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ABSTRACT

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Abstract

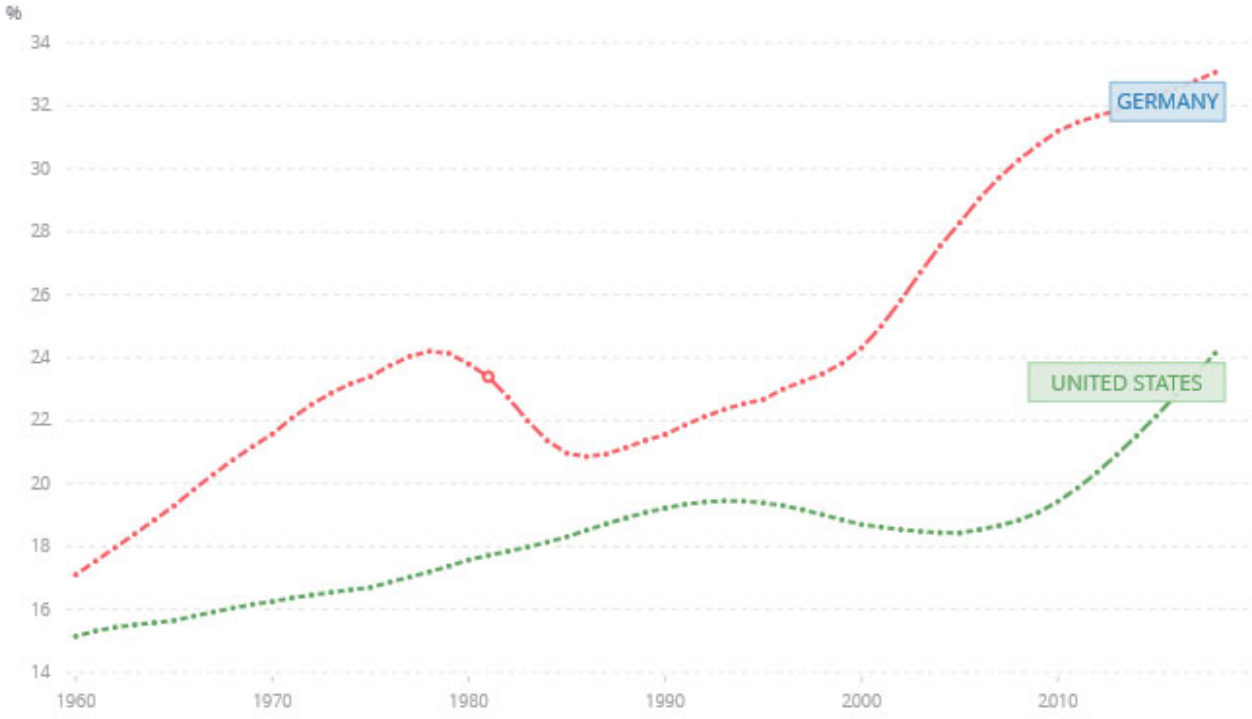
It has been well recognized that population ageing could generate structural changes centered around the dwindling labor force, on one hand, and the expanding dependency on the generosity of the welfare state, on the other hand. Ageing-related welfare state policy entails both fiscal issues and migration issues. The paper employs a general-equilibrium model with a policy-making focus, to help understand the mechanism governing the provision of social benefits, labor income taxation, capital income taxation, migration curbs on low skilled and high skilled, driven by the ageing of the population. Greater generosity of the welfare state comes together with policy, incentive compatible with the interests of the majority voters, of a more liberal migration policy.

I. Introduction

Ageing of the population is a fundamental factor which help determine the generosity of the welfare state. Germany, and EU member states, serve as a real world reference point. In 2010, the proportion of people aged 65 and older constituted in the core EU countries 20.8 percent in Germany, 20.3percent in Italy, 16.8 percent in France, and 16.6 percent in the UK (United Nations, 2013).As a benchmark, this share is only 13.1 percent in the US. Although the population in the US is getting older, and its numbers are growing more slowly, than in the past,

the demographic future for the US is younger than that of the core EU countries. In particular, the US population is projected to grow faster and age more slowly than the populations of its major economic partners in Europe. Figure 1 describes the ageing patterns of Germany (the largest EU economy) compared to the US as a benchmark, in terms of the age dependency ratio.

Figure 1: Old age dependency ratio (% of working-age population): Germany vs. United States

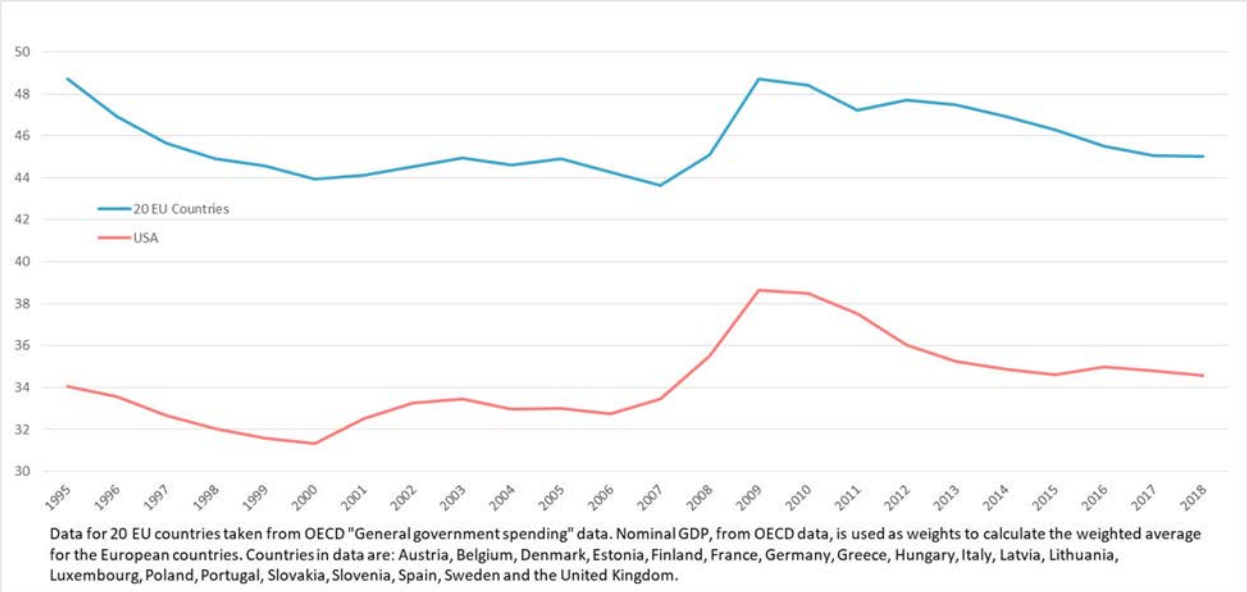


Source: The World Bank.

Concerning welfare-state generosity in advanced economies, Figure 2 compares the EU 20 non-defense government spending per capita, in percent of GDP, with US's per GDP spending, over

the years 1995-2018. . EU spending significantly exceeds the US spending, year by year, indicating that the EU welfare state is overwhelmingly more generous.

Figure 2: General Government Expenditure (Excluding Defense) in percentage of GDP



Milton Friedman famously quipped: "free immigration and a welfare state are incompatible".[1] To mitigate adverse macroeconomic impact of ageing on the labor force, fiscal prospects depend on two forces. The first is the potential for capital deepening through capital imports. The second is through immigration. Whereas capital imports are typically not administratively restricted, labor mobility is constrained by policy. The immigration constraints are typically rooted in the political-economy sensitivities in the host countries. One major reason for immigration restrictions is the negative on native-

[1] See, Razin and Wahba (2014) and Razin (2021).

born employment and wages.[2] Another reason for the rise of policy-based restrictions on immigration is the advent of a generous welfare state.

Welfare-state voters are motivated not only on how migration affects their wage income. That is, since the welfare state redistributes income from the rich to the poor, unskilled migrants, over lifetime, are net beneficiaries of the welfare state. In contrast, skilled (rich) migrants are in general net contributors. Consequently, a under free migration, the migrant skill composition is tilted towards the unskilled; whereas under controlled migration regime, the skill composition is skewed towards the skilled.

However, voters are driven also by how migration bears on the social insurance system, when they retire, become unemployed, etc. Migration effects on the social insurance system are common to voter preferences, regardless of skills. From the public-finance point of view, native-born voters opt for high-skilled migrants to come on shore; whereas, for the unskilled to stay away, to mitigate the fiscal burden on them. Therefore, notwithstanding the common interests in social insurance, the different income effects of migration on voters, every welfare state unavoidably adopts migration regulations and restrictions[3]. As native-born population ageing progress, the welfare state needs more immigrants to sustain the social insurance system. There is a growing share voters depends on social benefits. Consequently, these voters would benefit from loosening restrictions on migration; both high skilled and low skilled.

[2] See the findings in Borjas (2003) and Dustmann et al. (2017) among others, it is in contrast with results in Card (2001, 2005), Foged and Peri (2016), and Ottaviano and Peri (2012), who document that immigrants have a negligible, or even positive, impact on native-born earnings.

[3] See Razin et al. (202a, 2002b).

The purpose of this paper is to provide a macroeconomic framework to understand the effects of ageing on policies regarding the welfare state and migration. The model allows a comparison across different welfare-state and migration policy regimes. Key policy variables are the provision of social benefits, determined jointly with skill-based migration policy. Tax policies, capital mobility, good mobility, and policy, are all endogenously being determined in a general-equilibrium setup. Features analyzed are self-interest income group, ageing, and globalization.

The paper is organized as follows. Section II presents the main blocks of the model. Section III provides an interpretation of the simulations. Section IV concludes.

II. Model

The model brings out essential features of a welfare-state economy, which endures ageing-related shrunken labor force leading to a discrete fall in the "financially autarkic" rate of return on capital (therefore widening the international interest rate differential); which, in turn, generates upward trending of capital outflows. That is, a country which begins as labor-abundant, and capital importer, becomes labor-scarce and capital-exporter as ageing progress. Political-economy effects on taxation, social benefit provision, and migration of the ageing-related increase in the demand for social benefits depends on the relative labor-market skill, and wealth, represented in the group in charge of policy making.

We set a two-period political-economy policy model, with ageing as a driving force, capturing skill based immigration policy jointly and welfare-state redistribution policy, that are determined

through majority voting[4]. The government provides a uniform social benefit. Capital income tax is proportional whereas the average rate of the labor income tax progresses from low-skilled wage to high-skilled wage.

II.1 Income groups

In order to consider redistribution issues, which are at the heart of the welfare state, we assume that there minimally are two types of individuals -- low skilled-poor (indexed$u$) and high skilled –rich (indexed s). The workers have two types of skills—low (l) and high (h). There are three types of factors of production—capital (K) high-skilled labor (L_H), and low-skilled labor (L_H).[5]

Each high-skill individual is endowed with $\bar{x}_s$units of good x, and $\bar{y}_s$ units of good y, respectively, in the first period; a low-skill individual is endowed with only $\theta < 1$ units of a skilled individual's

[4] This is a typical Heckscher-Ohlin trade model. Using public opinion polls conducted in the United States, Steve and Slaughter (2001) and O'Rourke (2003), find support for hypotheses derived from the Heckscher-Ohlin trade model. Specifically, they find that there is a robust skills cleavage over immigration policy, with highly skilled workers being less likely to support restricting immigration policies and low-skilled counterparts more likely to do so; and these effects of immigration on workers at different skill levels are consistent with the model. Their findings suggest 'the potential for immigration politics to be connected to the mainstream redistributive politics over which political parties often contest elections.

5 Confining considerations to factor rewards under the standard complementarity—substitution specification of production functions, low skill labor, and capital, benefit from high skill immigration, whereas high skill labor loses. However, such narrow benefit-lose calculation abstracts from the general-equilibrium effect factor allocation across sectors, international capital flows and from the fiscal aspects associated with the welfare state.

wealth endowment. Thus, a skilled-rich individual enjoys both higher initial endowment ("wealth"), and higher labor market skill than the unskilled-poor individual.

Ageing leads to increasing dependency ratio – the ratio of retirees to workers- is the main driving force in our analysis.

To capture the essence of ageing, we assume an idiosyncratic shock in the second period so that, with certain likelihood the individual retires from work.

The overall size of the initial native-born population is normalized to one, where a proportion λ of the population is of high skill and a proportion $1-\lambda$ is of low skill. We denote by m_s the number of high-skill migrants and by m_l the number of low-skill migrants. We denote the number of high-skill immigrants, m_S, and low-skill immigrants, m_L .

II.2 Dependents

The welfare state provides universal social benefits, paid by tax on labor income and tax on capital income. There are two periods. We assume that everyone works in the first period. As for the second period, with a probability $\emptyset$, an individual is out of work, earning no wage income. The individual draws on the earned income which is saved from the first period. We label this individual as dependent, because relative to others in the same skill group, the individual spending draws more the welfare-state social transfers. To capture dependency on the social insurance through retirement, unemployment, disability, etc., we assume that there is an individual idiosyncratic shock. The probability of non-work realization is also the share of dependents in the population. Because migrants typically come in young and productive, the non-working shock does not apply to them.

II.3 Immigration

Immigrants, who bring with them no capital, consume only in the second period, and their utility function is given by:

$$u = (c_{x2})^{\alpha}(c_{y2})^{1-\alpha} + dB^{\gamma}$$

Consumption functions are:

$$(1a) \quad c_{xmS2} = a(1 - t_{LS})(w_H),$$

and

$$(1b) \quad c_{ymS2} = (1 - a)(1 - t_{LS})(w_H/\mathrm{p})$$

$$(1c) \quad c_{xmL2} = a(1 - b)(1 - t_{LL})(w_L),$$

and

$$(1d) \quad c_{ymL2} = (1 - a)(1 - b)\,(1 - t_{LL})(w_L/\mathrm{p})$$

Where t_{LS} and t_{LL} denote wage proportional wage tax rates on high-skill and low-skill, respectively.

The exogenously given pair u_H^*, u_L^* of utility levels attained by S-individuals and L-individuals, respectively, in foreign residence. The number of high skilled immigrants depends positively on the foreign-domestic utility differential, $u_{sm} - u_S^*$; and number of low skilled immigrants depends positively on the foreign-domestic utility differential $u_{Lm} - u_L^*$.

Under the free migration regime, the number of migrants are determined as follows.

$$m_H = Z_H(u_{mH} - u_H^*)^{z_H} \qquad \text{with } Z_H > 0,\ 0 < z_H < 1. \tag{2}$$

$$m_L = Z_L(u_{Lm} - u_L^*)^{z_L} \qquad \text{with } Z_L > 0,\ 0 < z_L < 1.$$

For consistency, under a controlled-migration regime, m_H and m_L are policy controlled variables. The migration quotas must be chosen so that

$$u_{mH} - u_H^* < \left(\frac{m_H}{Z_H}\right)^{-z_H}, \text{ and } u_{mL} - u_L^* < \left(\frac{m_L}{Z_L}\right)^{-z_L}. \tag{3}$$

II.4 Production and investment

To enable us to consider trade in goods we assume that there minimally are two tradable goods (x and y). In the absence of uncertainty and differentiated products, each sector will either export or import its standard product, but not both at the same time. World prices of x and y are exogenously given for our small open economy with good x serving as a numeraire, whose price is normalized to one, and the world price of y is denoted by p*. There is an impediment to trade in goods.

Specifically, goods can be exported, but again only at some border related friction cost (e.g., country specific standards, regulations, etc.). For concreteness of the notation, we consider y as an export good. A similar and straightforward notation applies when x is the export good.[6] We denote this cost per unit of price by δ_y, so that the domestic price of the export good y is

$$p_t = \frac{p^*}{(1+\delta_y)}. \quad (4)$$

A representative firm produces well g according to a constant-returns-to scale technology:

$$(5) \qquad g = A_g F_g\left(K_g, L_{Hg}, L_{Hg}\right) = A_g K_g^{\alpha_g} L_{Hg}^{\rho_g} L_{Lg}^{1-\rho_{g-\alpha_g}}, \quad g = x, y,$$

Where, K_g is the input of physical capital, and L_{Hg} is high-skill labor, and L_{Lg} is low-skill labor, used in the respective production process. $A_g > 0$ Is a total factor productivity coefficient, and α_g , ρ_g , and $1-\rho_g$ - α_g are, respectively, the capital, high-skill labor, and low-skill labor shares in the sector producing$g$.

Capital is employed together with labor in the first period with output generated in the second period. We assume that labor is paid in the second period, at the end of the production process.

Capital (K) is a composite good, produced in the first period is of a variable mix of x_k and y_k, according to:

[6] By the Lerner Symmetry proposition, any wedge between the domestic and the world prices applied to importable goods, is equivalent to a wedge between world and domestic prices applied to exportable goods.

(6) $K = x_k^{\beta} y_k^{1-\beta}$, where $0 < \beta < 1$.

To find the cost minimizing mix of x and y, of which a unit of capital (K) is composed of, one, has to solve the following problem:

$$\min_{(x,y)}(x_k + p_1 y_k)$$

Subject to:

$$x_k^{\beta} y_k^{1-\beta} \geq 1 ,$$

Where p_t is the domestic price of y in period $t = 1,2$.

Solving this problem yields also the unit price p_k of capital as

(7) $p_k = D p_1^{1-\beta}$,

where $D = (\frac{1-\beta}{\beta})^{\beta} + (\frac{\beta}{1-\beta})^{1-\beta}$.

Demands for labor and capital are given, respectively, by the marginal productivity conditions in both sectors. Note that because labor and capital move freely between the two sectors, then the factors of production earn the same remuneration across sectors, that is:

$$w_H = (\rho_x) A_x k_{Hx}^{\alpha_x} l_{Lx}^{1-\rho_{x-}\alpha_x},$$

(8a) $$w_H = p_2(\rho_y)A_y k_{Hy}^{\alpha_y} l_{Ly}^{1-\rho_y-\alpha_y}$$

(8b) $$w_L = (1-\alpha_x-\rho_x)A_x k_{Hx}^{\alpha_x} l_{Lx}^{-\rho_x-\alpha_x}$$

$$w_L = (1-\alpha_y-\rho_y)A_y k_{Hy}^{\alpha_y} l_{Ly}^{-\rho_y-\alpha_y}$$

(9) $$p_k(1+r) = \alpha_x A_x k_{Hx}^{\alpha_x-1} l_{Lx}^{1-\rho_x-\alpha_x},$$

(10) $$p_k(1+r) = p_2\alpha_y A_y k_{Hy}^{\alpha_y-1} l_{Ly}^{1-\rho_y-\alpha_y},$$

Where k_g is the capital- labor ratio in sector g, that is $k_{Hg} = \frac{K_g}{L_{Hg}}$; $l_{Lg} = \frac{L_{Lg}}{L_{Hg}}$; w_H is high-skill wage rate, paid in the second period (after the completion of the production process); and w_L is low-skill wage rate, paid in the second period after the completion of the production process. Note that for simplicity we assume that capital fully depreciates at the end of the production process.

II.5 Saving behavior

We denote by c_{gi1} the consumption of good g = x , y by an individual of type i = u,s in period t = 1,2. All native-born individuals have identical preferences, given by

(11) $$u_i = (c_{xi1}{}^{a} c_{yi1}{}^{1-a})^{b} (c_{xi2}{}^{a} c_{yi2}{}^{1-a})^{1-b} + dB^{\gamma},$$

Where, $0 < a < 1$, $0 < b < 1$, $d > 0$, $\gamma > 0$, and B is a uniform social benefit (provided in an equal amount to all individuals), assumed (for simplicity) to be provided in the second period only. This social benefit captures the various ingredients that a welfare state provides, such as health services, education, in-kind transfers, etc. Note that the social benefit is not a perfect substitute to private consumption[7].

The consumption basket remains the same across period 1 and 2. Therefore, we can aggregate consumption goods into a consumption composite:

$C_t = C_{xt}^{a} C_{yt}^{1-a}$, t = 1, 2

The composite price is $p_t = \Gamma_p p_{xt}^{a} p_{yt}^{1-a}$

With,

$\Gamma_P = \frac{1}{a^{a}(1-a)^{1-a}}$, , t = 1,2.

[7] In our model, the redistribution made by the welfare state is in the form of an in-kind benefit. There are other aspects of the social insurance system that we abstract from. For example, in Europe the welfare system is more in the tradition of Beveridge (based on universal at benefits). In some non-European countries, the system is mainly Bismarkian (based on benefits related to past contributions). Since social contributions are related to individual incomes, the more Beveridgean welfare systems have a higher implicit income redistribution. See Cremer and Goulão (2014).

The (two-state) idiosyncratic shock ∅, which occurs in the second period, is indexed ϵ, where, $\epsilon = W$, if the individual works, or $\epsilon = R$, if the individual retires from work; with the probability of the non-working state, ∅, and the probability of the working state, 1 - ∅.

The Individual household I seeks to maximize the expected utility

(12) $U_i = C_{1i} + \beta \mathbf{E}_{\epsilon}[\boldsymbol{log} C_{2i}(\epsilon)]$,

Subject to

$C_{1i} + S_{1i} = \bar{x}_i + p\,\bar{y}_i$, and

$$S_i[1 + (1 - t_k)r] + (1 - t_{Li})w_i = p_2 C_{W2} \text{ , if } \epsilon = W$$

$$S_i[1 + (1 - t_k)r] = p_2 C_{R2} \text{ , if } \epsilon = R,$$

Where, the proportional tax on labor income is t_{Li} , and the capital income of residents and foreigners (from domestic sources only) is taxed at a flat rate t_k; C_{ti} represents period- t consumption spending, S_i denotes period-1 domestic saving of individual I, and $\mathbf{E}_{\epsilon}$ denotes the expectation operator for the distribution function of the non-working shock ϵ; ; I = S, L..

II.6 Capital Flows

Recall that the welfare-state fiscal prospects depend on two factors, in order to mitigate adverse macroeconomic impact of ageing. The first is the potential for capital deepening. The second is increased immigration. Domestic capital deepening depends in and out capital flows.

As usual, capital flows are driven by net-of-tax rates of return. Capital does flow internationally, but at some cost $\delta_k > 0$ per unit. The net return on investing into domestic capital is $1 + r(1 - t_k)$ for investors, where r is the domestic interest rate. A domestic individual who invests abroad can thus gain only $1 + (1 - t_K^*)r^* - \delta_k$, where r^* is the world interest rate and t_K^* is the tax rate, levied abroad under a source-based taxation. In a small, open economy context, the two (exogenous) variables t_K^* and r^* play an equivalent role, where the only relevant variable is $R^* = (1 - t_K^*)r^*$, which is the net of tax international interest rate. We assume that the cost of capital flows applies symmetrically to foreign investors, i.e. their return on investment in the domestic country is given by $1 + (1 - t_K)r - \delta_k$, where investing abroad yields a return R^*.

The small open economy exports capital in case:

$$(13a) \qquad (1 - t_K)r = R^* - \delta_k.$$

This means that $(1 - t_K)r - \delta_k < R^*$, and therefore foreigners do not invest in the domestic economy.

Similarly, the small open economy imports capital in case:

$$(13b) \quad (1 - t_K)r - \delta_k = R^*.$$

This means that $(1 - t_K)r > R^* - \delta_k$, and therefore the residents of the small open economy do not wish to invest abroad.[8]

II.7 Current Account

First-period current account surplus is given by:

$$(14) \qquad (1-\lambda)(\bar{x}_u + p_1\bar{y}_u) + (\lambda)(\bar{x}_s + p_1\bar{y}_s) - (1-\lambda)\big(c_{xu1} + p_1 c_{yu1}\big) + (\lambda)\big(c_{xs1} + p_1 c_{ys1}\big) + p_k(K_x + K_y) = [(1-\lambda)S_u + (\lambda)S_s] - p_k(K_x + K_y).$$

[8] Ageing-related decline in the labor force brings about two reinforcing factors which effect capital outflows: the "international interest-differential effect", and the "relative factor endowment" effect.

Note that when the country exports capital (that is, $(1-\lambda)S_u + (\lambda)S_s > p_k(K_x + K_y)$, then it incurrs the cost of δ_k on its capital exports. Conversely, when foreigners invest in the domestic economy (that is, $(1-\lambda)S_u + (\lambda)S_s < p_k(K_x + K_y)$), then the country pays foreiners only $1 + (1-t_k)r$, because they are taxed on their income originating in the domestic economy; foreigners bears the friction cost δ_k in this case.

Second period resource constraint is given by:

$$(15) \qquad (1-\lambda)\left(c_{xu2} + p_2 c_{yu2}\right) + (\lambda)\left(c_{xs2} + p_2 c_{ys2}\right) + m_H(pc_{xmS2} + c_{ymS2)}$$
$$+ m_L((pc_{xmL2} + c_{ymL2)} + dc_{dep} + (1 + m_L + m_H + d)\,B$$
$$= F_x(K_x, L_x) + p_2 F_y\left(K_y, L_y\right) + [\,(1-\lambda)S_u + (\quad)S_s - p_k(K_x + K_y)]\,I_{CF}$$

$$(16) \qquad I_{CF} = \begin{cases} 1 + R^* - \delta_k & if \;\; (1-\lambda)S_u + (\lambda - m_S)S_S \geq p_k(K_x + K_y) \\ 1 + (1-t_k)r & if \;\; (1-\lambda)S_u + (\lambda - m_S)S_S \leq p_k(K_x + K_y) \end{cases}.$$

II.8 Policy Instruments

Finally, consider the government, which is active in a balanced-budget way only in the second period. Its budget constraint is:

(17)

$$(1 + m_H + m_L + d)B = t_{LL}(w_L((1-\lambda)\emptyset + m_L) + t_{LS}w_S(\lambda\emptyset + m_S) + t_k r p_k(K_x + K_y)\,.$$

Note that the government taxes capital income of both domestic residents and foreigners which originates in the domestic economy, $rp_k(K_x + K_y)$. This means that when saving of domestic residents exceeds domestic investment, $p_k(K_x + K_y)$, with the excess invested abroad, then this excess is not taxed at home. Conversely, when savings of domestic residents fall short of domestic investment, $p_k(K_x + K_y)$, with the shortage financed by foreigners, then this shortage is taxed by the domestic government.

The available policy instruments are the number of high-skilled migrants, m_H, the number of low -skilled migrants, , m_L, the labor income tax rates, t_{LS} and t_{LL} (proportional wage tax rates on high-skill and low-skill, respectively) , the capital income tax rate, t_k, and the scale of the social benefit, B. Labor income tax is progressive (measured by the difference in the average rate differential t_{LS} - t_{LL} > 0), whereas capital income tax (t_k) is proportional.

Note also that the government taxes capital income of both domestic residents and foreigners which originates in the domestic economy, $rp_k(K_x + K_y)$. This means that when saving of domestic residents exceeds domestic investment, $p_k(K_x + K_y)$, with the excess invested abroad, then this excess is not taxed at home. Conversely, when savings of domestic residents fall short of

domestic investment, $p_k(K_x + K_y)$, with the shortage financed by foreigners, then this shortage is taxed by the domestic government.

We abstract from a tax on the initial endowments because these are in fixed supply at the beginning of the first period, and a tax on them is not distortive; it will tend to be extremely high. Furthermore, when the low-skill form the majority, they will tax them at a rate of 100%. For a similar reason, we abstract also from a tax on consumption (VAT) because it is equivalent to a tax on wages (which are taxed directly in our model), and a tax on the initial endowments (see, for instance, Frenkel, Razin and Sadka (1991)).

III. Comparing Policy-Making Regimes

In what follows, the main results are summarized in table1 and 2., each followed by graphs of the numerical simulations, to provide details.

III.1 Ageing and Social Benefit provision

Table 1: Effects of Increase Ageing on Social Benefit Provision

	Low Dependency State		**High Dependency State**

POOR **policy maker**	**-** **(Capital-Import State),** **+** **(Capital-Export State)**		**+**
RICH **policy maker**	**+**		**+**

The Table demonstrates that ageing boosts, or lessens social-benefit provision according to the identity of the policy maker representing either the rich or the poor, the greater need for the social benefit when the probability of retirement grows, the ability to tax the foreigners who invest in the domestic economy, and the ability o a rich policy maker to tax the wage of low-skill labor and vice versa, for the case of a poor policy maker. To finance dwindling tax revenue when more people retire high-skilled naturally attempt to impose on the low skill higher wage tax to finance

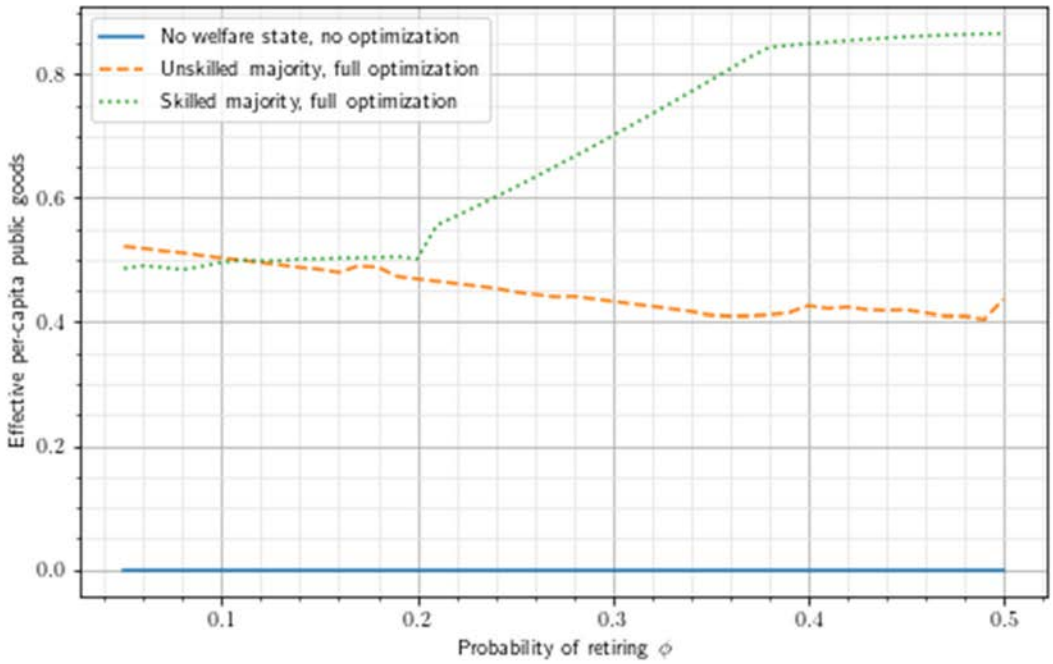
the ageing-related dwindling tax revenue when the high skilled are in a political power. They definitely are not interested tin a higher tax on capital that will reduce their net income from savings. When the low skill are in a political power, they impose on the high skill higher wage tax to finance the dwindling tax revenue when more people retire, and the increased provision of social benefit (per capita) because of greater income needs when they retire.

The capital import state the capital tax burden is shared with foreigners. Imposing tax on capital income has a Laffer-Curve effect on capital-income tax revenue.

If the POOR are policy makers, ageing also increases the provision of social benefit (per capita) in the high dependency state because of greater income needs when they retire. To finance the dwindling tax revenue when more people retire, they impose on the high skill higher wage tax to finance the dwindling tax revenue when more people retire. In the capital import state some of the capital tax burden is shared with foreigners. Imposing tax on capital income has a Laffer-Curve effect on capital-income tax revenue. In the low-dependency state overlapping with capital import state, the POOR will need to tax their wage income to sustain more generous retirement income—they cost exceeds the benefit. The RICH who are providing less generous retirement transfers than the POOR (and need smaller tax revenue) are on the more significant revenue –increasing segment of the capital tax Laffer curve.

To gain further insight into the results of the simulations it is worth to note that if the ageing parameter (the ∅-parameter) attains low values and the labor force is relatively large, the country imports capital from the rest of the world; whereas for large values of the ageing parameter (the ∅-parameter), the country become a capital exporter.

Figure 3: Provision of social benefits



Note: For ∅-parameter values falling short of 0.2 the economy imports capital. For ∅-parameter values exceeding 0.35 the economy exports capital. For ∅-parameter values in between 0.2 and 0.35 the economy is in financial autarky. For the model's parameter values, see Appendix.

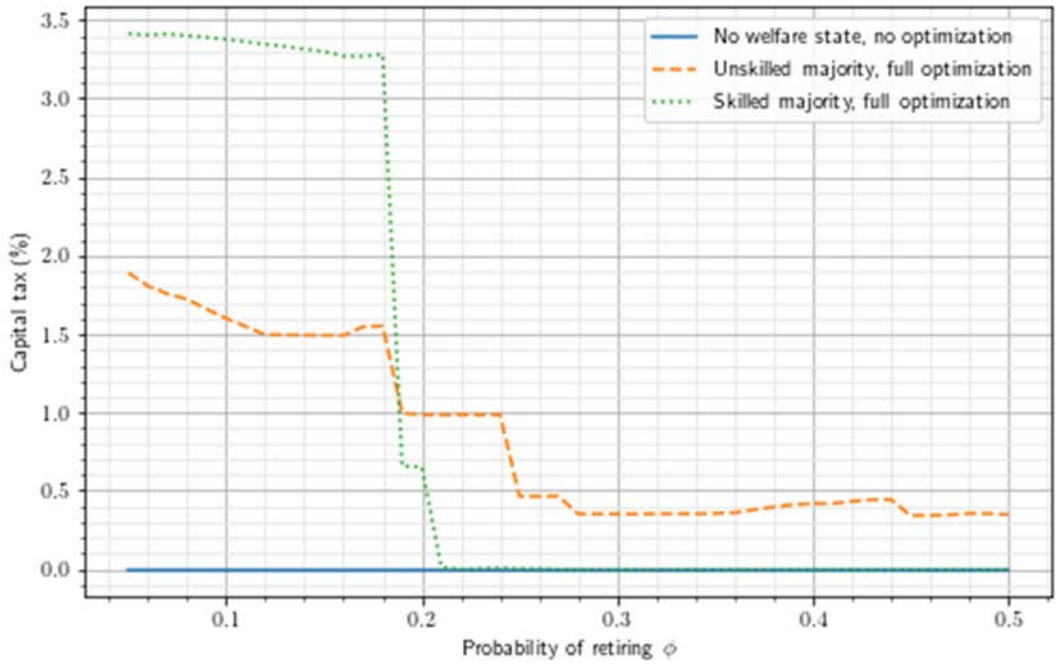
Figure 3 shows that,

1. The high-skilled regime provides greater social benefits than the low-skilled regime (under capital imports triggered by low values of the ageing parameter (the ∅-parameter) , social-benefit provision is approximately similar for both regimes).

2. For high ageing state, increasing the ageing parameter (the ∅-parameter) raises social-benefit provision in both the high-skilled regime and the low-skill regime (but, ageing lowers the provision in the low-skilled regime with low range of values values of the ∅-parameter) .

Ageing reinforce the demand for greater provision of social benefits, and strengthen these tendencies. In the following Figures we compare the high skilled regime policies with the low-skilled regime policies, through varying the retirement-likelihood parameter, ∅.

Figure 4: Capital income tax: high skilled majority vs. low-skilled majority



Note: For ∅-parameter values falling short of 0.2 the economy imports capital. For ∅-parameter values exceeding 0.35 the economy exports capital. For ∅-parameter values in between 0.2 and 0.35 the economy is in financial autarky. For the model's parameter values, see Appendix.

Figure 4: demonstrates that, indeed, ageing drives down taxation of capital income.

1. The capital tax rate set by the high-skilled, rich, policy making is higher than the rate set by the low-skilled majority if the country is capital importer. The capital tax rate is set equal to zero set by the high-skilled majority if the country is capital exporter.

2. Increasing the ageing parameter (the ∅-parameter) lowers the capital tax rate set by the high-skilled majority if the country is capital exporter. Increasing the ∅-parameter lowers the rate of tax on capital by the low-skilled majority, regardless of whether the country exports or imports capital.

Figure 5: **low-wage tax rate: high skilled majority vs. low-skilled majority**7

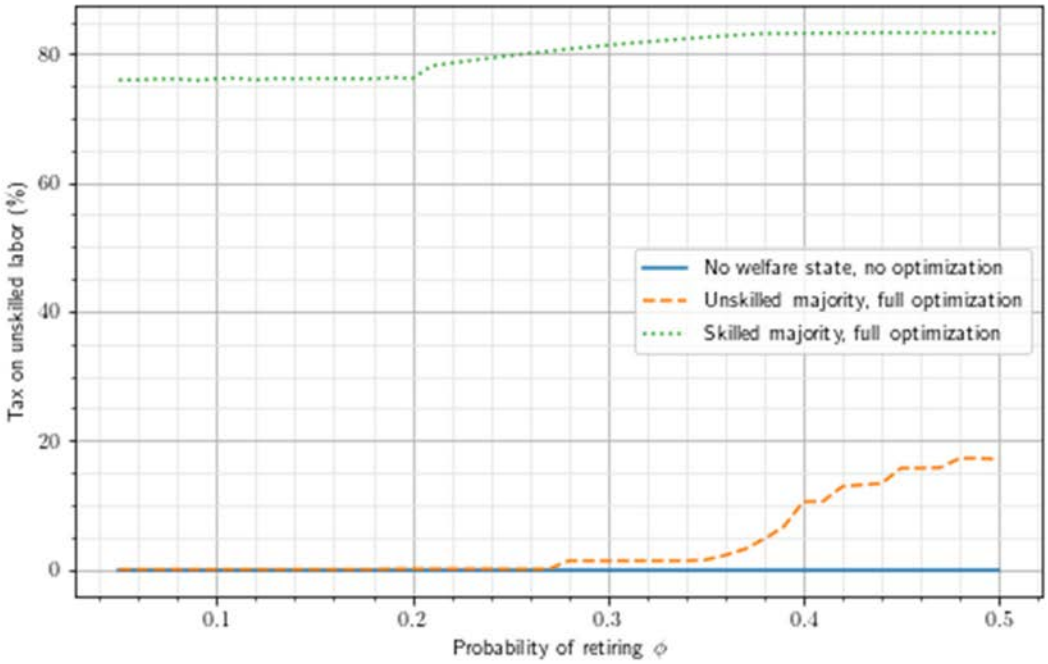


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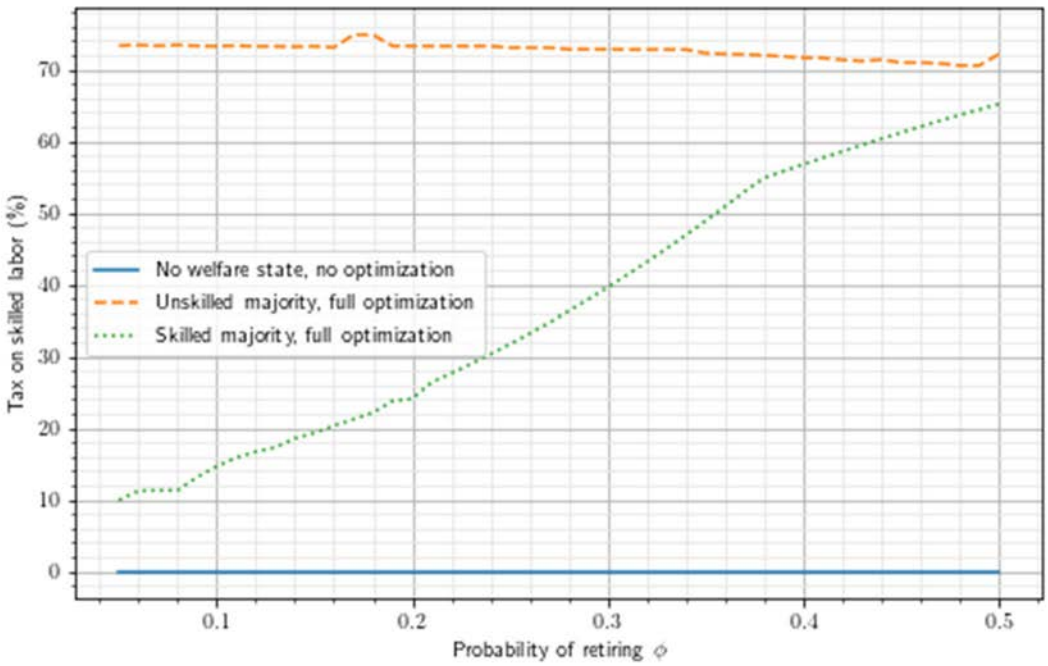
Figure 5 demonstrates that,

1. The low-wage tax rate set by the high-skilled majority is higher than the rate set by the low-skilled majority.

2. Increasing the ∅-parameter raises the low-wage tax rate under both the high-skilled and low-skilled regimes.

Figure 6: **High-wage tax rate: high skilled majority vs. low-skilled majority**



Note: For Ø-parameter values falling short of 0.2 the economy imports capital. For Ø-parameter values exceeding 0.35 the economy exports capital. For Ø-parameter values in between 0.2 and 0.35 the economy is in financial autarky. For the model's parameter values, see Appendix.

Figure 6 demonstrates that,

1. The high-wage tax rate set by the high-skilled majority is lower than the rate set by the low-skilled majority.

2. Increasing the Ø-parameter raises the high-wage tax rate by the high-skilled but lowers the rate set by low-skilled regime.

III.2 Ageing and Migration Policy

Main effects of ageing on migration policy are summarized in Table 2.

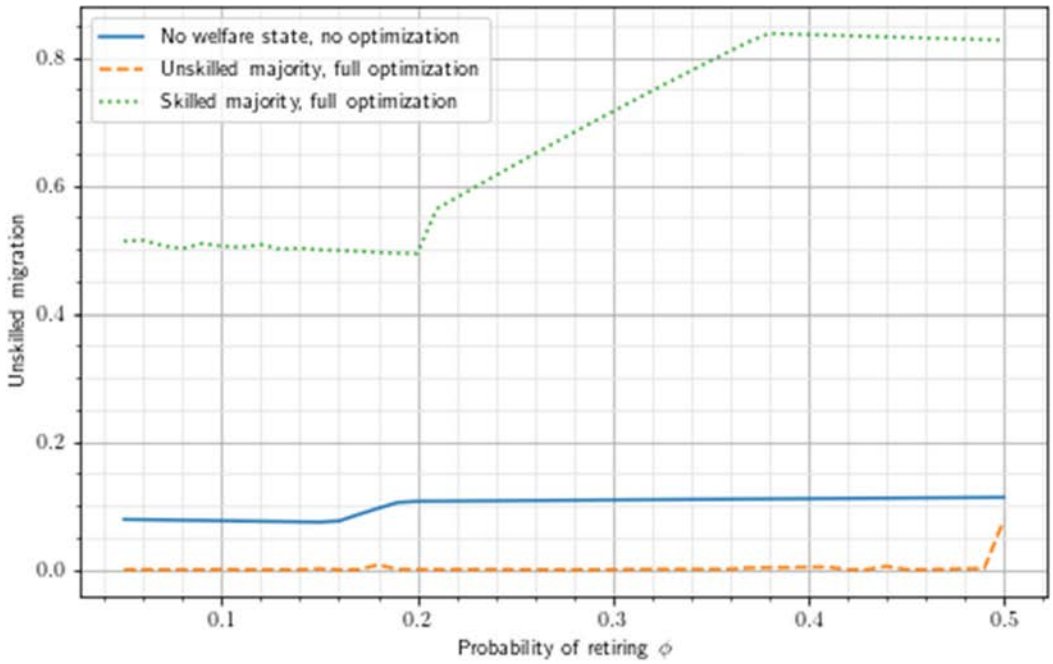
Table 2: Increased Ageing and Skill-based Migration Numbers

Migration/ageing		**Low-Ageing state**		**High- Ageing state**
Number of Low - Skill Migrants		**S-regime > Zero B regime > U-regime**		**S-regime > U-regime > Zero B regime**
Number of High-Skill Migrants		**S-regime < Zero B regime < U-regime**		**S-regime < U-regime < Zero B regime**

Note: S-regime refers to the regime where rich are the policy makers; U-regime refers to the regime where the poor are the policy makers; and, Zero B regime refers to the regime with zero provision of social benefits.

When ageing of the native population rises, the dwindling labor force requires drives up demand for migrants. The consequent rise in the welfare state generosity strengthens this force. If the rich are in charge of the migration policy making, in both the high-ageing state and the low–ageing state they are biased towards relying on low skill migrants more than on the competing high-skill labor. If the poor are in charge of the migration policy making, in both the high-ageing state and the low–ageing state they are biased towards relying more on high skill migrants more than on the competing low-skill labor. Interestingly, in the low-ageing state, the no-welfare state regime migration policy is purely based on substitution-complementarity consideration for the labor market migration effects, the Zero-B regime separates the S-regime and the U-regime in terms of migrant numbers.

Figure 7: low-skilled-migration quota: high-skilled majority and low-skilled majority



Note: For ∅-parameter values falling short of 0.2 the economy imports capital. For ∅-parameter values exceeding 0.35 the economy exports capital. For ∅-parameter values in between 0.2 and 0.35 the economy is in financial autarky. For the model's parameter values, see Appendix.

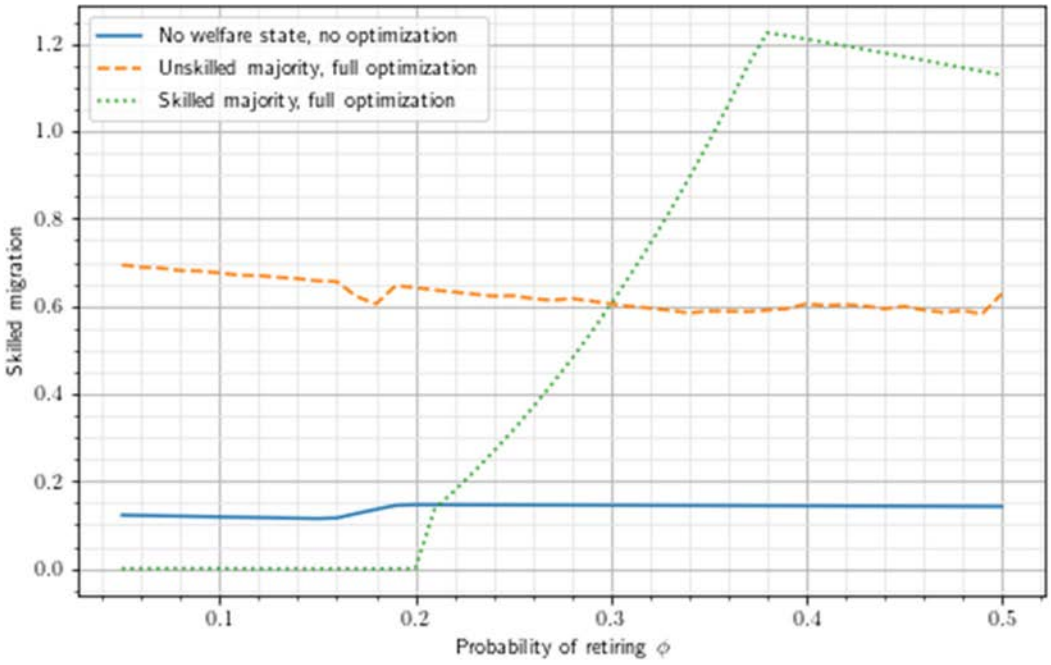
Figure 7 shows that,

1. Low skill in- migration numbers are larger under high-skill, rich, policy making then under low-skill, poor, policy making; whereas the numbers under no-social benefit regime take an intermediate position in the ranking.

2. The high-skilled set high migration quotas to low-skilled migrants, whereas the low-skilled set the quota equal to zero.

1. Raising the ageing parameter (the ∅-parameter), drives up the low-skill migration quota under the high skill, rich, policy regime; whereas under the policy making set by the low-skill poor the migration quota increses with ageing for high values of the ageing parameter when the scarce-labor effect becomes binding.

Figure 8: high-skilled-migration quota: high skilled majority and low-skilled majority



Note: For ∅-parameter values falling short of 0.2 the economy imports capital. For ∅-parameter values exceeding 0.35 the economy exports capital. For ∅-parameter values in between 0.2 and 0.35 the economy is in financial autarky. For the model's parameter values, see Appendix.

Figures 8 shows that,

1. High skill in- migration numbers are smaller under high-skill, rich, policy making then under low-skill, poor, policy making; whereas the numbers under no-social benefit regime take an intermediate position in the ranking, for low levels of the ageing parameter (the ∅-parameter) when the country is a capital importer. However, when the country becomes labor scarce, because of high ageing (and it becomes capital-exporter), the migration numbers change: under high-skill, rich, policy making they are larger compared to those set under low-skill, poor, policy making, Under no-social benefit regime these numbers are the lowest.

2. The quota for high-skilled migration set under the high-skilled regime is zero and the quota set by the low-skilled regime is positive if the country imports capital; If the country exports capital, the quota set by the high-skilled regime exceeds the quota set by the low-skilled regime.

3. Increasing the ageing parameter (the ∅-parameter) lowers the high-skilled migration quota set by low-skilled regime; increasing the ∅-parameter lowers the high-skilled migration quota set by the high-skilled regime once the country becomes capital exporter.

IV. Concluding Remarks

The paper employs a general equilibrium policy-making model to understand how migration quotas of low skilled and high skilled, provision of social benefits, labor income taxation, capital income taxation, are endogenously driven by population ageing.

Ageing generates structural changes whereby a country which begins as labor-abundant becomes labor-scarce. In a parallel fashion, the country which begins as a capital-importer becomes with increased ageing capital-exporter. The paper analyzes effects population ageing on welfare-state policy: provision of social benefits, labor income taxation, and capital income taxation, and migration. The dwindling of the labor force drive up demand for foreign labor to support the distribution of income from the young to the old. Hence migration policy is an integral part of the welfare-state policy.

Population ageing involves also social policy restructuring. Ageing is a particularly pressing issue in countries with a pay-as-you-go system, where pensions are directly financed through social contributions of the working age population. The public pension scheme and the health insurance system will be responsible for a large part of increases in future public debt. To assure the sustainability of the social insurance system, a gradual increase in the statutory retirement age might be inevitable. Public debt issues are not picked up by the present two-period model, like the one in the present paper. The dynamics of ageing and the provision of social benefits, in a public debt dynamic set up, is a subject of future research.

Appendix 1: Simulation model and Parameter values

To simplify the model in the text, the simulation model has a layered production structure with three inputs, two intermediary goods and one final good in each period. This is without much loss of generality, but simplifies the analysis. The final good in each period serves this purpose.

The final good is produced by a Cobb-Douglas production function. Individuals start with an endowment θ_i of the final good, I = 1, 2. The capital good is produced one-to one from the final good, thus reducing the need to track another production function that is not at the core of the analysis.

Preferences are specified as

$$u(c_{i,t}, b) = \frac{c_{i,t}^{1-\sigma} - 1}{1-\sigma} + d_g \frac{(\bar{b})^{1-\gamma_g} - 1}{1-\gamma_g}$$

Provision of social benefit b is:

$$b = \frac{B}{(\sum_i \lambda_i + \sum_m m_m)^{\eta_b}}.$$

B is total government spending on public goods, and $\eta_b \geq 0$ measures to what extent there are congestion externalities in its provision. In particular, for $\eta_b = 0$, the public good would be a pure public good, and for$\eta_b = 1$, only per-person spending on it would be relevant. By setting the value $\eta_b \in (0,1)$, we allow for some returns to scale in public goods provision.

Parameter	Value	Description
σ	1.0	Elasticity of intertemporal substitution
γ_g	1.3	CES parameter public goods
d_g	0.5	Weight public good
β	0.5987369392383787	Discount factor
$\bar{b}$	0.05	Subsistence level of public goods
δ_k	1.0	Depreciation rate

ω_h	0.0	Skilled agents' unskilled endowment
t_k^*	0.2	Foreign capital tax rate
η_b	0.9	Congestion in public goods use
n_u	1.0	Labor endowment unskilled
n_h	1.0	Labor endowment skilled
$n_{u,m}$	1.0	Labor endowment unskilled migrants
$n_{h,m}$	1.0	Labor endowment skilled migrants
p_w^*	1.5	Relative price of goods on the world market
P_w	1.0	Price level abroad
A_w	1.0	MFP final goods abroad
α_x^w	0.5	World market share of x
r^*	3.321942375150668	Interest rate abroad
ξ	0.0	Default risk dependents
μ_u	0.0	Cost of curbing unskilled migration
μ_h	0.0	Cost of curbing skilled migration
μ_{hu}	0.0	Cost of sorting migrants
Δ_y	0.01	Trade wedge

Δ_k	0.01	Capital wedge
γ	-0.30000000000000004	Exponent on public good
d	-1.6666666666666665	Modified weight

Parameters relating to domestic agents

Parameter	Unskilled	Skilled	Description
λ_i	0.5	0.5	Initial population
θ_i	0.1	1.0	Elasticity of immigration
ϕ_i	0.05	0.05	Probability of retiring
$\bar{}\hat{}Ui*$	-10.0	-9.0	Reference utility if migrating abroad
z_i^*	0.5	0.5	Elasticity of emigration
Z_i	0.3	0.3	Scaling factor emigration

Parameters relating to potential immigrants

Parameter	Unskilled	Skilled	Description
Z_m	1.0	1.0	Scaling factor immigration
z_m	0.5	0.5	Elasticity of immigration

U_m^*	-2.255	-2.145	Reference utility of immigrants

Parameters relating to production structure

	Factor shares			Other parameters	
$g =$	Unskilled labor	Skilled labour	Capital	MFP (A_g)	Demand share (α_g)
x	0.3	0.4	0.3	9.0	0.5
y	0.33	0.33	0.34	9.0	0.5

Other parameters

Note: Aan additional layer of production is inserted: Unskilled labor is transformed into unskilled labor services at a rate of 1:1, whereas skilled labor is transformed into skilled labor services at a rate 1:1.5. This ensures that the skilled wage is higher than the unskilled wage. In effect, this is similar to changing n_h to 1.5, but reporting $w_h n_h$as the effective wage.

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