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Abstract

It has been widely recognized that population ageing could generate structural changes centered around a dwindling labor force, on one hand, and an expanding dependency on the generosity of the welfare state, on the other hand. Welfare state policy related to population ageing entails both fiscal and migration issues. This paper employs a general-equilibrium model with a policy making focus to help illuminate the mechanisms governing social benefit provision, labor income taxation, capital income taxation, and migration curbs on low-skilled and high-skilled workers, all driven by population ageing. Greater generosity of the welfare state comes together with a more liberal migration policy when incentives are compatible with the interests of the majority of voters. The effects of ageing on the tax and benefit sides of the welfare state depend on the number of dependents in the population and whether the country is a capital importer (in which case the capital tax burden is shared with foreigners) or a capital exporter (in which case the age-related wage increase skews taxation towards labor income). Low ageing evolution correlates with a relatively labor-abundant country (low retirement), which turns into a labor-scarce country (high retirement). Parallel to the evolution of the labor force, a country that is a capital importer (with a high rate of return) becomes a capital exporter (with a low rate of return). Greater demand for social benefits from an ageing population is balanced against the rising costs of labor income taxation and capital income taxation.

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Ageing and Welfare State Policy: A Macroeconomic Perspective

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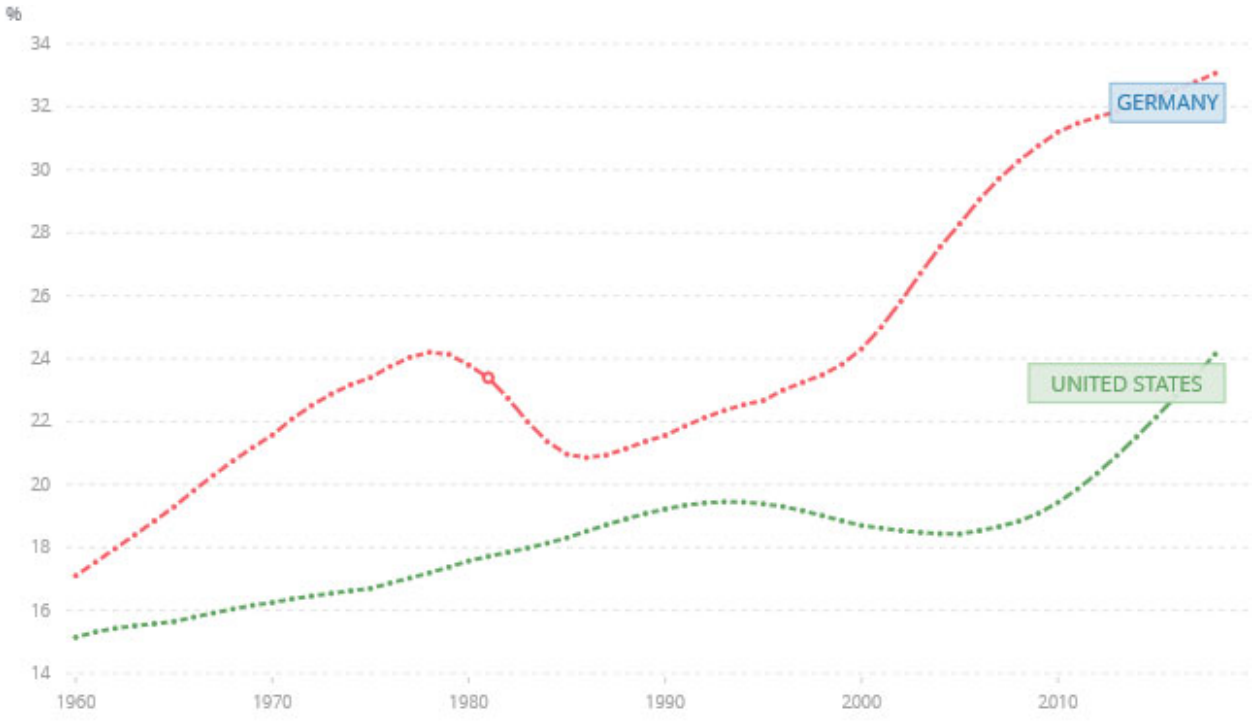
It has been widely recognized that population ageing could generate structural changes centered around a dwindling labor force, on one hand, and an expanding dependency on the generosity of the welfare state, on the other hand. Welfare state policy related to population ageing entails both fiscal and migration issues. This paper employs a general-equilibrium model with a policy making focus to help illuminate the mechanisms governing social benefit provision, labor income taxation, capital income taxation, and migration curbs on low-skilled and high-skilled workers, all driven by population ageing. Greater generosity of the welfare state comes together with a more liberal migration policy when incentives are compatible with the interests of the majority of voters. The effects of ageing on the tax and benefit sides of the welfare state depend on the number of dependents in the population and whether the country is a capital importer (in which case the capital tax burden is shared with foreigners) or a capital exporter (in which case the age-related wage increase skews taxation towards labor income). Low ageing evolution correlates with a relatively labor-abundant country (low retirement), which turns into a labor-scarce country (high retirement). Parallel to the evolution of the labor force, a country that is a capital importer (with a high rate of return) becomes a capital exporter (with a low rate of return). Greater demand for social benefits from an ageing population is balanced against the rising costs of labor income taxation and capital income taxation.

I. Introduction

Population ageing is a fundamental factor in determining the generosity of the welfare state. On this subject, Germany and other EU member states serve as a reference point. In 2010, the proportion of people aged 65 and older was 20.8 percent in Germany, 20.3 percent in Italy, 16.8 percent in France, and 16.6 percent in the UK (United Nations, 2013). As a benchmark, this figure is only 13.1 percent in the US. Although the US population is getting older and growing more slowly than in the past, the United States' demographic future is still younger than that of 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 economy in the EU) in terms of the age dependency ratio, compared to the US as a benchmark.

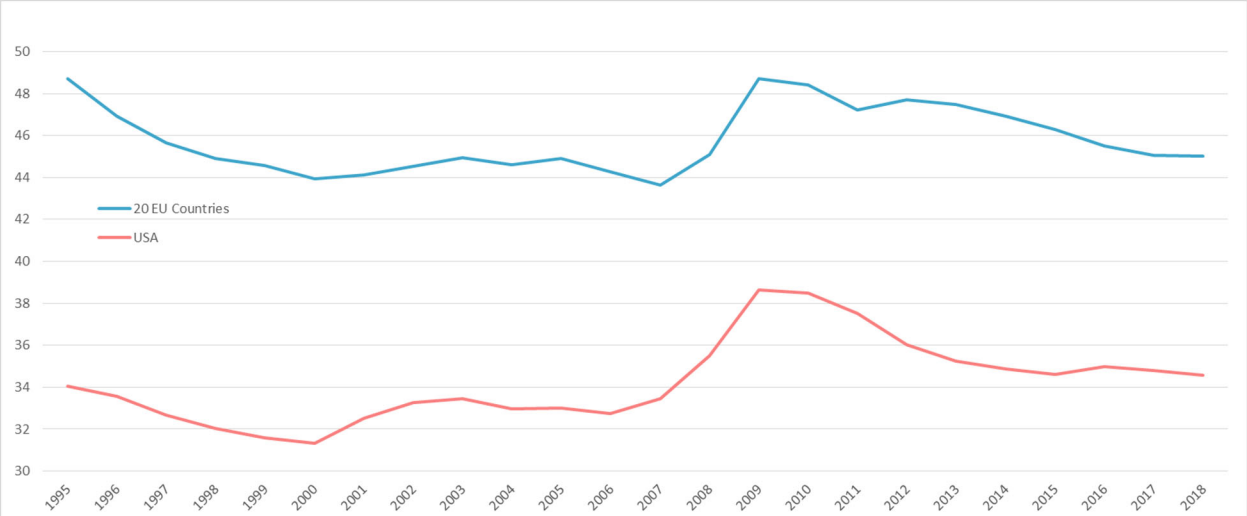
Figure 1: Old age dependency ratio (% of working-age population): Germany vs. United States



Source: The World Bank.

Concerning welfare state generosity in advanced economies, Figure 2 compares non-defense government spending per capita as a percentage of GDP for 20 EU countries versus the US from 1995-2018. The figure demonstrates that EU spending has significantly exceeded US spending year after year, indicating that the EU welfare state is overwhelmingly more generous.

Figure 2: General Government Expenditure (Excluding Defense) as a Percentage of GDP



Data for 20 EU countries taken from OECD "General government spending" data. Nominal GDP, from OECD data, is used as weights to calculate the weighted average for the European countries. Countries in data are: Austria, Belgium, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Italy, Latvia, Lithuania, Luxembourg, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden and the United Kingdom.

Razin and Wahba (2015) and Razin (2021) utilize the data on free labor movement within the European Schengen Area and restricted movement outside the Area to compare the free migration regime with the restricted migration regime. They find strong support for the "magnet hypothesis" under the free migration regime and the "fiscal-burden hypothesis" under the restricted migration regime even after controlling for differences in educational quality and returns to skills in source and host countries.[1] Welfare state voters are motivated partially by how migration affects their wage income. That is, since the welfare state redistributes income from the rich to the poor, unskilled migrants, over their lifetime, are net beneficiaries of the welfare state. In contrast, skilled (rich) migrants are generally net contributors. Consequently, under free migration, migrant skill composition is tilted towards the unskilled, whereas under a controlled migration regime, it is skewed towards the skilled. Results of empirical studies on low-skill migration effects on wages are mixed. Findings in Borjas

[1] Recall that Milton Friedman famously quipped: “free immigration and a welfare state are incompatible”.

(2003) and Dustmann et al. (2017), among others, 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. [2]

To mitigate the 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 immigration. Whereas capital imports are typically not administratively restricted, labor mobility is constrained by policy. Immigration constraints are typically rooted in the political economy sensitivities of host countries. One major reason for immigration restrictions is the potential for negative impact on native-born employment and wages. Another reason for the rise of policy-based restrictions on immigration is the advent of a generous welfare state.

However, voters are also driven by how migration bears on the social insurance system when they retire, become unemployed, etc. The effects of migration on the social insurance system are common to voter preferences regardless of skill level. From the public-finance point of view, native-born voters opt for an influx of high-skilled migrants and oppose low-skilled migrants in order to mitigate the fiscal burden on themselves. Therefore, notwithstanding the common interest in social insurance and the different income effects of migration on voters, every welfare state unavoidably adopts migration regulations and restrictions.[3] As the ageing of the native-born population progresses, the welfare state requires more immigrants to sustain its social insurance system. There is a growing share of voters dependent on social benefits who would benefit from loosening restrictions on migration for both high- and low-skilled workers.

[2] For a brief survey of related empirical literature, the reader is referred to Appendix 1.
[3] See Razin et al. (2002a, 2002b).

This paper provides a macroeconomic framework to illuminate the effects of ageing on policies regarding the welfare state and migration. A parsimonious model allows a comparison across different welfare state and migration policy regimes. The provision of social benefits, determined jointly with skill-based migration policy, are the key policy variables. Furthermore, the provision of social benefits, wage income tax, capital income tax, international capital mobility, and international trade are endogenously determined in this general-equilibrium setup. The economic interests of various income groups as ageing progresses is a policy-related feature.

The paper is organized as follows. Section II presents the main blocks of the model. Section III explains the patterns which emerge from the simulations. Section IV concludes.

II. Model

We set up a two-period political economy policy model with ageing as a driving force, jointly capturing skill-based immigration policy and welfare state redistribution policy, both of which are determined through majority voting. The supply side features a standard Heckscher-Ohlin model.[4] In a low-ageing state, the economy is relatively labor abundant, importing capital from the rest of the world. Increased ageing causes the economy to become relatively more labor-scarce, which triggers

[4] Using public opinion polls conducted in the United States, Steve and Slaughter (2001) and O'Rourke (2003), find indirect support for hypotheses derived from the Heckscher-Ohlin trade model. Specifically, they find that there is a robust skills cleavage over immigration policy, with high-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.

the export of domestic capital to the rest of the world. Ageing therefore directly affects factor prices and changes tax bases. 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 wages to high-skilled wages. Ageing-related dwindling of the labor force drives up demand for foreign labor in the form of high- and low-skilled immigration. International capital mobility generates Laffer-Curve effects of tax policies on tax revenue, which is needed for providing social benefits. A low capital tax rate creates a high volume of capital imports, so taxing foreigners helps raise tax revenue. However, an excessively high capital tax rate diminishes capital imports and tax revenue.

II.1 Income groups

In order to consider redistribution issues, which are at the heart of the welfare state, we assume that there are at least 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-skilled 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-skilled individual is endowed with only $\theta < 1$ units of a

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

high-skilled individual's wealth endowment. Thus, a high-skilled–rich individual enjoys both higher initial endowment ("wealth") and higher labor market skill than a low-skilled–poor individual.

The main driving force in our analysis is that ageing leads to an increasing dependency ratio, or the ratio of retirees to workers.

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-skilled migrants and by m_l the number of low-skilled migrants. We denote the number of high- skill immigrants as m_S, and low-skill immigrants as m_L .

II.2 Dependents

The welfare state provides universal social benefits, paid for by tax on labor income and 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 saved from the first period. We label this individual as dependent, because relative to others in the same skill group, the individual's spending draws more from the welfare state's social transfers. To capture dependency on 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 enter the country 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

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

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

The exogenously given pair u_H^*, u_L^* represents 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 the number of low-skilled immigrants depends positively on the foreign-domestic utility gap$u_{Lm} - u_L^*$.

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

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

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

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

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

II.4 Production and investment

To enable us to consider trade in goods, we assume that there are at least 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:

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

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.

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

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, and a variable mix of x_k and y_k is produced in the first period according to:

(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, one must 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, 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 the high-skill wage rate, paid in the second period (after the completion of the production process); and w_L is the 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

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

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 <u>not</u> 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:

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[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 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).

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

The (two-state) idiosyncratic shock $\emptyset$, 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, $\emptyset$, and the probability of the working state, 1 - $\emptyset$.

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 fiscal prospects of the welfare state depend on two factors to mitigate the adverse macroeconomic impact of ageing. The first is the potential for capital deepening. The second is increased immigration. Domestic capital deepening depends on 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 in 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) $(1 - t_K)r - \delta_k = R^*$.

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:

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

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

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

Second period resource constraint is given by:

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

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

II.8 Policy Instruments

Finally, consider the government, which is active in a balanced-budget capacity 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 originating in the domestic economy for both domestic residents and foreigners, $rp_k(K_x + K_y)$. This means that when savings 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 labor, 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.

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-skilled migrants form the majority, they will be taxed 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 tables 1 and 2, each followed by graphs of the numerical simulations to provide further details.[9]

III.1 Ageing and Social Benefit provision

Table 1: Effects of Increased Ageing on Social Benefit Provision

	Low Dependency State		**High Dependency State**

[9] See Appendix 2 for the simulation parameter values.

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

Table 1 demonstrates that ageing boosts or lessens social benefit provision according to the identity of the policy maker as representing either the rich or the poor, the greater need for social benefits when the probability of retirement grows, the ability to tax foreigners who invest in the domestic economy, and the ability of a rich policy maker to tax the wages of low-skilled laborers, and vice versa for the case of a poor policy maker. To finance dwindling tax revenue caused by growing retirement rates, when they have political power, high-skilled laborers naturally attempt to

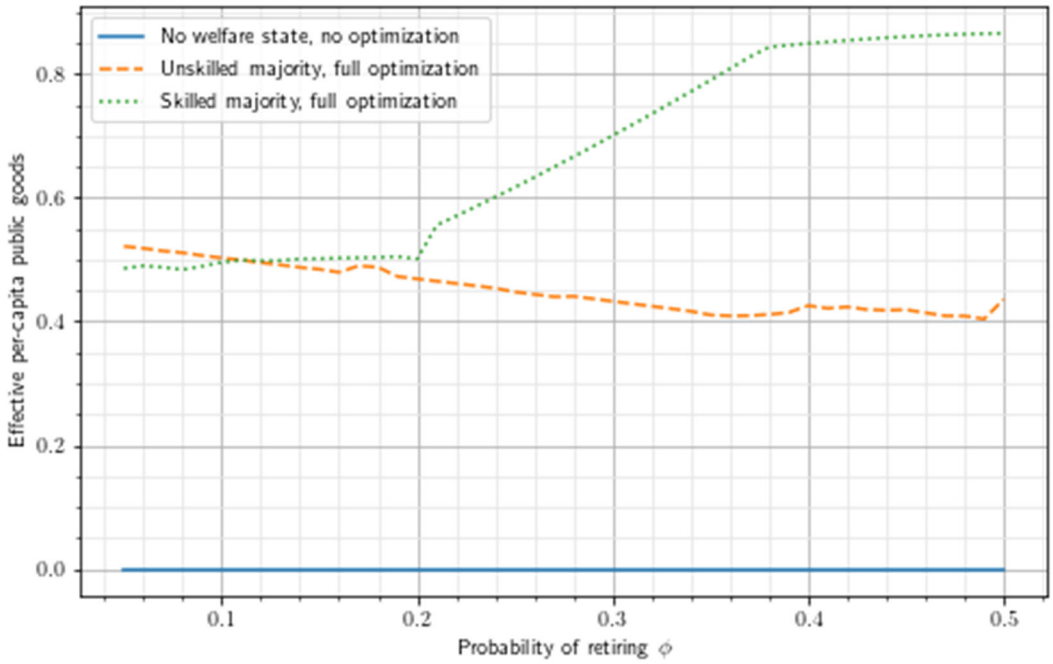
impose higher wage taxes on low-skilled laborers. They certainly wish to avoid a higher tax on capital, which would reduce their net income from savings. Conversely, when low-skilled laborers have political power, they tend to impose higher wage taxes on high-skilled laborers and advocate for the increased provision of social benefits (per capita), since they will have greater income needs when they retire.

In a 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.

In a low-dependency state that is also a capital import state, the POOR will need to tax their wage income to sustain more generous retirement income—the cost exceeds the benefit. The RICH who are providing less generous retirement transfers than the POOR (and need less 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 noting 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. Conversely, for large values of the ageing parameter (the ∅-parameter), the country becomes 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 between 0.2 and 0.35, the economy is in financial autarky. For the model's parameter values, see Appendix.

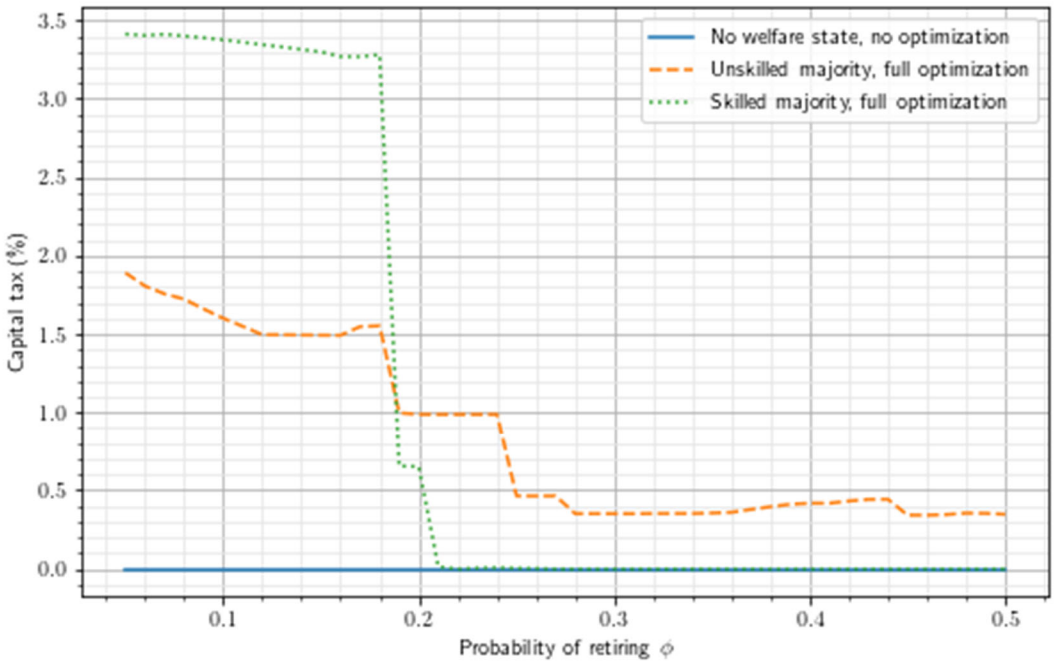
Figure 3 shows that:

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 a 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 a low range of values for the ∅-parameter) .

Ageing reinforces the demand for social benefits and strengthens these tendencies. In the following figures, we compare the policies of the high-skilled and low-skilled regimes by 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 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 the taxation of capital income:

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

2. Increasing the ageing parameter (the ∅-parameter) lowers the capital tax rate set by the high-skilled majority if the country is a 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

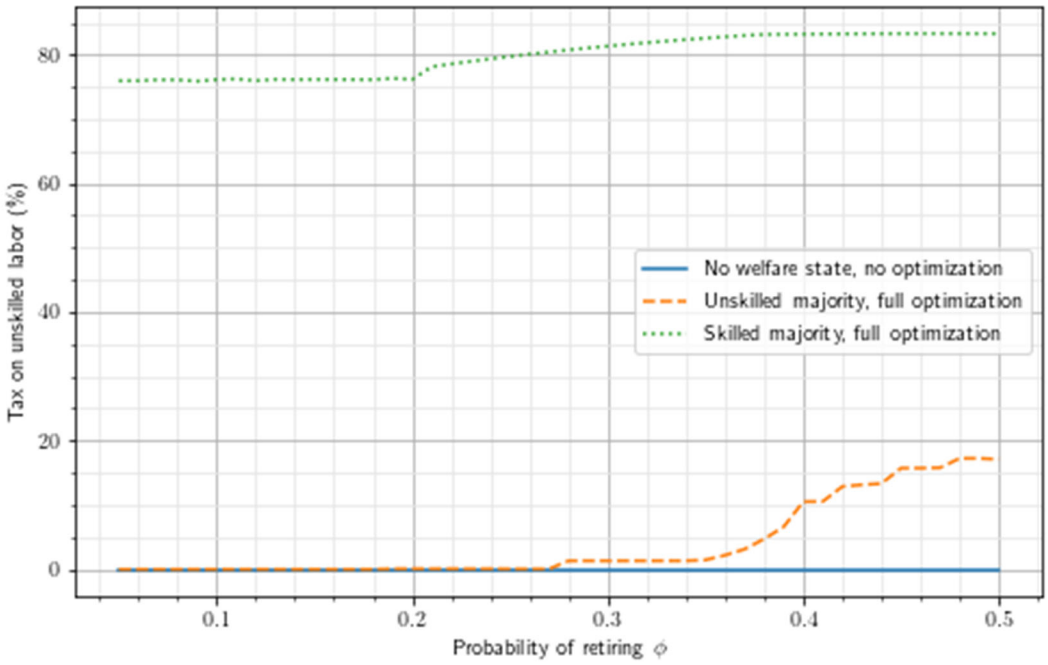
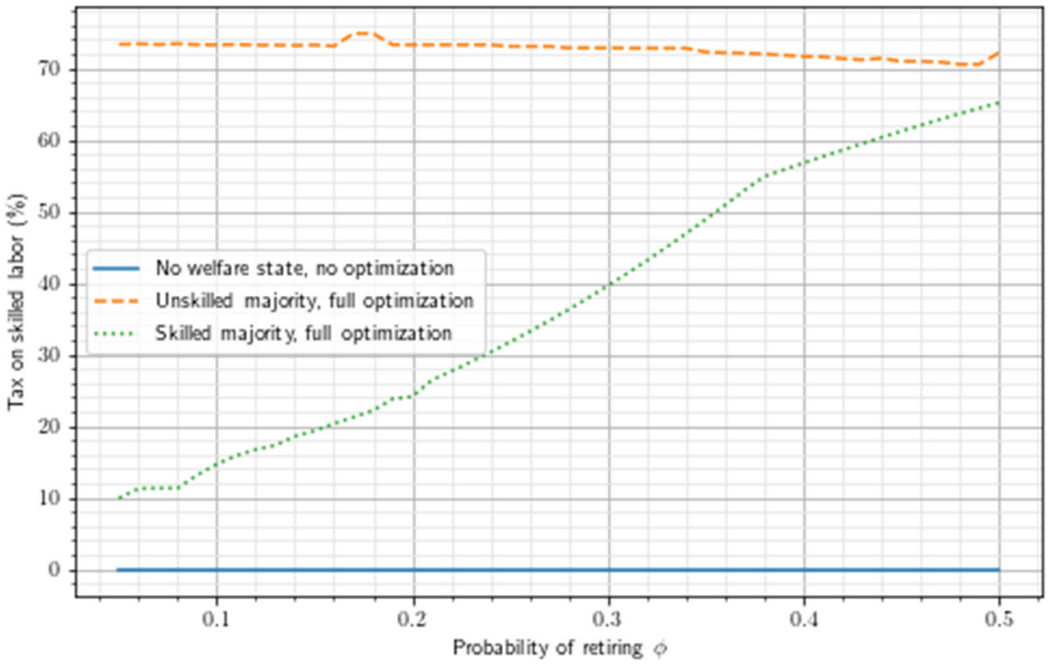


Figure 5 demonstrates that:

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 Ø-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 ∅-parameter values falling short of 0.2, the economy imports capital. For ∅-parameter values exceeding 0.35, the economy exports capital. For ∅-parameter values 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 ∅-parameter raises the high-wage tax rate by the high-skilled regime but lowers the rate set by low-skilled regime.

III.2 Ageing and Migration Policy

The 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**

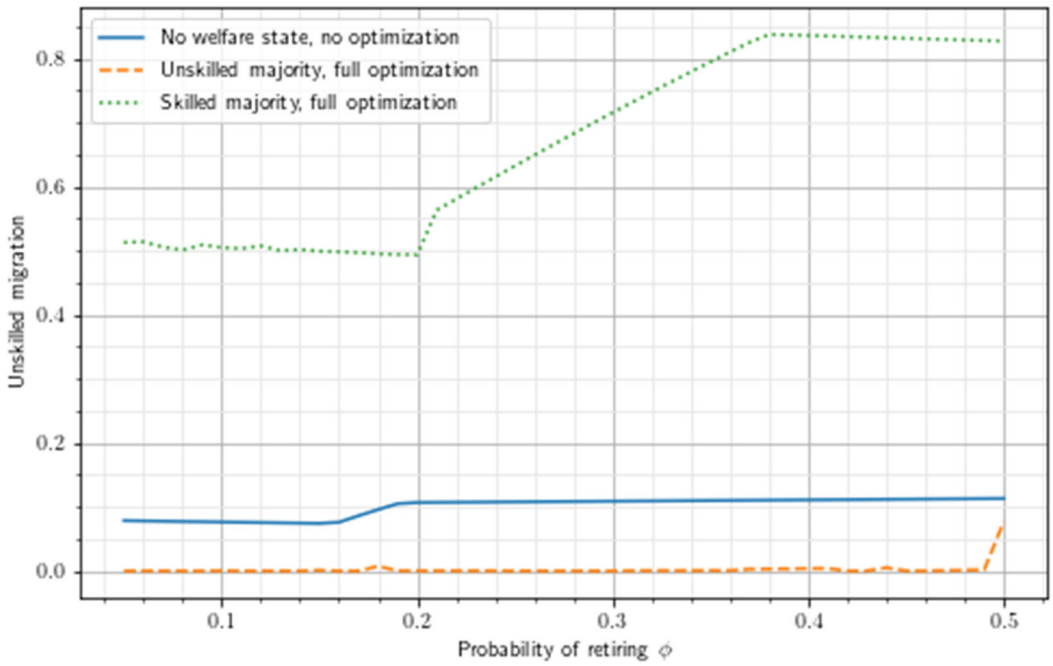
Number of Low - Skilled Migrants		**S-regime > Zero B regime > U-regime**		**S-regime > U-regime > Zero B regime**
Number of High-Skilled Migrants		**S-regime < Zero B regime < U-regime**		**S-regime < U-regime < Zero B regime**

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

When ageing of the native population rises, the dwindling labor force drives up demand for migrants. The consequent rise in welfare state generosity strengthens this force. If the rich are in charge of migration policy making, whether in the high-ageing or low–ageing state, they are biased towards relying on low-skilled migrants rather than the competing high-skill labor. If the poor are in charge of migration policy making, whether in the high-ageing or low–ageing state, they are biased towards relying more on high-skill migrants rather than 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 between 0.2 and 0.35, the economy is in financial autarky. For the model's parameter values, see Appendix.

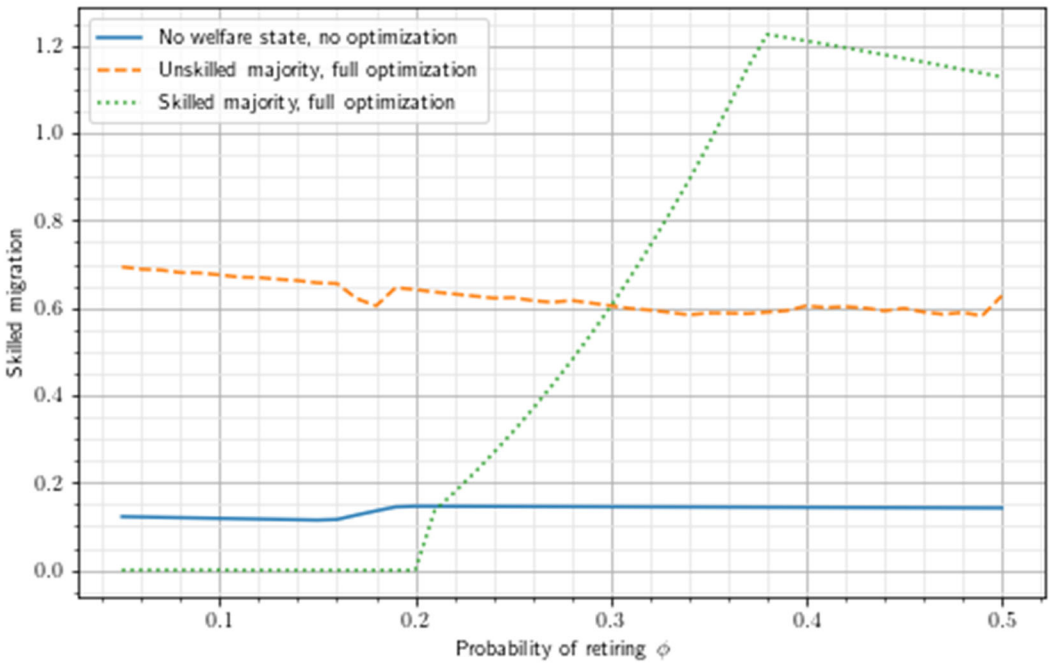
Figure 7 shows that:

1. Low-skilled in-migration numbers are larger under high-skilled, rich policy makers than under low-skilled, poor policy makers, whereas the numbers under no social benefit regime take an intermediate position in the ranking.

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

3. Raising the ageing parameter (the Ø-parameter) drives up the low-skilled migration quota under the high-skilled, rich policy regime, whereas under the low-skilled, poor policy regime, the migration quota increases 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 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 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-skilled in-migration numbers are smaller under high-skilled, rich policy makers than under low-skilled, poor policy makers, whereas the numbers under a no social benefit regime take an intermediate position in the ranking for low levels of the ageing parameter (the Ø-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: in-migration numbers under high-skilled, rich policy makers are greater compared to those under low-skilled, poor policy makers. 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 Ø-parameter) lowers the high-skilled migration quota set by the low-skilled regime; increasing the Ø-parameter lowers the high-skilled migration quota set by the high-skilled regime once the country becomes a capital exporter.

IV. Concluding Remarks

This paper employs a general equilibrium policy making model to increase our understanding of how migration quotas on low-skilled and high-skilled laborers, the provision of social benefits, labor income taxation, and capital income taxation are endogenously driven by population ageing. We find that low ageing evolution correlates with a relatively labor-abundant country (low retirement), which turns into a labor-scarce country (high retirement). Parallel to the evolution of the labor force, a capital-importer country (with a high rate of return) becomes a capital-exporter (with a low rate of return). Greater ageing-related demand for social benefits is balanced against the rising costs of labor income taxation and capital income taxation.

Population ageing also involves 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 significant portion 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, as used in this paper. The dynamics of ageing and the provision of social benefits in a public debt dynamic setup will be a crucial subject for future research. The model we employ is static. Consequently, there are important fiscal policy and redistribution issues related to ageing that require more in-depth investigation.

The dynamics of ageing on aggregate saving, and consequently on the real interest rate, is articulated by Lane (2020), who observes that the current phase of population ageing is contributing

to the decline in the underlying equilibrium real interest rate. While a large population cohort that is saving for retirement puts upward pressure on the total savings rate, a large elderly cohort may push down aggregate savings by running down accumulated wealth. Auclert et al. (2021) developed a dynamic cohort-based general equilibrium model that rigorously assesses the Lane conclusion. They predict that demographics will continue to push in the same direction, leading to falling rates of return for financial assets and rising wealth-to-GDP ratios.

Appendix 1: Macro Literature on Migration Policy

In general, a change in the share of high-skilled migrants in the total number of migrants affects the utility level of the decisive voter through three channels. First, an increase in the skill-share raises the economy's labor productivity and thereby its capacity to raise tax revenues. This, in turn, raises its ability to provide social benefits per capita. Second, an increase in the migrant skill-share, which evidently raises the supply of high-skilled labor relative to the supply of unskilled labor, depresses the skill premium in the labor market. Third, raising the tax rate is distortionary, moving the economy below its production possibility frontier. If the decisive voter is low-skilled, both of the above effects raise their utility. Thus, a low-skilled voter would like to set the skill composition of migrants at its maximum. If, however, the decisive voter is high-skilled, whereas the first effect raises their utility, the second effect lowers it. This means that the share of high-skilled migrants preferred by the decisive high-skilled voter is typically lower than that preferred by the decisive low-skilled voter. Under a policy-controlled migration regime, if the

decisive voter is a low-skilled worker, an increase in the tax rate (which thereby raises the provision of social benefits) would benefit an unchanged low-skilled migration policy. This is because it is always set at the maximum possible limit, constrained by the magnitude of the tax distortionary effect. However, if the decisive voter is a high-skilled worker, an increase in the tax rate (thereby raising the provision of social benefits) will change the policy concerning the skill composition of migrants in the direction towards a larger share of skilled migrants. The reason for this is that when the tax rate is higher, the redistribution burden upon a high- skilled decisive voter increases. That is, allowing an additional skilled migrant can ease this rise in the fiscal burden. In both cases, whether the decisive voter is a high-skilled worker or a low-skilled worker, the skill-mix of migrants is higher than what would be expected without a policy controlling migration. This effect is called a fiscal-burden effect of the welfare state generosity on the skill-composition of migrants. An increase in the generosity of the welfare state in the destination country under free migration would mean a greater fiscal burden falling on the high-skilled migrants and more redistribution that benefits low-skilled migrants, thereby diminishing the skill composition of migration. This effect is called a magnet effect of the welfare state generosity on the skill-composition of migrants. Razin and Wahba (2014) put these effects into an empirical validation, using the inter- and intra-migration flows in the European Union as a central identification strategy. To this end, Razin and Wahba (2014) decompose a bilateral migration sample into three groups as follows. Group A (EUR to EUR) contains only the source-host pairs of countries, which allow free mobility of labor between them according to the Schengen agreement. Razin and Wahba (2015) find that a more generous welfare state tilts the skill composition downward under free migration and upward under policy-controlled migration. Regardless of whether migration is free or controlled, a higher Gini coefficient generates greater income distribution and consequently more skill-biased immigration. Under a free-migration regime, the skill-composition of immigration depends also on the skill- distribution of the labor force in the sending and

receiving countries. In a seminal paper, George Borjas (1987) derived the conditions under which immigrants are negatively or positively selected in terms of skills. Borjas (1987) analyzes some conditions which favor negative selection—meaning that immigrants are drawn disproportionately from the bottom half of the skill distribution. They are: high returns to skills in the sending country relative to the receiving country, and migration costs that are proportional to worker productivity (for example, costs that have an iceberg form), which combine to give less skilled workers a relatively strong incentive to migrate. On the other hand, migration costs that are fixed in nature and a marginal utility of income that is not strongly decreasing favor positive selection of immigrants in terms of skills (Grogger and Hanson 2011), in which case immigrants are drawn more heavily from the top half of the skills distribution. In Razin, Sadka and Swagel (2002 a, b) the dependency effect of unskilled migrants on the welfare state policy depends on two contrasting driving forces. On the one hand, the effect is negative because a rise in the dependency ratio increases the fiscal burden on the median voter. On the other hand, the dependency-ratio effect on policy is positive to the extent that the median voter preference shifts towards the group of voters who are net beneficiaries of the welfare state. In the present context of two skill levels, the effects of a rise in the dependency ratio on the welfare state generosity policy is negative if the high-skilled workers are in the majority, and positive if the low-skilled workers are in the majority. Interest group arguments in political science date back more than a century, from the pioneering works of Arthur F. Bentley (1908), to V.O. Key, Jr. (1942), to David B. Truman (1951). Group models of politics search for propositions about how and when individuals coordinate their activities and engage in collective behavior (Olson 1971). Work in this vein commonly attempts to link policy demands to concrete (or expected) gains and losses of identifiable sub-groups of the electorate, and to the bargains and concessions they produce in pluralistic political systems. Interest group approaches have focused on a broad range of groups

positioned for or against immigration (Freeman (1995); Gimpel and Edwards (1999); Haus (1995); Joppke (1998)).

Appendix 2: 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 labor	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: An 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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