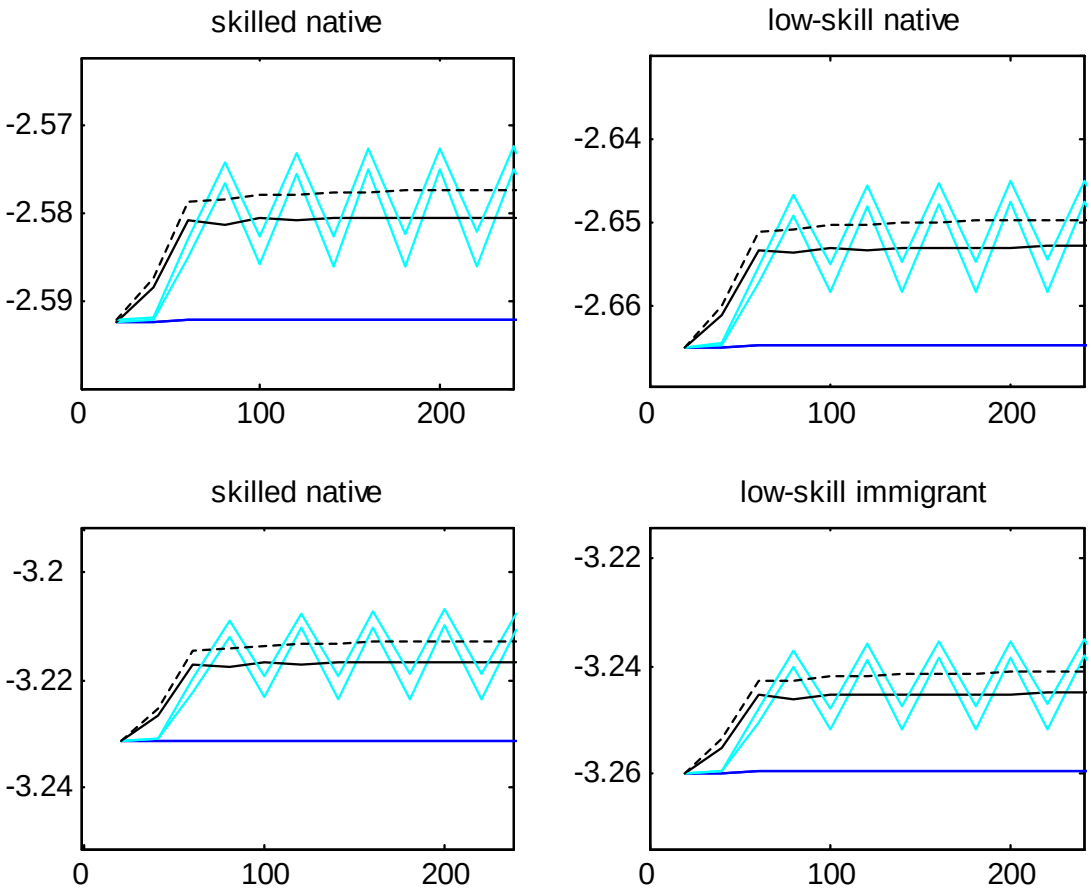

Figure 3: Figure 3. The welfare of (g,s) agents in SQ economy (in blue) and reformed economy with low-skilled migrants (in black) and more high skill migrants (dotted)

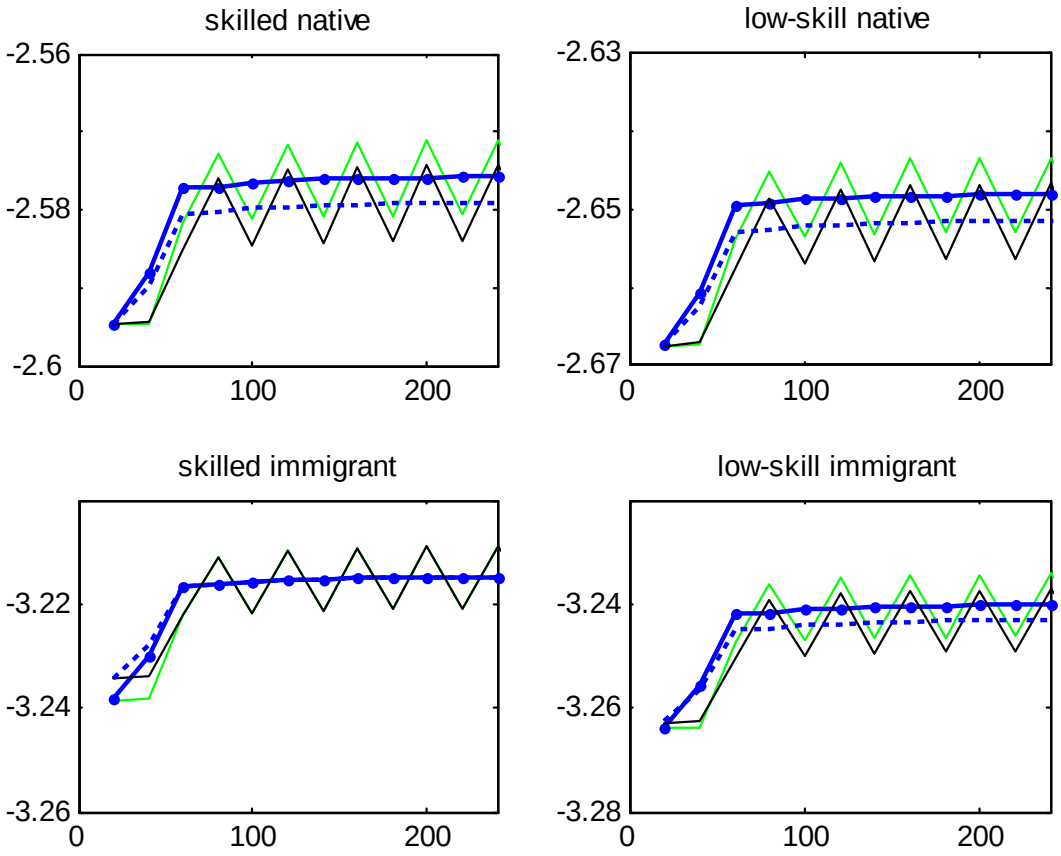

Figure 4: Figure 4. The welfare of (g,s) agents in reformed economy where migrants are out of SS (blue with diamonds) vis-a-vis reformed economy with SS including migrants

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