Essays on Population Aging and the Political Economy of Immigration

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For my great-grandmother who would have been an Economist if the Russian Revolution had not got in her way.

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Part I
Introduction

Due to increasing life expectancies and decreasing birth rates, the world population is aging. However, demographic structures differ widely across regions. Figure I.1 shows the development of the median age in more developed relative to less developed regions (using a United Nations definition) over the period from 1950 to 2010. Although the median age has been increasing faster in the less developed than in the more developed regions since 1970 (resulting in the decline in the relative median age shown in figure I.1), the more developed regions' populations are still much older: for 2010 the median age in the more developed regions was estimated to be 39.7, whereas its estimate in the less developed regions was only 26.8.[1]

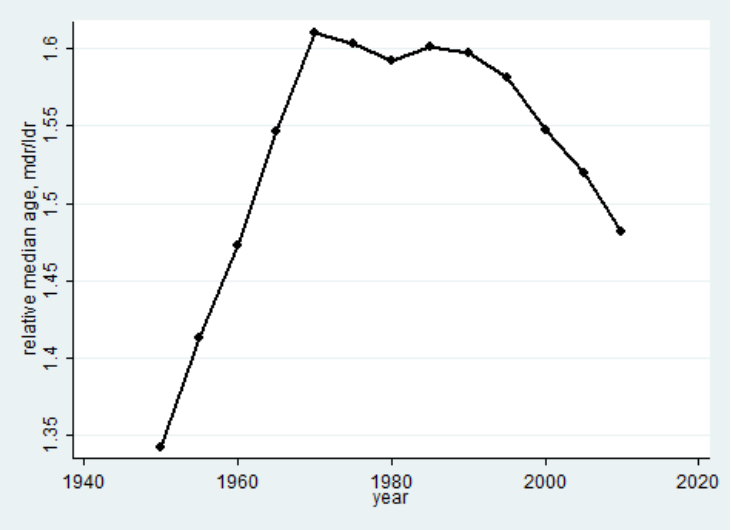

Figure I.1: Median Age, More Developed Relative to Less Developed Regions

Source: UNPD (2008). The category "more developed regions" includes Europe, Northern America, Australia, New Zealand and Japan. The category "less developed regions" includes all other countries.

Population aging affects labor, capital and goods markets.[2] It also poses a strain on social security systems. In particular it challenges the financial viability of unfunded pension systems in the more developed countries since the number of contributors declines relative to the number of beneficiaries.

[1] UNPD (2008)

[2] These effects of population aging are discussed extensively in Börsch-Supan (2004).

Immigration is often seen as one key instrument to counteract this negative fiscal consequence of demographic change. The United Nations' report on replacement migration (UNPD 2001) shows that it can hardly be the only solution: in order to keep the ratio of 15 to 64 year olds to over 64 year olds in the United States constant until 2050, immigration would have to be about 16 times its forecast. Immigration to the 15 "old" European Union countries with their less favorable demographic structure would even have to increase by a factor of over 60. This larger increase is also due to the fact that forecasted immigration to the European Union is much lower than forecasted immigration to the United States.

Increasing the number of admitted immigrants can still be part of a wider set of solutions, including pension reform. Various studies estimate a positive fiscal impact of increases in immigration, see, e.g., Storesletten (2000) for the US or Bonin et al. (2000) for Germany. The size of the effect is contingent on immigrant characteristics. A stronger positive effect can be expected if immigrants are selected according to age and skill. Fehr et al. (2004, 2005) also show that the impact of increases in immigration on the welfare of natives is contingent on host country characteristics: a more positive impact is estimated for the European Union as compared to the United States and Japan because of its higher tax rates.

Furthermore, the marked differences in demographic structures between regions add to the large potential efficiency gains from international trade, capital investment in less developed regions and labor migration to more developed regions.[3] Whereas the global markets for goods and capital are by now as integrated as they were before World War I, see, e.g., Hatton and Williamson (2005, p. 225), the same is not true for labor markets. Hatton and Williamson (2005, ch. 17) conclude that even modest increases in migration would induce large gains in terms of world income.

The incentives to migrate from the less developed to the more developed regions are strong: after adjusting for differences in purchasing power, gross national income (GNI) in the less developed regions was still only about 8,000$ in 2010, compared to 28,000$ in the more developed regions.[4] The income difference between more and less developed regions has even increased over the last 30 years. Whereas GNI per capita in the less developed regions is now less than a fourth of that in the more developed regions, it amounted to a third of that in the more developed regions in 1980, see figure I.2.

If increasing labor migration would induce income gains for the world as

[3]Investigations dealing with the impact of population aging on international *capital* flows are INGENUE (2001), Brooks (2003) or Börsch-Supan et al. (2006).

[4]World Bank (2010)

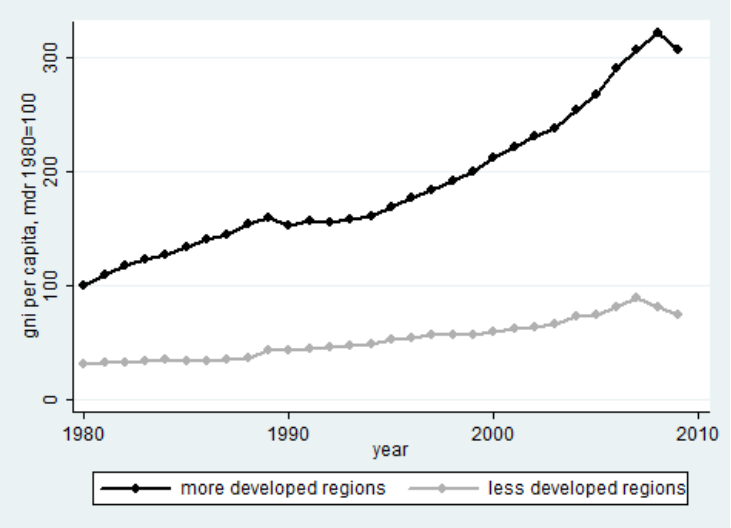

Figure I.2: Gross National Income Per Capita, Normalized

Source: World Bank (2010). In order to match the United Nations' definition, the category "more developed regions" includes Europe, Northern America, Australia, New Zealand and Japan whereas the category "less developed regions" includes all other countries. GNI per capita in the more developed regions in 1980 was normalized to 100.

a whole and especially for the migrants, the question arises which mobility barriers limit migration. Restrictive immigration policies in the more developed regions currently seem to play a major role in limiting labor flows, see, e.g., Facchini and Mayda (2008) or Hatton and Williamson (2005, ch. 11). These politically induced mobility barriers are at the core of this thesis. Policy outcomes, in turn, depend crucially on voters' preferences in any democracy. However, voters in the more developed countries do not have homogeneous preferences with regard to immigration. This thesis models differences in immigration preferences that arise along *demographic* lines, and their translation into policy.

An increase in the population share of old individuals is likely to increase those individuals' political weight. Therefore, a key question analyzed in this thesis is how young and old individuals differ with respect to their immigration preferences. First of all, young and old are affected differently by immigration because their factor endowments differ. Young individuals who work are more likely to view labor immigration negatively than older individuals who have accumulated substantial amounts of capital. This is because immigrants tend to be young themselves. Immigrants who expand the domestic labor force are therefore complements to native workers and

substitutes to capital employed in production, at least to a certain degree.

Furthermore, old individuals rely more heavily on social security systems. The design of social security systems determines whether recipients or contributors benefit more strongly from an increase in the number of contributors. With defined benefits in a pension system native workers benefit from sharing the burden of pension contributions with immigrant workers. With defined contribution rates pensioners are more likely to benefit, although wages, from which pensions are financed, decline. Finally, non-monetary factors may also shape young and old individuals' immigration attitudes differently. For instance, younger individuals may be more open to changes in social norms and customs induced by immigration.

This thesis is divided into four essays which are centered around one common political economy perspective. The first three essays construct theoretical economic models of endogenous immigration policy. The last essay is an empirical investigation of the impact of age on individual immigration attitudes.

Essays number one and two set up dynamic models of immigration policy in an aging country. As an extension, they also consider the simultaneous determination of immigration and pension policies. They investigate how the impact of immigration on factor prices (and on the parameters of the pension system) translates into immigration policy.

Several previous investigations analyze endogenously determined immigration policy in static settings (see Benhabib 1996 and Mazza and van Winden 1996) or in settings with myopic individuals (see Scholten and Thum 1996). Dynamic investigations related to this essay are, for instance, Haupt and Peters (1998), Dolmas and Huffman (2004), Ortega (2005, 2010), and Sand and Razin (2007). An important insight derived from dynamic analyses of immigration policy is that individuals do not necessarily favor the admission of immigrants who are different from themselves, as predicted by static models. The reason is that, unless immigration is temporary, immigrants' preferences may influence policies in future periods. For instance, low skilled immigrants are likely to endorse income redistribution.

The investigations by Haupt and Peters (1998) and Sand and Razin (2007) are closest in spirit to the first two essays of this thesis since they examine immigration policy in the light of demographic change, employing a Markov politico-economic equilibrium concept as defined in Krusell et al. (1997) and in Forni (2005), with fully rational voters and sequentially determined policies. Furthermore, they rely on overlapping generations models. To capture the possibly heterogeneous interests of individuals at different stages of their life cycle, it is necessary to model different generations living simultaneously rather than one representative consumer. This approach traces back

to Samuelson (1958) and Diamond (1965).

The first two essays in this thesis also employ a Markov politico-equilibrium concept and use overlapping generations models. They differ from the studies by Haupt and Peters (1998) and Sand and Razin (2007) in their assumption concerning the translation of preferences into policy. The former postulate a representative democracy government maximizing an objective function that accounts for the welfare of all contemporaneously living voters instead of accounting for the welfare of the median voter only, as in Haupt and Peters (1998) and Sand and Razin (2007). Employing such an objective function, which can be motivated from a probabilistic voting framework as in Lindbeck and Weibull (1987) or Coughlin et al. (1990), captures the gradual shift in immigration policy resulting from population aging.[5] In a median voter framework, population aging may induce radical shifts in immigration policy from the young to the old generation's preferred policy. Given that the median voter's identity does not change, it may also imply that immigration policy is not altered by population aging.

The first essay (*Aging, Factor Returns, and Immigration Policy*) makes the simplifying assumption that immigrants have the same number of offspring as natives. This assumption makes it possible to solve the model analytically for an infinite time horizon. However, it eliminates any effect of immigration on the political balance between young and old voters in the next period. As a result, the equilibrium immigration rate is time-invariant. The key finding is that aging increases the demand for immigration.

The second essay (*Aging and Immigration Policy in a Representative Democracy*) is an extension of the first, as it allows for a higher number of offspring among immigrants. A two-period version of the model is solved numerically. This yields additional insights with respect to the channels through which immigration affects future policy. In particular, immigration in the first period increases the political weight of the young generation in the second period. Consequently, the immigration rates in the two periods are substitutes, even though aging initially enhances immigration. Furthermore, immigration and social security policies are interdependent.

The third essay (*Why Don't Labor and Capital Flow Between Young and Old Countries?*) deviates from the previous literature in a different direction. It is novel in modeling the interplay between policies which determine international labor and capital flows. It is based on a static setting with two countries. As in the first two essays, a young and an old generation with heterogeneous interests live simultaneously. The two countries differ with

[5]This kind of government objective function is employed by Mazza and van Winden (1996) to analyze immigration policy and by Lorz (2004) to analyze redistribution policy.

respect to their demographic structure and with respect to their total factor productivity. Capital flows are assumed to be limited by the possibility of expropriation in the (younger) developing destination country. The mere possibility of expropriation reduces capital flows in *Why Don't Labor and Capital Flow Between Young and Old Countries?*, even though expropriation does not actually take place.

This third essay is thus closely related to the literature on the impediments to capital flows, see, for instance, Lucas (1990) or Alfaro et al. (2008). Eaton and Gersovitz (1984), Cole and English (1991) and Thomas and Worrall (1994) deal explicitly with the expropriation risk of foreign direct investment (FDI). The simultaneous consideration of immigration and expropriation policies yields new insights: in particular, migration and FDI need not be substitutes if both kinds of factor flows are limited by policy. Depending on the translation of preferences into policy, emigration from a developing country may instead reduce expropriation incentives there and thereby raise capital flows to developing countries.[6]

The third essay also presumes that economically, older individuals in more developed countries benefit more strongly from immigration than do younger ones. Yet previous empirical research has found opposition to immigration to increase with age. This holds for the investigations by Chandler and Tsai (2001) for the US, by Tucci (2005) for Germany, and by O'Rourke and Sinnott (2006) and Facchini and Mayda (2009) who use international data. However, age as a determinant of immigration attitudes is not at the center of the analysis of the mentioned investigations.

The fourth and last essay of this thesis (*Population Aging and Individual Attitudes toward Immigration: Disentangling Age, Cohort and Time Effects*) is an empirical investigation of immigration attitudes which focuses on the impact of age, and also accounts for economic and non-economic individual characteristics correlated with age. The data used stem from the German Socio-Economic Panel, a large representative longitudinal survey of private households in Germany. An unbalanced panel of all German voters who were ever interviewed on their immigration attitudes is constructed.

One recent study (Ivlevs) explicitly takes into account the impact of population aging. Other studies, as, for instance, Bauer et al. (2000), Dustmann and Preston (2005) and Facchini and Mayda (2009), account for labor market and welfare state concerns, which are related to individual age. The importance of non-economic factors is discussed extensively in Mayda (2006), but

[6]This is the case in the median voter framework employed in this essay. If, however, the government accounts for the welfare of all generations in its objective function, a decline in the population share of young workers enhances expropriation incentives, see Harms and an de Meulen ().

also in Chandler and Tsai (2001) and Dustmann and Preston (2007). The contribution of this last essay is the separation of the effect of individual age from cohort effects, a differentiation which can only be achieved by using panel data. The essay presents evidence for distinct effects of an individuals' year of birth and stage in the life cycle on attitudes toward immigration. Relative to other areas of concern, concerns about immigration do in fact decrease over the life cycle. The results also suggest that representative democracy governments admit more immigrants as their voting populations age.

In summary, the four essays in this thesis focus on the *demand* for immigration. Their aim is to discern the impact of individuals and populations growing older on immigration preferences and immigration policies. Economically, older individuals are found to benefit more strongly from immigration. However, non-economic factors are also key in explaining immigration preferences.

Part II
Aging, Factor Returns, and Immigration Policy

Lena Calahorrano and Oliver Lorz[a]

Abstract

Immigration has various economic and non-economic effects on the destination country's inhabitants. In this paper we focus on the impact of immigration on factor returns and analyze how aging affects immigration policy, employing a dynamic political-economy model of representative democracy. Aging, i.e. a decline in the growth rate of the native population, has an expansionary effect on immigration in this framework. This immigration effect may even overcompensate the initial contraction of the labor force. We show that the immigration rate in the representative democracy equilibrium exceeds the immigration rate which would maximize welfare of current and future generations and also discuss the influence of social security on immigration policy.

JEL classification: D78, F22, J10
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1 Introduction

Virtually all industrialized countries are facing a decline in birth rates and an increase in life expectancy resulting in a substantial aging of the native population. Immigration is often seen as one key instrument to counteract this development (see, e.g., UNPD 2001). Against this background, our paper analyzes how countries adjust their immigration policy in the wake of demographic change. Point of departure is a standard overlapping generations economy with two generations, young and old. Immigration affects factor incomes of both generations differently, as the capital income of the old generation increases whereas the labor income of the young generation declines if immigrant workers expand the domestic labor pool. Consequently, old and young have different interests with regard to the desired level of immigration. Although capital movements and trade may dampen the influence of immigration on factor prices, neither capital nor goods are perfectly mobile internationally, and there is indeed empirical evidence showing that immigration reduces wages or employment among native workers in the destination countries (see, e.g., Borjas 2003 or Angrist and Kugler 2003).

To determine the equilibrium policy, we consider a dynamic model of representative democracy. The government sets the immigration level in each period to maximize aggregate welfare of both currently living generations, weighting each generation proportionally to its share in the population. Such an approach to modeling policy outcomes in representative democracies, which can be derived from probabilistic voting models, has become common by now.[1] Due to its effects on factor accumulation, immigration not only influences current welfare but also has consequences for later periods. Therefore, immigration policy constitutes a sequential game between subsequent governments. We derive the Markov-perfect equilibrium of this game and analyze how a decline in the rate of population growth influences the equilibrium level of immigration. In addition to the effects on factor incomes mentioned above, we also allow for non-monetary costs of immigration, which capture the often observed reluctance of the native population to admit foreigners as permanent immigrants.

In our model, a Markov-perfect equilibrium exists in which the number of immigrants relative to the domestic workforce is stationary. The equilibrium immigration rate is positive as long as the population is sufficiently old and the non-monetary costs of immigration are low. With regard to the effects of aging on immigration policy, we can show that the government allows more

[1] For textbook treatments, see, e.g., Persson and Tabellini 2000, ch. 3 or Mueller 2003, ch. 12.

immigrants if the growth rate of the native population declines. This results from the increase in the relative size of the old generation, which benefits from immigration, in the electorate. Because of this expansionary effect of aging on immigration, the relationship between aging, factor intensities and factor prices is not as clear-cut as in a standard growth model without immigration. Instead, the influence of the growth rate of the native population on the total size of the labor force and on the capital intensity may be non-monotonic.

Our paper builds on a few related approaches dealing with the political economy of immigration policy. Benhabib (1996) examines immigration policy in a median voter model with heterogeneous wealth endowments. Mazza and van Winden (1996) analyze redistribution and immigration policies under representative democracy with workers and capital owners. Unlike our paper, the models of Benhabib (1996) and Mazza and van Winden (1996) are entirely static and therefore do not account for intertemporal effects of immigration policy we focus on. Dolmas and Huffman (2004) and Ortega (2005, 2010) consider the interplay between policies concerning immigration and income redistribution. As immigrants may differ from the native population with respect to their wealth endowments or skill levels, allowing more immigration may change political majorities with respect to redistribution policies. Dolmas and Huffman (2004) and Ortega (2005, 2010) analyze how this effect influences equilibrium immigration policy employing a median voter framework.

Sand and Razin (2007) deal with the influence of aging on immigration and social security policies. They set up a median-voter model with two overlapping generations and assume that immigrants have more children than the native population. Immigration alters the population shares of both generations in the subsequent period, which may have consequences for the identity of the median voter (old or young). Sand and Razin (2007) show that several equilibrium types may emerge in this setting, depending on the growth rate of the native and of the immigrant population. Earlier related papers that rely on the median-voter approach are Scholten and Thum (1996) and Haupt and Peters (1998).

In a median voter model, population aging may have drastic consequences for immigration policy, as it may lead from an immigration level characterized by the preferences of the young to the implementation of the old generation's most preferred policies, namely maximum immigration and a tax rate which maximizes social security revenues. In contrast to this rather extreme outcome, our paper is able to capture the gradual shift in political weights toward the old generation which results from a decline in population growth.[2]

[2]Amegashie (2004), Facchini and Willmann (2005), and Epstein and Nitzan (2006)

2 Equilibrium Immigration Policy

Our economic framework is a standard overlapping-generations model with workers and retirees. In each period t, competitive firms produce a single aggregate good with a Cobb-Douglas technology

$$Y_t = K_t^{\alpha} L_t^{1-\alpha} .$$

The workforce L_t is composed of native workers N_t and immigrants, i.e. $L_t = N_t(1+\gamma_t)$, where $\gamma_t \geq 0$ is the ratio of immigrants per native worker. We assume that immigrants have the same labor productivity as native workers. This assumption simplifies the exposition but is not important for our qualitative results. A lower labor productivity of immigrants could easily be incorporated into the model by weighting the immigration rate with a productivity term less than unity.[3] Capital is given by past domestic savings and depreciates completely after one period. With $\tilde{k}_t \equiv K_t/N_t$ as the capital endowment per native worker, factor returns for labor and capital are given by

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

Young individuals in period t supply one unit of labor and allocate their wage income w_t to consumption and savings. Old individuals are retired and consume all of their wealth $s_{t-1}(1+r_t)$ generated from previous savings. Utility of young and old individuals is given by

$$\begin{aligned} U_t^o &= \ln c_t^o - \psi\gamma_t \qquad \text{and} \\ U_t^y &= \ln c_t^y + \beta \ln c_{t+1}^o - \psi\gamma_t - \beta\psi\gamma_{t+1} , \end{aligned}$$

respectively. This logarithmic specification of utility, together with the assumed Cobb-Douglas technology, allows an analytical closed-form solution of our model. The terms c_t^o and c_t^y denote the consumption levels of the old and young, respectively, and $\psi\gamma_t$ captures non-monetary costs related to immigration ($\psi > 0$). These costs represent negative sentiments toward immigration or negative welfare effects of immigration that are not accounted for in individual incomes.[4] For example, the native population may be reluctant to accommodate to different social norms and customs of immigrants, immigration may reduce the utility derived from local public goods (as in

set-up interest group models of immigration.

[3] As we assume full employment, welfare migration, which would represent an economic burden for all natives in the destination country, is not an issue in our model.

[4] See Hillman (2002), Hansen (2003), Krieger (2005), or Verbon and Meijdam (2008) for similar specifications.

Alesina and La Ferrara 2005), it may cause congestion effects in the host country or additional costs to the welfare system. The parameter ψ allows us to capture these different factors in a tractable and straightforward way. Accounting for non-monetary costs of immigration further ensures an interior solution for the equilibrium immigration policy. Empirically, non-economic effects of immigration play an important role in shaping attitudes toward immigration, see, e.g., O'Rourke and Sinnott (2006) and Mayda (2006). To focus on the economic determinants of migration policy, we assume for the time being the same cost term ψ for young and old individuals. At the end of this section, we discuss the implications of relaxing this assumption. Note that the young generation also anticipates non-monetary costs of future immigration $\psi\gamma_{t+1}$ in addition to immigration costs in t.
The budget constraint of a young individual is given by

$$c_t^y + \frac{c_{t+1}^o}{1+r_{t+1}} = w_t \ .$$

Maximizing the utility of the young subject to their budget constraint yields the individual savings and consumption levels

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

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

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

Immigration in our model is permanent, and immigrants gain the right to vote after one period in the host country. We assume that immigrants have the same number of children as natives, and that immigrants' children are fully integrated into the economy. For a discussion of the effects of different birth rates, see our concluding remarks.[5] With a population growth rate of n ($n > -1$) we have $N_t = (1+n)L_{t-1} = (1+n)\left(1+\gamma_{t-1}\right)N_{t-1}$.

To derive the political economy equilibrium in this setting, we assume a representative democracy in which the government accounts for the welfare

[5]Empirical research has shown that labor market outcomes of second-generation immigrants fall short of those of natives (see, e.g., Algan et al. 2010). In our model, a worse labor market performance of immigrants' children would aggravate the opposition of the young generation against immigration whereas the preferences of the old generation with respect to immigration would be unchanged. The central mechanism of our model, the conflict between young and old generation with regard to the preferred immigration rate, would remain in such an extension.

of the young and the old generation in its objective function. More precisely, we assume that the government in period t sets γ_t to maximize

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

with V_t^o and V_t^y as the indirect utilities of old and young. In (4) the size of the old generation is normalized to one, and the young generation's welfare is weighted with its size relative to the old generation. As is well known, such an objective function, which incorporates the welfare of all voter groups instead of only the median, can be motivated by a probabilistic voting framework (see, e.g., Lindbeck and Weibull 1987 or Coughlin et al. 1990). An equal welfare weight of all individuals in the government's objective function is the outcome of a probabilistic voting model if the degree of uncertainty about individual voting behavior does not differ between groups. However, our model can easily be extended to incorporate different welfare weights of young and old individuals, e.g. due to lobbying of interest groups, as in Facchini and Mayda (2008).

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

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

Young and old have conflicting preferences concerning immigration: On the one hand, an increase in the immigration rate γ_t raises the return on capital and thereby the income of the old. On the other hand, the wage rate and thereby the income of the young generation declines if more immigrants are allowed to enter the country.[6] Setting $\partial\gamma_{t+1}/\partial\tilde{k}_{t+1} = 0$, we can derive the following effects of raising the immigration rate on individual consumption levels:

$$\frac{dc_t^o}{d\gamma_t} = \frac{1-\alpha}{1+\gamma_t}c_t^o \,, \quad \frac{dc_t^y}{d\gamma_t} = -\frac{\alpha}{1+\gamma_t}c_t^y \,, \quad \text{and} \quad \frac{dc_{t+1}^o}{d\gamma_t} = -\frac{\alpha^2}{1+\gamma_t}c_{t+1}^o \,. \tag{5}$$

[6] Since individuals react to a declining wage rate by lowering their savings, this negative effect is partly offset by an increase of future capital returns.

The marginal indirect utilities of both generations are then given by:

$$\frac{dV_t^o}{d\gamma_t} = \frac{1-\alpha}{1+\gamma_t} - \psi \qquad \text{and} \qquad \frac{dV_t^y}{d\gamma_t} = -\frac{\alpha(1+\alpha\beta)}{1+\gamma_t} - \psi \,. \tag{6}$$

According to equation (6), marginal utilities in period t do not depend on the state variable $\tilde{k}_t$. Taking the first derivative of W_t and inserting (6), we obtain the following result:

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

$$\gamma = \max\left(0; \frac{1-\alpha-(1+n)\alpha(1+\alpha\beta)}{(2+n)\,\psi} - 1\right). \tag{7}$$

The equilibrium policy rule as specified in Proposition 1 satisfies our previous conjecture $d\gamma/d\tilde{k} = 0$. Equilibrium immigration policy is thus time-invariant. For a further interpretation of the equilibrium policy, we focus on the interior solution with $\gamma > 0$. This is the case, if the term ψ, which determines non-monetary immigration costs, is sufficiently small and if the population growth rate n is sufficiently small. For all $\gamma > 0$, we find that the equilibrium immigration rate is negatively related to population growth, i.e. $d\gamma/dn < 0$. This is because the political weight of the old generation, which benefits from immigration in our model, decreases with n. Population aging – a decline of the population growth rate n – thus leads to more immigration. Immigration also declines in the capital share α and in the discount factor β. Intuitively, the positive impact of immigration on the old generation's income is stronger the higher the capital share whereas a high discount factor implies a high utility weight of the young generation who is against immigration.

The immigration effect of aging also has consequences for the growth rate l of the labor force in the immigration country. This growth rate is determined by $1+l = (1+\gamma)(1+n)$. Inserting for γ from (7) and taking the derivative yields

$$\frac{dl}{dn} = \frac{1-\alpha-\left[(2+n)^2-1\right]\alpha\,(1+\alpha\beta)}{(2+n)^2\,\psi}\,. \tag{8}$$

Thus,

$$\frac{dl}{dn} \gtreqless 0 \quad \text{iff} \quad (2+n)^2 \lesseqgtr \frac{1+\alpha^2\beta}{\alpha+\alpha^2\beta}\,. \tag{9}$$

According to (9), the growth rate of the labor force does not necessarily increase with n if immigration policy is endogenous. Only if n is very small,

the influence of n on l is positive. For larger n, however, we may obtain a negative relationship between n and l. The effect of aging on immigration policy is so strong in this case that it outweighs the initial decline of native population growth. To be more specific, let us consider numerical values of $\alpha = 0.35$ and $\beta = 0.75$.[7] With these values we obtain $dl/dn < 0$ for all $n > -0.43$. That is, for any reasonable value of the population growth rate our model predicts a negative relationship between population growth and labor force growth. Aging then results in a higher labor supply.

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

$$k^* = \left(\frac{\beta(1-\alpha)}{(1+\beta)(1+l)}\right)^{\frac{1}{1-\alpha}} . \tag{10}$$

In a standard growth model with an exogenous immigration rate, the influence of population growth on k^* is clearly negative, and aging results in capital deepening, causing the wage rate to increase and the capital return to decline. With endogenous immigration, there is now an additional effect of aging on k^* via the chosen immigration rate: an aging population admits a larger number of immigrants.

Figure II.1 illustrates the relationship between n and k^* in our model for $\alpha = 0.35$, $\beta = 0.75$ and $\psi = 0.1$. Since $dl/dn > 0$ for small n, the capital intensity first declines with n. If, however, n exceeds a certain threshold value, determined by the equality in (9), the capital intensity increases if n rises. Finally, the population share of the young may be so high as to impede any immigration. In this case, we have $\gamma = 0$ instead of an interior equilibrium with immigration. Then the effect of n on γ vanishes, causing the capital intensity to fall in the population growth rate as in a model with exogenous immigration policy. This last threshold depends on the level of the non-monetary immigration costs. The lower ψ, the further the critical population growth rate is shifted to the right.

Our previous analysis assumed that the non-monetary costs related to immigration are the same for young and old individuals. To show that our main conclusions survive a deviation from this assumption, we can also derive

[7] For instance, Börsch-Supan et al. (2003), who carefully motivate the choice of different parameter values for their policy simulations, let the production share of capital vary between 0.3 and 0.4. According to Börsch-Supan et al. (2003) a common assumption for the annual discount rate of households is 0.01. If it is assumed that each of the two life periods lasts for 30 years, this corresponds to a discount factor β of about 0.75.

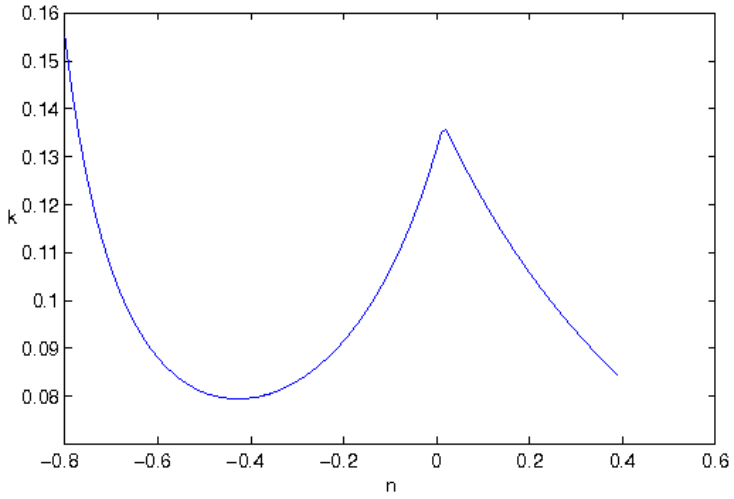


Figure II.1: Population Growth and Steady State Capital Intensity

the equilibrium immigration rate for the case $\psi^y \neq \psi^o$. It is given by

$$\gamma = \max\left(0; \frac{1-\alpha-(1+n)\alpha(1+\alpha\beta)}{\psi^o+(1+n)\,\psi^y} - 1\right) \tag{11}$$

instead of equation (7). Clearly, immigration now declines in both generations' non-monetary immigration costs and is positive only if none of these are too large. The government's preferred level of immigration is still higher the older the population, even if pensioners are more averse to changes in social norms than workers are. Furthermore, immigration still counteracts the negative effect of population aging on labor force growth, as long as the immigration rate is positive, i.e. $d\gamma/dn < 0$ for $\gamma > 0$.

Note that the immigration rate in all periods is higher than the rate which would maximize welfare of current and future, yet unborn generations. In period t, a social welfare function can be defined as the discounted sum of all current and future native generation's utilities:

$$SWF_t = \sum_{s=t}^{\infty} (1+n)^{s-t}\beta^{s-t}\{\ln c_s^o + (1+n)\ln c_s^y - (2+n)\psi\gamma_s\}\ , \tag{12}$$

In this social welfare function, the individual discount factor is also used to discount future consumption streams, and each generation is weighted with its size relative to the first generation. The solution to the maximization of

this function is given by

$$\gamma^{SW} = \max\left(0; \frac{1-\alpha\beta(1+n)-\alpha(2+n)}{(1-\alpha\beta(1+n))\,(2+n)\psi} - 1\right) . \tag{13}$$

Comparing γ^{SW} with the equilibrium immigration rate γ yields $\gamma > \gamma^{SW}$ in an interior equilibrium. Immigration under representative democracy is too high from a social welfare viewpoint. The reason is an intergenerational externality: More immigration in period t causes a decline in capital accumulation, which has a negative effect on future generations' wages.

For a further interpretation, we may also compare our equilibrium with the outcome in a median voter setting. The equilibrium policy in a median voter model either maximizes the welfare of the young (for $n > 0$) or of the old generation. As young voters are against immigration, we have a Markov-perfect equilibrium with zero immigration in a median voter setting for $n > 0$. For $n < 0$, the equilibrium immigration rate is given by $\gamma^M = \max(0; (1-\alpha)\psi^{-1} - 1)$. As long as the identity of the median voter remains unchanged, aging does not influence immigration policy at all in such a setting. This prediction of the median voter approach differs sharply from our model of representative democracy in which the immigration rate varies continuously with the rate of population growth n.

3 Social Security

Since aging implies a higher old-age dependency ratio, immigration is often seen as a (partial) solution to the problem of sustaining an unfunded social security system. To investigate how immigration policy in a representative democracy is related to social security, we now introduce intergenerational transfers into our model. We assume that in each period the government simultaneously sets the immigration rate γ_t and the rate of social security contributions τ_t raised from labor income of the young. Revenues from social security contributions are used to finance benefits b_t to the old generation. With social security, net wages of the young are thus given by $w_t(1-\tau_t)$, and the balanced budget constraint $b_t L_{t-1} = \tau_t w_t L_t$ determines benefits as $b_t = \tau_t w_t (1+l_t)$.

For a given contribution rate, an increase in the number of contributors due to more immigration raises social security benefits that can be paid to the old generation. One might expect that this effect causes a positive relationship between optimal benefits and optimal immigration, implying a higher immigration rate than in a world without social security. However, as we show in the following, this is not the case in our model. Given the assumed

parametrization of utility and production technology, we find instead that chosen immigration and social security policies are independent from each other if the government sets social security contributions in addition to the immigration rate. Consequently, with a social security system in place, the same immigration rate as in our baseline model constitutes an equilibrium.

With social security, individuals face the intertemporal budget constraint

$$c_t^y + \frac{c_{t+1}^o}{1+r_{t+1}} = w_t(1-\tau_t) + \frac{b_{t+1}}{1+r_{t+1}} \ , \tag{14}$$

and optimal consumption and savings are given by

$$\begin{aligned} s_t &= \frac{\beta}{1+\beta} w_t(1-\tau_t) - \frac{1}{1+\beta}\frac{b_{t+1}}{1+r_{t+1}} \ , \\ c_t^y &= \frac{1}{1+\beta}\left[w_t(1-\tau_t) + \frac{b_{t+1}}{1+r_{t+1}}\right] \ , \quad \text{and} \\ c_{t+1}^o &= \frac{\beta}{1+\beta}(1+r_{t+1})\left[w_t(1-\tau_t) + \frac{b_{t+1}}{1+r_{t+1}}\right] \ . \end{aligned} \tag{15}$$

The government maximizes its objective function (4) with respect to γ_t and τ_t. This determines the equilibrium policy functions $\gamma(\tilde{k}_t)$ and $\tau(\tilde{k}_t)$. As in the case without social security, we can derive a Markov-perfect equilibrium in which policies are time-invariant.

Starting from the conjectures $d\gamma/d\tilde{k}_t = 0$ and $d\tau/d\tilde{k}_t = 0$, we first determine the effects of marginally raising γ_t and τ_t on welfare of the old and the young. With respect to social security benefits for the old generation, immigration has two effects: On the one hand, it increases the number of contributors to social security, and on the other hand, it diminishes wages from which social security contributions are financed. The net effect of immigration on social security benefits is clearly positive, however:

$$\frac{db_t}{d\gamma_t} = \frac{1-\alpha}{1+\gamma_t} b_t \ .$$

In addition to its influence on social security benefits, immigration raises the capital income of the old as in the baseline model without social security. The resulting effect of immigration on the consumption level and on welfare of the old in period t is

$$\frac{dc_t^o}{d\gamma_t} = \frac{1-\alpha}{1+\gamma_t} c_t^o \quad \text{and} \quad \frac{dV_t^o}{d\gamma_t} = \frac{1-\alpha}{1+\gamma_t} - \psi \ , \tag{16}$$

just as in the case without social security. Although the income gain from immigration for the old is higher with a social security system in place – the

income gain from immigration is proportional to c_t^o – the marginal utility of income is accordingly lower.

For the young generation's consumption and welfare the effect of immigration on social security matters. Inserting for b_{t+1} from the government's budget constraint, we can write the discounted value of future benefits as follows:

$$\frac{b_{t+1}}{1+r_{t+1}} = \frac{1-\alpha}{\alpha}(1+n)\tau_{t+1}\tilde{k}_{t+1} \; .$$

Employing $\tilde{k}_{t+1} = s_t/(1+n)$ and s_t as given by (15) yields

$$\begin{aligned} \frac{b_{t+1}}{1+r_{t+1}} &= \frac{(1-\alpha)\beta\tau_{t+1}}{\alpha(1+\beta)+(1-\alpha)\tau_{t+1}} w_t\,(1-\tau_t) \quad \text{and} \\ \tilde{k}_{t+1} &= \frac{\alpha\beta w_t\,(1-\tau_t)}{(1+n)\,[\alpha(1+\beta)+(1-\alpha)\tau_{t+1}]} \; . \end{aligned} \tag{17}$$

Setting $d\tau_{t+1}/d\tilde{k}_{t+1} = 0$, we obtain

$$\frac{d\,(b_{t+1}/(1+r_{t+1}))}{d\gamma_t} = -\frac{\alpha}{1+\gamma_t}\frac{b_{t+1}}{1+r_{t+1}} \quad \text{and} \quad \frac{d\tilde{k}_{t+1}}{d\gamma_t} = -\frac{\alpha}{1+\gamma_t}\tilde{k}_{t+1} \; . \tag{18}$$

That is, the discounted value of future benefits declines with immigration, because immigration diminishes capital accumulation and thereby raises the interest rate. With (15) and (18) we obtain the same derivatives

$$\begin{aligned} \frac{dc_t^y}{d\gamma_t} &= -\frac{\alpha}{1+\gamma_t}c_t^y \; , \quad \frac{dc_{t+1}^o}{d\gamma_t} = -\frac{\alpha^2}{1+\gamma_t}c_{t+1}^o \; , \quad \text{and} \\ \frac{dV_t^y}{d\gamma_t} &= -\frac{\alpha(1+\alpha\beta)}{1+\gamma_t} - \psi \end{aligned} \tag{19}$$

as in the baseline model without social security. Consequently, the equilibrium level of immigration is the same as in the case without social security.

Proposition 2 *The immigration rate as specified in Proposition 1 also constitutes an equilibrium if a social security system is in place.*

Regarding the equilibrium level of social security contributions, young and old have conflicting interests: the old generation prefers high contributions in order to raise their social security benefits whereas the welfare of the young declines in the contribution rate.[8] The old's welfare gain from marginally raising social security contributions is given by

$$\frac{dV_t^o}{d\tau_t} = \frac{w_t(1+l)}{c_t^o} = \frac{b_t/\tau_t}{c_t^o} \; . \tag{20}$$

[8]Social security benefits rise unambiguously in τ_t, since labor supply is exogenous.

For the influence on consumption and welfare of the young we can derive from (15) and (17) the following terms:

$$\frac{dc_t^y}{d\tau_t} = -\frac{1}{1-\tau_t}c_t^y \ , \quad \frac{dc_{t+1}^o}{d\tau_t} = -\frac{\alpha}{1-\tau_t}c_{t+1}^o \ , \quad \text{and}$$
$$\frac{dV_t^y}{d\tau_t} = -\frac{1+\alpha\beta}{1-\tau_t} \ . \tag{21}$$

Given the influence of τ_t on welfare of both generations (19) and (21), the equilibrium contribution rate can be determined as follows:[9]

$$\tau = \frac{1-\alpha-\alpha(1+n)(1+\alpha\beta)}{1-\alpha+(1-\alpha)(1+n)(1+\alpha\beta)} \ . \tag{22}$$

Note that τ is smaller than one. Equilibrium social security contributions decline in the population growth rate n since the share of old individuals who prefer a high level of social security decreases in n. Contributions also decline in the capital share α and in the time preference factor β.

We see from this section that, given our model specification, equilibrium immigration and social security policies are independent of each other. In contrast to the case of a social security system with fully flexible contributions and benefits we have considered, social security may influence immigration policy in a system with exogenous (flat) benefits b. However, given the experience of substantial pension reforms in the past, it appears to be more plausible to assume that governments can change social security parameters over time instead of modeling a rigid social security system with fixed benefits for all cohorts now and in the future.

4 Concluding Remarks

In this paper, we have analyzed the effects of population aging on immigration policy in a representative democracy model with two overlapping generations. The assumptions of logarithmic utility and Cobb-Douglas technology allowed an analytical closed-form solution of our model. We have shown that aging, i.e. a decline in population growth, has an expansionary influence on the chosen immigration level, and that this effect may even overcompensate the positive impact of aging on the capital intensity. We have also found that equilibrium immigration policy is time-invariant, and that the immigration level set by a representative democracy government, which

[9] Lorz (1999) and Gonzales-Eiras and Niepelt (2007) derive similar results in models without immigration.

maximizes the welfare of the currently living generations only, exceeds the immigration level which would also take into account the welfare of future, yet unborn generations.

To obtain further insights into the political economy of migration policy, our analysis may be extended in various directions: For example, one may distinguish different skill levels of workers and thereby model the distributional conflict with regard to the desired immigration level not only between different generations but also within generations between skilled and unskilled workers. Another extension would involve more general utility and production functions. With more general functional forms, however, a closed-form solution as in our baseline model would no longer be possible.

Finally, taking into account that immigrants tend to have more children than industrialized countries' natives would introduce additional dynamics into the model. Immigration would then alter the age composition of the electorate in subsequent periods.

Part III
Aging and Immigration Policy in a Representative Democracy

Lena Calahorrano

Abstract

This paper analyzes how population aging affects immigration policy in rich industrialized countries. It sets up a two-period model of a representative democracy with two overlapping generations. The government's preferred immigration rate is found to increase with the share of retirees in the population. The paper differentiates between an economy without a pension system and one with pay-as-you-go pensions. The chosen immigration rate is contingent on the design of the pension system. If pension contributions and benefits are set freely by the government, equilibrium immigration is lower than it is in the absence of a pension system. On the contrary, it is higher if the pension level is fixed ex ante to a relatively generous level, since native workers then benefit from sharing the burden of pension contributions with the immigrants.

JEL classification: J1, D78, F22

Keywords: Demographic Change, Political Economy, Immigration Policy

1 Introduction

Virtually all industrialized countries are facing a decline in birth rates and an increase in life expectancy resulting in substantial population aging. Against this background, the question arises how rich countries adjust their immigration policies in the wake of demographic change. For instance, the United Nations' report on replacement migration (UNDP 2001) investigates how much immigration would be necessary to offset population aging in various low-fertility countries. Apparently, the supply of potential migrants is not a limiting factor for international labor flows, see, e.g., Facchini and Mayda (2008) who make restrictive immigration policies responsible for low observed international labor flows.

This paper sets up a political economy model of a representative democracy to answer the question whether the demand for immigrants is higher in countries with an older population. It accounts for the fact that immigrants in industrialized countries tend to have more children than natives, altering the political balance in subsequent periods. Furthermore, the paper distinguishes between different possible pension system characteristics. While the benchmark model abstracts from public pensions, the model extensions in section 4 contrast a pension system with fixed benefits to one with fully flexible benefits and contributions.

Point of departure is a two-period economy with two overlapping generations, young workers and old retirees. In each period the respective government sets the immigration level to maximize political support from its voters, i.e. from both currently living generations. The electorate is heterogeneous since workers and retirees have conflicting preferences concerning the number of immigrants. Due to its effects on factor accumulation, immigration policy in the first period not only influences the welfare of current generations but it also has consequences for welfare in the second period. Immigration policy is, therefore, a sequential game between the governments of the subsequent periods. The equilibrium of this game is derived to analyze how the population growth rate influences the level of immigration. The bottom line of the analysis is that in a representative democracy an increase in the share of old individuals in the electorate enhances immigration. This result holds regardless of whether old individuals have a pension income financed by young individuals' contributions or only an income from private savings.

In the present model, preferences concerning immigration are driven both by the impact of immigration on factor prices and on the pay-as-you-go (PAYG) pension system, and by non-economic factors subsumed in a "disutility" parameter. The income effects induced by immigration in the host country have been analyzed under a variety of assumptions, see, e.g., Razin

and Sadka (2000, 2004), Epstein and Hillman (2003), and Kemnitz (2003). In theory, immigration alters factor prices by increasing labor supply (wages decline while returns to capital increase). If the labor market is not fully flexible, unemployment may increase instead, as in Kemnitz (2003). These effects are dampened if capital is mobile internationally, or if production structures adjust as predicted by the Rybczynski theorem, see, e.g., Hillman and Weiss (1999). Despite capital mobility and trade migration seems to have an impact on incomes: whereas Card (1990) finds that the Mariel boatlift of 1980, a worker inflow of 7% of the Miami labor force, had virtually no effect on wages and unemployment there, there is evidence for negative wage effects at the national level, see, e.g., Borjas (2003). Furthermore, Angrist and Kugler (2003), using European panel data from 1983 to 1999, find that in Europe, immigration displaced natives, and that unemployment effects were more negative in countries with less flexible labor markets. Meanwhile, non-economic factors clearly shape attitudes toward immigration as well, see, for instance, O'Rourke and Sinnott (2006) and Mayda (2006).

The present paper builds on several related publications with endogenous immigration policy. Benhabib (1996) examines immigration policy in a median voter model with heterogeneous wealth endowments, whereas Mazza and van Winden (1996) analyze the determination of redistribution and immigration policies in a representative democracy with workers and capital owners. In both models, individuals are in favor of admitting immigrants if these are different from themselves. In the dynamic models by Dolmas and Huffman (2004) and Ortega (2005, 2010) preferences are mitigated or even reversed as immigrants get to vote on redistribution policy in the future. Natives may then favor the admission of immigrants who are similar to themselves. This effect is counteracted in the present model by the high number of immigrants' offspring, who will oppose high pension benefits in the future.

Scholten and Thum (1996) and Haupt and Peters (1998) analyze immigration policy in the presence of (exogenous) PAYG pensions in median voter models with three generations. Immigration policy is determined by old workers' preferences in their settings. More closely related to this analysis is a relatively recent paper by Sand and Razin (2007). They analyze equilibrium immigration and pension policy making in a dynamic set-up with two overlapping generations. In their median-voter framework, population aging may lead to a switch from the young voters' preferred policies to an implementation of the old voters' preferred policies, namely maximum immigration and a tax rate which maximizes social security revenue. Following Hillman and Weiss (1999), the present approach chooses a political support function that includes all groups of voters to model a representative demo-

cracy, rather than a median voter model. In contrast to Sand and Razin (2007), the predicted consequences of aging are less drastic. Instead, the relationship between population growth and the equilibrium immigration level is continuous.[1]

The remainder of the paper is structured as follows: The economic model is set up in section 2 and immigration policy is analyzed in section 3. Section 4 adds a social security system to the model. Section 5 concludes.

2 The Economic Model

The economic framework is a two-period version of an overlapping generations model with workers and retirees. A two-period model is sufficient to show the key effects of immigration on both generations' utility levels while it is relatively straightforward to solve: individuals know that the world ends after two periods and there is a closed-form solution for the equilibrium in the second period, which can be used to derive the equilibrium in the first period.

In each period $t = 1, 2$ competitive firms produce a single aggregate good with a Cobb-Douglas technology:

$$Y_t = K_t^{\alpha} L_t^{1-\alpha} \ .$$

Young individuals supply one unit of labor. The workforce L_t is composed of natives and immigrants such that $L_t = N_t(1 + \gamma_t)$, where γ_t is the ratio of immigrants per native worker (as in Sand and Razin 2007). The capital stock K_t is given by the old individuals' savings. For simplicity capital is assumed to depreciate completely after one period. The capital stock per worker (native or immigrant) is defined as $k_t \equiv K_t/L_t$ and the capital stock per native worker as $\tilde{k}_t \equiv K_t/N_t$, therefore $k_t = \tilde{k}_t/(1 + \gamma_t)$. International trade or capital mobility which may theoretically result in world factor price equalization are ignored. For a given capital stock per native worker, immigration thus lowers the capital intensity in production and thereby wages, whereas capital returns increase. Equilibrium factor prices are then given by

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

In each period, young individuals receive a wage income w_t. The young generation born in the first period allocates the wage income to consumption and savings. The young generation born in the second period only lives for

[1] Note that in an overlapping-generations model with many generations, aging would not lead to drastic changes in the median voter's preferred policy either.

that period and therefore consumes its entire wage income. Old individuals are retired and consume all of their wealth $s_{t-1}(1+r_t)$. In the benchmark setting there is no social security system. Utility is logarithmic in consumption:

$$U_1^y = \ln c_1^y + \beta \ln c_2^o - d\gamma_1 - \beta d\gamma_2 \ , \quad U_2^y = \ln c_2^y - d\gamma_2 \ , \quad \text{and}$$
$$U_t^o = \ln c_t^o - d\gamma_t \ , \quad t = 1, 2 \ .$$

The term $d\gamma_t$ denotes a disutility related to immigration or to the integration of immigrants, which is not accounted for in incomes and does not affect individuals' consumption decision. For instance, an increased heterogeneity of social norms and customs may reduce utility as in Hillman (2002) and Krieger (2005). Additionally, the parameter d may capture a reduction in the utility derived from public goods which results from heterogeneous preferences (see Alesina and La Ferrara 2005). The young in period 1 also anticipate the disutility $d\gamma_2$ related to immigration in period 2. Optimal savings and consumption of the first-period young are

$$s_1 = \frac{\beta}{1+\beta} w_1 \ , \quad c_1^y = \frac{1}{1+\beta} w_1 \ , \quad \text{and} \quad c_2^o = \frac{\beta}{1+\beta} w_1 (1+r_2) \ . \tag{2}$$

Immigration is permanent and the children of immigrants are considered as natives, such that $N_2 = (1+n)N_1 + (1+m)\gamma_1 N_1$, where n is the native rate of population growth and m the immigrant rate of population growth. Defining the difference between the population growth rates of immigrants and natives as $\delta = m - n$, the number of workers in period 2 is $N_2 = [(1+n)(1+\gamma_1) + \delta\gamma_1]N_1$. In line with empirical evidence on immigration to industrialized countries, only the case $\delta \geq 0$ is considered. Immigrants are fully integrated into the economy after one period and are allowed to vote in their old age.

The capital market is in equilibrium if $K_2 = s_1 L_1$. The capital endowment of each native worker in the second period is given by

$$\tilde{k}_2 = \frac{\beta(1-\alpha)\tilde{k}_1^{\alpha}(1+\gamma_1)^{1-\alpha}}{(1+\beta)\left[(1+n)(1+\gamma_1) + \delta\gamma_1\right]} \ , \tag{3}$$

since $\tilde{k}_2 = s_1(1+\gamma_1)N_1/N_2$. According to (3), immigration lowers capital accumulation per native worker:

$$\frac{d\tilde{k}_2}{d\gamma_1} = -\frac{\tilde{k}_2}{1+\gamma_1}\left[\frac{\delta}{(1+n)(1+\gamma_1) + \delta\gamma_1} + \alpha\right] < 0 \ . \tag{4}$$

The reason for this result is that both wage income and thereby individual savings, and the ratio of savers to next period's native workers decline with immigration.

3 Immigration Policy in the Benchmark Model

The political economy equilibrium is derived under the assumption of a representative democracy in which the government accounts for the welfare of both contemporaneously living generations when setting immigration policy. More precisely, in each period $t = 1, 2$ the government sets γ_t to maximize the following objective function:

$$W_t = \omega_t^o V_t^o + \omega_t^y V_t^y \ ,$$

where V_t^o and V_t^y denote the indirect utility of a representative old and young individual, respectively, while ω_t^o and ω_t^y denote their political weights. This objective function is more suitable for replicating policy outcomes in a representative democracy than the median voter's utility, as Hillman and Weiss (1999) argue. It can be motivated by a probabilistic voting framework as in Lindbeck and Weibull (1987) and Coughlin et al. (1990). It is assumed that both generations are equally responsive to policy changes, such that the government weights each generation's utility with its share in the electorate:[2]

$$\omega_t^o = \frac{1 + \gamma_{t-1}}{(2+n)(1+\gamma_{t-1}) + \delta\gamma_{t-1}} \quad \text{and} \quad \omega_t^y = 1 - \omega_t^o \ .$$

The sequence of events is as follows: At the beginning of each period, the respective government decides on immigration policy. Production takes place after immigration and finally, young individuals decide how to allocate their wage income to consumption and savings. It is straightforward to solve the model by backward induction. Therefore, equilibrium immigration policy in the second period is discussed first. The second-period immigration rate is then used to derive the first-period equilibrium. While a closed-form solution for γ_2 exists, this is not the case for γ_1. However, it is possible to identify the different channels through which first-period immigration affects the young and old generations and to solve numerically for the equilibrium.

Immigration Policy in the Second Period

In the second period, the young prefer not to admit any immigrants because of the induced decline in the wage and because of the disutility related to immigration, $d\gamma_2$. The old would like to admit immigrants up to the point where the marginal increase in the capital return is equal to the marginal

[2]Relaxing this assumption would allow for the influence of interest groups as in Facchini and Mayda (2008).

non-income disutility d. Marginal utilities are

$$\frac{dV_2^o}{d\gamma_2} = \frac{1-\alpha}{1+\gamma_2} - d \quad \text{and} \quad \frac{dV_2^y}{d\gamma_2} = -\frac{\alpha}{1+\gamma_2} - d \tag{5}$$

for the old and young respectively. From the government's first-order condition

$$\omega_2^o \frac{1-\alpha}{1+\gamma_2} - \omega_2^y \frac{\alpha}{1+\gamma_2} - d = 0 \,,$$

follows the policy rule

$$1+\gamma_2 = \frac{\omega_2^o - \alpha}{d} \,. \tag{6}$$

Equilibrium immigration is contingent on past immigration but not on the state variable $\tilde{k}_2$. The policy rule in (6) has a number of properties which are worth discussing because they also apply to the first period: A positive number of immigrants is admitted ($\gamma_2 > 0$) as long as $d < \omega_2^o - \alpha$, i.e., the non-income disutility of integrating immigrants has to be sufficiently small. Since only the old generation favors admitting a positive number of immigrants, the second-period immigration rate rises with the old's population share (and declines with their share in aggregate income). The population share is contingent on the native population growth rate, on the previous period's immigration rate and on the difference in population growth rates between natives and immigrants.

A high native population growth rate n implies that the political weight of the old generation is low. Population aging – a decline in the population growth rate n – therefore leads to a rise in immigration (for a given first-period immigration rate):

$$\frac{\partial \gamma_2}{\partial n} = -\frac{(\omega_2^o)^2}{d} \quad < 0 \,.$$

The immigration rate in the first period alters the age composition of the electorate in the second period as long as immigrants have more children than natives. The second-period population share of the old generation declines as more immigrants are admitted in the first period. Consequently, γ_2 declines in γ_1:

$$\frac{d\gamma_2}{d\gamma_1} = -\frac{1}{d} \cdot \frac{\delta(\omega_2^o)^2}{(1+\gamma_1)^2} \quad \leq 0 \quad \text{iff} \quad \delta \geq 0 \,. \tag{7}$$

The second-period immigration rate is also a declining function of δ (for given $\gamma_1 > 0$) since a higher number of offspring among the immigrants from the previous period increases the share of young individuals:

$$\frac{\partial \gamma_2}{\partial \delta} = -\frac{\gamma_1}{1+\gamma_1} \frac{(\omega_2^o)^2}{d} \quad \leq 0 \quad \text{iff} \quad \gamma_1 \geq 0 \,.$$

In summary, the government's preferred immigration rate in the second period clearly increases as the young generation's share in the electorate declines. However, the immigration rates in both periods are substitutes. A high first-period immigration rate thus counteracts the effect of population aging on the second-period immigration rate. The effects of first-period immigration on both generations and the first-period government's preferred immigration rate will be discussed now.

Immigration Policy in the First Period

The first-period government accounts for the impact of its immigration policy decision on factor accumulation and on the immigration rate set by the second-period government. In the first period, the old generation's marginal utility from immigration is the same as in the second period, $dV_1^o/d\gamma_1 = (1-\alpha)/(1+\gamma_1) - d$. However, the young generation's marginal utility is contingent on factor accumulation and on future policy:

$$\frac{dV_1^y}{d\gamma_1} = \frac{1}{c_1^y}\frac{1}{1+\beta}\frac{dw_1}{d\gamma_1} + \beta\frac{1}{c_2^o}\frac{\beta}{1+\beta}\left[\frac{dw_1}{d\gamma_1}(1+r_2) + w_1\frac{dr_2}{d\gamma_1}\right] - d - \beta d\frac{d\gamma_2}{d\gamma_1} \ . \quad (8)$$

Whereas the declining wage lowers consumption in young and old age, immigration also has some second-order effects on the future capital return (via its impact on capital accumulation and on the future age composition of the electorate). Furthermore, since the immigration rates in both periods are substitutes, admitting more immigrants in the first period lowers the disutility related to immigration in the second period, which can be seen from the last term in (8). The impact of immigration on the wage rate is

$$\frac{dw_1}{d\gamma_1} = -\frac{\alpha}{1+\gamma_1}w_1 \ , \quad (9)$$

while the impact on the future capital return is given by

$$\frac{dr_2}{d\gamma_1} = -\frac{1-\alpha}{\tilde{k}_2}(1+r_2)\frac{d\tilde{k}_2}{d\gamma_1} + \frac{1-\alpha}{1+\gamma_2}(1+r_2)\frac{d\gamma_2}{d\gamma_1} \ , \quad (10)$$

with $d\gamma_2/d\gamma_1 < 0$ given by (7) and $d\tilde{k}_2/d\gamma_1 < 0$ given by (4).

The government's first-order condition in the first period can be written

as

$$\begin{aligned}
&\omega_1^o \cdot \frac{1-\alpha}{1+\gamma_1} - \omega_1^y \cdot \frac{\alpha(1+\beta)}{1+\gamma_1} \\
&+ \omega_1^y \beta \cdot \frac{1-\alpha}{1+\gamma_1} \left[\frac{\delta}{(1+n)(1+\gamma_1)+\delta\gamma_1} + \alpha - \frac{\delta(\omega_2^o)^2}{(1+\gamma_1)(\omega_2^o-\alpha)} \right] \qquad (11) \\
&- d + \omega_1^y \beta \frac{\delta(\omega_2^o)^2}{(1+\gamma_1)^2} = 0 \ ,
\end{aligned}$$

where the population shares reduce to $\omega_1^o = 1/(2+n)$ and $\omega_1^y = (1+n)/(2+n)$, since there is no past immigration. This equation is highly non-linear in the immigration rate γ_1 and therefore cannot be expressed analytically in closed form. Note, however, that γ_1 does not depend on the state variable $\tilde{k}_1$ either, but only on the model parameters. The impact of the parameters determining the demographic structure of the population is of primary interest, i.e. the impact of the native population growth rate n and of the difference between the immigrant and the native population growth rate δ.

Whereas in the second period a lower population growth rate n enhances immigration by increasing the old generation's share in the electorate, it has some additional (contrasting) effects on the equilibrium immigration rate in the first period. Firstly, as argued in section 2, immigration reduces the future ratio of capital to native workers, implying a higher future capital return, because of lower wages and because of a lower number of savers relative to the number of next-period natives. Both of these effects are enhanced by a low population growth rate, weakening the opposition of the young generation to immigration. Secondly, the dampening effect of first-period immigration on second-period immigration is larger the lower is the native population's growth rate. This has two opposing effects on preferences over the level of first-period immigration. A lower γ_2 due to a higher γ_1 directly increases the young generation's lifetime utility, also weakening the young's opposition to immigration as n declines. However, the second-period capital return is reduced, enhancing opposition to immigration. In summary, a lower population growth rate induces several expanding effects on immigration policy, but also a contracting effect, since the increase in the future return on savings is dampened.

Contrary to the second period, the difference in population growth rates between immigrants and natives δ does not influence the political weights of the two generations in the first period, since there is no past immigration.[3] However, δ alters the impact of the first-period immigration rate on the second-period immigration rate γ_2 and on second-period capital per native

[3]This simplification would not apply in a setting with a longer time-horizon.

$\tilde{k}_2$. It can be shown that δ has contrasting effects on both derivatives. On the one hand, first-period immigration has a stronger negative impact on second-period immigration the larger the reduction in the old generation's future political weight ω_2^o. As mentioned above, this weight declines as immigrants have more children than natives. On the other hand, there is also a level effect: the impact of γ_1 on γ_2 is weaker the smaller ω_2^o. Similarly, γ_1 has a stronger negative impact on $\tilde{k}_2$ the larger δ. This is because the ratio of savers to next-period natives declines with the difference in population growth rates between immigrants and natives. However, there is also a level effect: the impact of γ_1 on $\tilde{k}_2$ is weaker the smaller is $\tilde{k}_2$, which is the case for a large difference in population growth rates. Intuitively, the government admits many immigrants if there is a strong negative impact of immigration on capital accumulation, since this implies higher capital returns in the second period.

If immigrants have the same number of children as natives, immigration policy does not have any impact on the future age composition of the electorate and the nonlinear terms vanish. For this special case ($\delta = 0$), immigration policy is determined by the time-invariant rule

$$1 + \gamma_1 = \frac{(1-\alpha) - (1+n)\alpha(1+\alpha\beta)}{(2+n)d} .$$

The derivative of the immigration rate with respect to the population growth rate can then analytically be shown to be negative. For $\delta > 0$, however, numerical simulations are necessary to find a solution for γ_1 and to investigate the impact of n and δ.

Before discussing the simulation results the choice of parameter values is now motivated. This investigation largely follows Börsch-Supan et al. (2003) in defining the different parameter values. Population parameters are taken from the United Nations' Population Division Database (UNPD 2006). The production share of capital α is set to 0.35. According to Börsch-Supan et al. (2003) a common assumption for the annual discount rate of households is 0.01. If it is assumed that each of the two life periods lasts for 30 years,[4] this corresponds to a discount factor β of about 0.75. The benchmark native population growth rate is $n = -0.2$, which is computed from the 2000-2005 average number of children per woman for the world's more developed regions. The difference between the immigrant and native population growth rates δ is set to 0.5, the difference between the less developed regions (excluding the least developed regions) and the more developed regions. The non-economic disutility parameter related to the integration of immigrants,

[4]An increase in life expectancy is not modeled.

d, is set to 0.1. This is, of course, somewhat arbitrary. However, this parameter has a direct and unambiguous impact on equilibrium immigration. Therefore, the effect of picking a different value for d is quite clear.

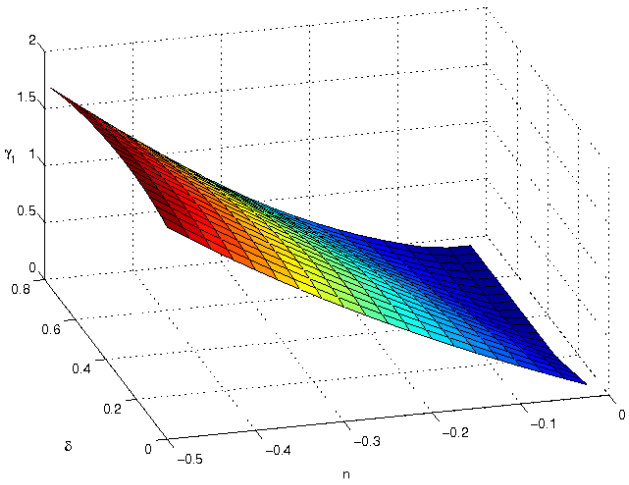
Figure III.1 illustrates the simulation results. Population aging visibly increases the government's preferred immigration rate γ_1. Bear in mind that this attenuates the positive effect of population aging on second-period immigration since the immigration rates in both periods are substitutes. The aggregate effect of the population growth rate on the second-period immigration rate is given by

$$\frac{d\gamma_2}{dn} = \frac{\partial \gamma_2}{\partial n} + \frac{d\gamma_2}{d\gamma_1} \cdot \frac{\partial \gamma_1}{\partial n} \ .$$

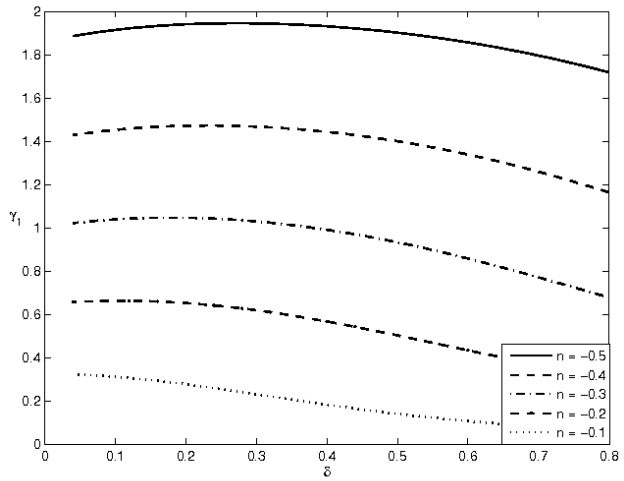
With $\partial \gamma_1 / \partial n < 0$, the positive effect of population aging on the second-period immigration rate is at least attenuated by a higher first-period immigration rate. The simulations reveal that the aggregate effect of aging on the immigration rate in the second period is positive for very low population growth rates but negative for population growth rates close to zero. Meanwhile, the overall effect of the difference between the native and the immigrant population growth rate is ambiguous. Figure 1(b) shows more clearly that δ has a non-monotonic effect on γ_1. An increase in the difference between population growth rates lowers immigration, given that this difference is already high. However, the opposite is true for a low difference δ. The conclusions which can be drawn from the simulations are outlined in proposition 1.

Proposition 1 *In a representative democracy without a social security system,*
(i) a lower native population growth rate has a direct positive effect on the equilibrium immigration rate. However, the immigration rates in the two periods are substitutes.
(ii) the difference between the native and the immigrant population growth rate has a non-monotonic effect on the equilibrium immigration rate. The immigration rate increases for low differences in population growth rates but decreases for high differences.

Summarizing, immigration influences voters' welfare in two ways, by altering factor prices and by causing a non-income disutility. Population aging leads to a higher level of immigration in the first period since immigration increases the return on the old generation's accumulated capital. If immigrants have more children than natives, first-period immigration raises the share of young voters in the second period. Consequently, the immigration rates in both periods are substitutes. The following section turns to the question of whether the existence of a social security system changes these results.



(a) Impact of n and δ



(b) Impact of δ for given n

Figure III.1: Impact of n and δ on First-Period Immigration

4 Social Security

Since aging implies a higher old-age dependency ratio, immigration is often seen as a (partial) solution to financing problems of social security, in particular of PAYG pension systems. Therefore, a pension system is introduced into the model to investigate the relationship between immigration and social security. Net wages are $w_t(1-\tau_t)$, where τ_t is the contribution rate to the pension system. A balanced budget is assumed such that

$$\tau_t = \frac{b_t}{w_t(1+l_t)} ,$$

with b_t as the level of individual pension benefits.

Optimal savings and consumption of the first-period young are then given by

$$\begin{aligned} s_1 &= \frac{\beta}{1+\beta} w_1(1-\tau_1) - \frac{1}{1+\beta}\frac{b_2}{1+r_2} , \\ c_1^y &= \frac{1}{1+\beta} w_1(1-\tau_1) + \frac{1}{1+\beta}\frac{b_2}{1+r_2} , \quad \text{and} \\ c_2^o &= \frac{\beta}{1+\beta} w_1(1-\tau_1)(1+r_2) + \frac{\beta}{1+\beta} b_2 . \end{aligned} \tag{12}$$

Note that the impact of immigration on capital accumulation, determined by $\tilde{k}_2 = s_1\,(1+\gamma_1)\,N_1/N_2$, is ambiguous. Although the ratio of workers to next period's native workers $(1+\gamma_1)N_1/N_2$ declines with immigration, the net wage may not. Furthermore, per capita savings increase with a declining discounted value of future pension benefits.

Equilibrium immigration policy with PAYG pensions is analyzed in two different settings. In the first setting, pensioners receive a flat benefit $b_t = b$, whereas in the second setting, the government can freely set the social security contribution rate τ_t in each period.[5] In the first setting, pension contributions are endogenously determined by the government's choice of the immigration rate.

Flat Benefit

In the case of a flat benefit, the government sets immigration policy γ_t to maximize (3), taking into account that individuals allocate consumption according to (12). Individuals' marginal utility in the second period is not the

[5]The same results would hold if the government was assumed to set b_t instead of τ_t.

same as in a model without a social security system, see (5). Instead, it is given by

$$\frac{dV_2^o}{d\gamma_2} = \frac{1-\alpha}{1+\gamma_2} \cdot \frac{s_1(1+r_2)}{c_2^o} - d \quad \text{and} \quad \frac{dV_2^y}{d\gamma_2} = -\frac{1}{1+\gamma_2} \cdot \frac{w_2(\alpha-\tau_2)}{c_2^y} - d \ , \tag{13}$$

for the old and young generation respectively, where

$$c_2^o = s_1(1+r_2) + b \qquad \text{and} \qquad c_2^y = w_2(1-\tau_2) \ .$$

In this setting, immigration has no effect on the old generation's social security benefits. The old's utility gain due to increasing capital returns is smaller the smaller the share of private savings in the old's total consumption – the larger social security benefits. Although the young experience a utility loss due to declining wages, they benefit from a declining social security contribution rate. For $\tau_2 > \alpha$, the young's marginal economic utility from raising immigration is actually positive. Even if $\tau_2 \leq \alpha$, the old's and young's preferences in the presence of PAYG pensions are closer together than in the benchmark model.

From the first-order condition

$$\omega_2^o \frac{1-\alpha}{1+\gamma_2} \frac{s_1(1+r_2)}{c_2^o} - \omega_2^y \frac{1}{1+\gamma_2} \frac{w_2(\alpha-\tau_2)}{c_2^y} - d = 0 \ ,$$

the government's preferred immigration rate can be computed numerically. Again, population aging increases the share of individuals who clearly favor immigration. Additionally, aging now boosts the positive effect of immigration on the young's utility because a lower native population growth rate implies higher pension contributions. Note that the equilibrium immigration rate is now contingent on the old's and young's consumptions levels, and therefore on the state variable $\tilde{k}_2$. An increase in $\tilde{k}_2$ weakens the effect of immigration on the old generation's utility and enhances its effect on the young generation's utility. Equilibrium immigration thus decreases, unless $\tau_2 > \alpha$.

The results for the second period are not discussed separately, but the first-order condition of the second-period government is used for the simulations of the full model with social security. In the first period, immigration affects the old in the same way as in the second period: $dV_1^o/d\gamma_1 = (1-\alpha)/(1+\gamma_1) \cdot s_0(1+r_1)/c_1^o - d$. The old's benefit from increasing capital returns is smaller the smaller the share of private savings in their consumption. Meanwhile, the young's welfare is also affected by the impact of first-period

on second-period immigration and by the change in future capital returns:

$$\begin{aligned}\frac{dV_1^y}{d\gamma_1} = &\frac{1}{c_1^y}\frac{1}{1+\beta}\left[\frac{dw_1(1-\tau_1)}{d\gamma_1} - \frac{b}{(1+r_2)^2}\frac{dr_2}{d\gamma_1}\right] \\ &+ \frac{\beta}{c_2^o}\frac{\beta}{1+\beta}\left[\frac{dw_1(1-\tau_1)}{d\gamma_1}(1+r_2) + w_1(1-\tau_1)\frac{dr_2}{d\gamma_1}\right] \\ &- d - \beta d\frac{d\gamma_2}{d\gamma_1}\,,\end{aligned} \tag{14}$$

where c_1^y and c_2^o are given by (12).

The impact of immigration on the young's net wage,

$$\frac{dw_1(1-\tau_1)}{d\gamma_1} = -\frac{w_1\,(\alpha-\tau_1)}{1+\gamma_1}\,,$$

may be positive or negative, as in the second period. Furthermore, immigration in the first period affects second-period capital returns via capital accumulation and via the second-period immigration rate, as in (10).

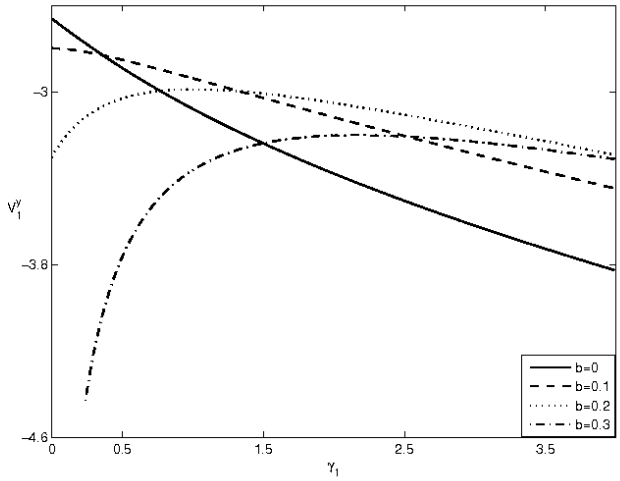
Raising immigration raises the future share of young voters, which suggests a negative derivative $d\gamma_2/d\gamma_1$, confirmed by the simulations. The impact of immigration on capital accumulation is contingent on r_2 and therefore also on the derivative $d\gamma_2/d\gamma_1$:

$$\frac{d\tilde{k}_2}{d\gamma_1} = \frac{-\frac{\delta}{(1+\gamma_1)^2}\tilde{k}_2 - \frac{\beta}{1+\beta}\frac{w_1(\alpha-\tau_1)}{1+\gamma_1} + \frac{1}{1+\beta}\frac{1-\alpha}{1+\gamma_2}\frac{b}{1+r_2}\frac{d\gamma_2}{d\gamma_1}}{\frac{\omega_2^y}{\omega_2^o} + \frac{1}{1+\beta}\frac{1-\alpha}{\tilde{k}_2}\frac{b}{1+r_2}}\,. \tag{15}$$

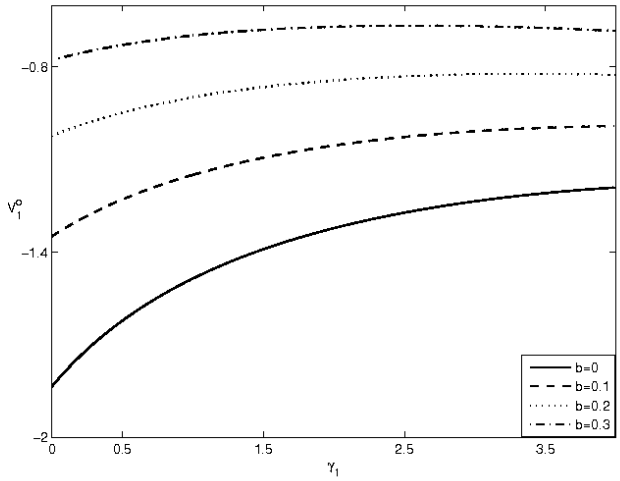
Although the net wage may increase with immigration, the decreasing ratio of savers to second-period natives and the increasing value of discounted second-period benefits cause a dampening effect of γ_1 on $\tilde{k}_2$, also confirmed by the simulations.

Figure III.2 illustrates that, in the first period as well, both generations' conflict of interest concerning immigration is less pronounced than in the absence of a pension system. Given a native population growth rate of $n = -0.2$ and a difference between the immigrant and the native population growth rate of $\delta = 0.5$, figures 2(a) and 2(b) show both generations' utility levels as functions of first-period immigration, for different degrees of generosity of the pension system.[6] One can see from the figures that the old's utility gain from increasing capital returns is smaller the larger pension benefits,

[6]Only benefit levels below the level of the wage income (in the absence of immigration), $w_1|_{\gamma_1=0} = 0.37$ are considered. The capital stock per native worker and immigration in the second period are computed endogenously.



(a) Impact of γ_1 on V_1^y



(b) Impact of γ_1 on V_1^o

Figure III.2: Impact of Immigration on Welfare

whereas the young's utility loss from a decreasing gross wage is mitigated or even reversed by decreasing pension contributions. For sizable levels of social security benefits, the young thus also prefer positive levels of immigration over no immigration.

To derive the level of immigration in the first period, the following Lagrangian is set up:

$$\mathcal{L} = \omega_1^o V_1^o + \omega_1^y V_1^y + \lambda \frac{dW_2}{d\gamma_2} + \mu \left(\tilde{k}_2 - \frac{\omega_2^o}{\omega_2^y} s_1 \right) .$$

The government in the first period thus maximizes aggregate welfare in the first period subject to the first-order condition in the second period and subject to the capital accumulation condition. To find the equilibrium of the 2-period model, one has to solve the system

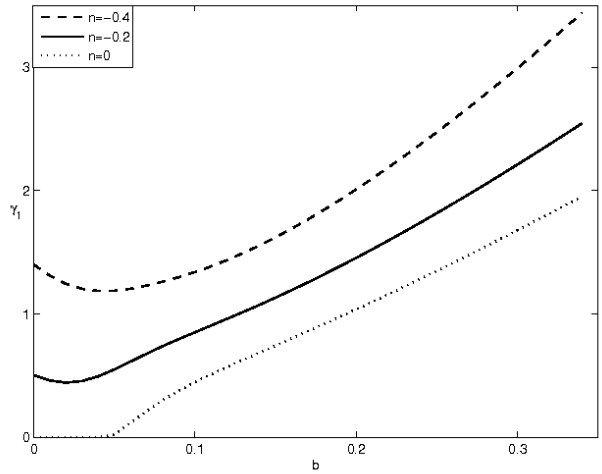
$$\frac{d\mathcal{L}}{d\gamma_1} = 0, \quad \frac{d\mathcal{L}}{d\tilde{k}_2} = 0, \quad \frac{d\mathcal{L}}{d\gamma_2} = 0, \quad \tilde{k}_2 - \frac{\omega_2^o}{\omega_2^y} s_1 = 0 \quad \text{and} \quad \frac{dW_2}{d\gamma_2} = 0 .$$

It is relatively straightforward to compute these derivatives numerically.

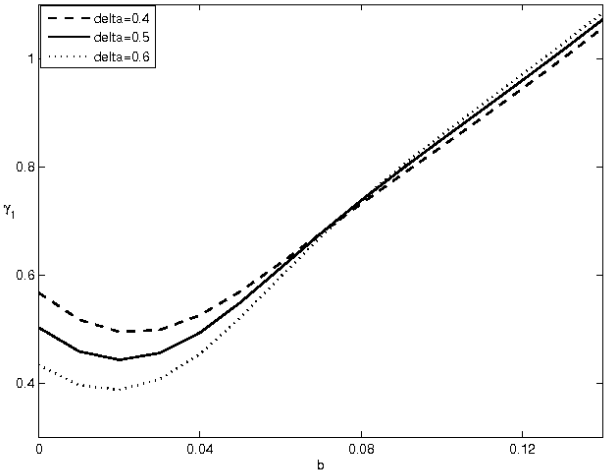
Figure III.3 shows the simulated equilibrium values for first-period immigration γ_1 as a function of the level of individual pension benefits b. The solid line in figures 3(a) and 3(b) is based on the benchmark parameter values $n = -0.2$ and $\delta = 0.5$. The figures illustrate that an initially positive preferred immigration rate is reduced by the introduction of pensions. This is due to the old generation's decreased utility gain, as private savings account for a smaller share of their income. While immigration still entails a non-income disutility, its effectivity as a device for income redistribution is reduced. However, the government's preferred immigration rate increases as pensions increase further, because the young generation benefits from sharing the burden of pension contributions with the immigrants. Whereas figure 3(a) shows the relationship between b and γ_1 for various levels of the native population growth rate, figure 3(b) shows a smaller detail of this relationship for various levels of the difference in population growth rates. As in the case without a social security system, population aging clearly enhances immigration, whereas the impact of differences in the number of children is ambiguous.

The conclusion is:

Proposition 2 *Given a PAYG pension system with exogenous benefits b*
(i) the level of pension benefits has a non-monotonic effect on equilibrium immigration. The government's preferred immigration rate decreases for small levels of b, but increases above the immigration rate in the absence of PAYG



(a) Different levels of n



(b) Different levels of δ

Figure III.3: Impact of Social Security on First-Period Immigration

pensions for high levels of b.
(ii) a lower native population growth rate has a positive effect on the equilibrium immigration rate.
(iii) the difference between the native and the immigrant population growth rate has an ambiguous effect on the immigration rate.

Notice that in this setting the old's pension benefits are not contingent on the level of the young's wages. This is different if the government can freely set both the current immigration rate γ_t and the current social security contribution rate τ_t. That setting is discussed next.

Fully Flexible Contributions and Benefits

The government now maximizes its objective function (3) with respect to γ_t and to τ_t. Even though substantial pension reforms in the last decade have met with a lot of opposition, it seems plausible to assume that industrialized countries' governments are able to change the parameters of the social security system over time. In many industrialized countries, the level of pension benefits is at least partly tied to wages. Actual PAYG pension systems should therefore be located between the two extreme settings discussed here.

Second period consumption levels are $c_2^o = s_1(1+r_2)+b_2$ and $c_2^y = w_2(1-\tau_2)$, where $b_2 = \tau_2 w_2(1+l_2)$ and τ_2 is set by the government. Immigration negatively affects the young generation since the gross wage declines. It has several effects on the old generation's welfare: on the one hand immigration raises the capital return and also the number of contributors to social security. On the other hand, the declining gross wage reduces social security benefits, ceteris paribus. The net effect of higher immigration on the old generation's welfare is positive. Marginal utilities reduce to (5):

$$\frac{dV_2^o}{d\gamma_2} = \frac{1-\alpha}{1+\gamma_2} - d \quad \text{and} \quad \frac{dV_2^y}{d\gamma_2} = -\frac{\alpha}{1+\gamma_2} - d\,,$$

just as in the case without social security. Although the income change from immigration is proportional to consumption and thus higher for the old and lower for the young with a social security system in place, the marginal utility of income is accordingly lower for the old and higher for the young. The additional effects of immigration induced by the existence of a social security system exactly cancel out and consequently, the chosen level of immigration in the second period is given by (6).

Regarding social security contributions, the old and young generations' preferences are unambiguous. Whereas the old favor high benefits, the young

would prefer not to pay any social security contributions. From the government's first-order condition follows the equilibrium social security contribution rate[7]

$$\tau_2 = \frac{\omega_2^o - \alpha}{1-\alpha} \; . \tag{16}$$

Equilibrium social security contributions increase in the population share of the old generation. Although the social security contribution rate in the second period is independent from second-period immigration, it is contingent on first-period immigration since first-period immigration reduces the share of old voters in the second period.

In the first period, the old generation's marginal utility corresponds to the one in the second period and thus does not differ from the case without a pension system. However, the young generation's marginal utility does not reduce to equation (8). Instead, it is given by

$$\begin{aligned} \frac{dV_1^y}{d\gamma_1} = & \frac{1}{c_1^y}\frac{1}{1+\beta}\left[\frac{dw_1}{d\gamma_1}(1-\tau_1) + \frac{d\left(b_2/\left(1+r_2\right)\right)}{d\gamma_1}\right] \\ & + \beta\frac{1}{c_2^o}\frac{\beta}{1+\beta}\left[\frac{dw_1}{d\gamma_1}(1-\tau_1)(1+r_2) + w_1(1-\tau_1)\frac{dr_2}{d\gamma_1} + \frac{db_2}{d\gamma_1}\right] \\ & - d - \beta d\frac{d\gamma_2}{d\gamma_1} \; . \end{aligned} \tag{17}$$

with $dw_1/d\gamma_1$ and $dr_2/d\gamma_1$ still given by equations (9) and (10), where $d\gamma_2/d\gamma_1 < 0$, still given by (7). The key difference is that immigration in the first period now has an impact on future social security policy, with

$$\frac{d\tau_2}{d\gamma_1} = -\frac{1}{1-\alpha}\frac{\delta\left(\omega_2^o\right)^2}{\left(1+\gamma_1\right)^2} \quad < 0 \; .$$

Lower future pension contributions ceteris paribus imply lower benefits and a negative effect on the young generation's utility. This suggests that the government's chosen immigration rate will be lower than in the absence of a pension system. Furthermore, lower future benefits enhance capital accumulation since individuals have to provide for their old age consumption.

The impact of immigration on capital accumulation is now determined by

$$\begin{aligned} \frac{d\tilde{k}_2}{d\gamma_1} = & -\frac{\delta}{\left(1+\gamma_1\right)^2}\frac{\omega_2^o}{\omega_2^y}\tilde{k}_2 \\ & - \frac{\omega_2^o}{\omega_2^y}\left[\frac{\alpha}{1+\gamma_1}\frac{\beta}{1+\beta}w_1(1-\tau_1) + \frac{1}{1+\beta}\frac{d\left(b_2/(1+r_2)\right)}{d\gamma_1}\right] \; . \end{aligned} \tag{18}$$

[7]See Lorz (1999) and more recently Gonzales-Eiras and Niepelt (2007) who derive similar results in models without immigration.

Discounted future benefits $b_2/(1+r_2)$ can be written in terms of τ_2 and w_1:

$$\frac{b_2}{1+r_2} = \frac{\frac{1-\alpha}{\alpha}\frac{\beta}{1+\beta}\tau_2}{1+\frac{1-\alpha}{\alpha}\frac{1}{1+\beta}\tau_2} \cdot w_1\left(1-\tau_1\right) \ .$$

Since immigration reduces both w_1 and τ_2 it has a negative impact on discounted future benefits:

$$\frac{d\left(b_2/(1+r_2)\right)}{d\gamma_1} = -\frac{b_2}{1+r_2}\left[\frac{\alpha}{1+\gamma_1} + \frac{\delta\left(\omega_2^o\right)^2}{\left(1+\gamma_1\right)^2} \cdot \frac{1}{\left(\omega_2^o-\alpha\right)\left(1+\frac{\omega_2^o-\alpha}{\alpha}\frac{1}{1+\beta}\right)}\right] < 0 \ , \tag{19}$$

and therefore a positive (partial) effect on capital accumulation. The simulations show that the aggregate effect on capital accumulation is still negative.

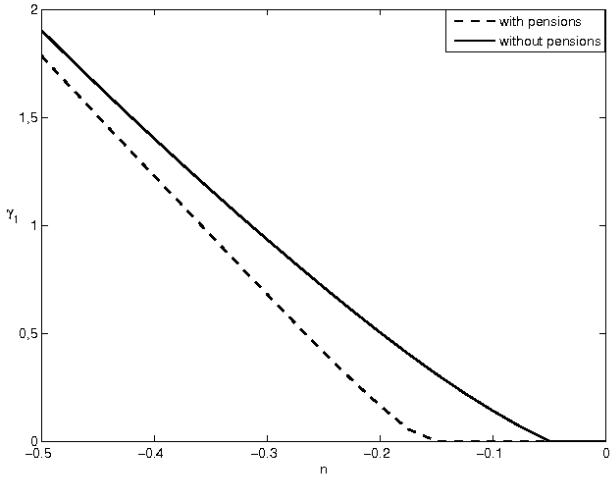
Meanwhile, the effect on undiscounted benefits is ambiguous: even though the contribution rate and the number of future immigrant contributors decline, the future ratio of native contributors to pension recipients increases. Furthermore, the impact of immigration on the future wage rate is ambiguous. The derivative can be written as

$$\frac{db_2}{d\gamma_1} = b_2\frac{\omega_2^o}{\omega_2^y}\frac{\delta}{\left(1+\gamma_1\right)^2} + b_2\left(\frac{\alpha}{\tilde{k}_2}\cdot\frac{d\tilde{k}_2}{d\gamma_1} - \frac{2-\alpha}{1+\gamma_2}\cdot\frac{1}{d}\frac{\delta(\omega_2^o)^2}{\left(1+\gamma_1\right)^2}\right) \ , \tag{20}$$

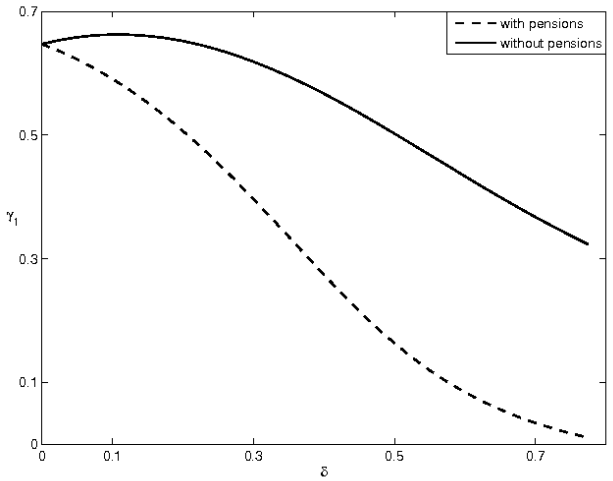
with $d\tilde{k}_2/d\gamma_1$ defined by equations (18) and (19). The first term in (20) is the effect on the future ratio of native contributors to pension recipients, whereas the last term is the effect on the future share of old voters, which determines both γ_2 and τ_2.

The simulations of the model confirm that the equilibrium immigration rate in the presence of fully flexible pension contributions and benefits is lower than in the absence of a pension system, see figure III.4. Figure 4(a) shows the relationship between the first-period immigration rate and the native population growth rate in the presence and in the absence of social security, given $\delta = 0.5$. Figure 4(b) shows the relationship between the first-period immigration rate and the difference in population growth rates given $n = -0.2$.

Since the old generation unambiguously benefits from immigration, population aging still boosts immigration, as figure 4(a) shows. The difference between the native and the immigrant population growth rate still has a non-monotonic effect, see figure 4(b). Note that if immigrants have the same number of children as natives ($\delta = 0$), the existence of a PAYG pension system does not affect immigration. This result is due to the fact that first-



(a) Impact of n



(b) Impact of δ

Figure III.4: First-Period Immigration With and Without a Pension System

period immigration then does not have any impact on the second-period pension contribution rate τ_2. The findings of the model with a pension system with fully flexible parameters are summarized in the following proposition.

Proposition 3 *Given a PAYG pension system with fully flexible benefits and contributions*
(i) the equilibrium immigration rate is lower than in the absence of a pension system.
(ii) a lower native population growth rate has a positive effect on the equilibrium immigration rate.
(iii) the difference between the native and the immigrant population growth rate has a non-monotonic effect on the equilibrium immigration rate.

Recall that in the presence of exogenous old-age pensions financed by the young generation the equilibrium immigration rate may well be higher than in the absence of a pension system. However, the immigration rate is lower if the government can freely decide on both the volume of immigration and the generosity of the pension system. If the pension benefit is exogenous, young individuals benefit from sharing the burden of pension contributions with immigrants. This effect is absent when the burden of pension contributions is endogenous. However, then, immigration generates a negative externality for the young generation as long as immigrants have more children than natives: the larger future cohort of young individuals will induce lower pension contributions and ceteris paribus lower benefits.

5 Conclusion

This paper has analyzed the effects of population aging on immigration policy in a two-period economy with two overlapping generations. A representative democracy was modeled by assuming that in each period the respective government limits immigration to the level that maximizes aggregate welfare of its voters. Immigration preferences are driven by economic as well as non-economic motives: immigration alters factor prices and additionally causes a disutility not related to individual incomes. Population aging implies that the old generation receives a higher political weight in the government's objective function. Aging has an expansionary effect on the chosen immigration level, due to the fact that immigration increases the return on the old generation's savings. However, as immigrants have more children than natives, a high immigration rate in the first period is tantamount to a large share of young voters, and therefore low immigration, in the second period.

In the presence of a PAYG pension system, immigration additionally affects the level of pension contributions and/or benefits. Population aging still unambiguously enhances immigration but the predictions concerning the effect of pensions on immigration policy are contingent on how the pension system is modeled. The paper contrasts a system with fixed benefits to one with fully flexible contributions and benefits. With exogenous pension benefits the young and old generations' preferences are closer together than in the absence of a pension system: whereas the old's utility gain from immigration decreases with a decreasing share of private savings in their consumption, the young's net wage may even increase with immigration since individual pension contributions decline. For high benefit levels, equilibrium immigration is higher than in the absence of a pension system, whereas the reverse is true for low benefit levels. Contrary to this, the chosen immigration rate is lower than in the absence of pensions when the government can freely set contributions: the government anticipates that immigration will reduce its young voters' future pensions benefits. As immigrants have more children than natives, the future old's population share declines with immigration.

In the benchmark model presented in this paper, positive levels of immigration are driven solely by old individuals' preferences for high capital returns. If pension benefits are fixed, native young workers also benefit from sharing the burden of pension contributions with immigrant workers. Further insights can be expected from introducing different skill levels into the model. Skilled native workers may support the immigration of low skilled workers and vice versa. Furthermore, as the World Bank (2008) outlines, the agglomeration of skilled labor may entail benefits because of increasing returns to scale and external effects such as welfare spillovers as in Facchini and Mayda (2008).

Part IV
Why Don't Labor and Capital Flow Between Young and Old Countries?

Lena Calahorrano and Philipp an de Meulen[a]

Abstract

We investigate the effect of demographics on international factor flows in a political-economy framework. Demographic differences between industrialized and developing countries add to factor price differences which imply economic incentives for migration to developed countries and for capital flows to developing countries. However, political barriers to immigration in developed countries and expropriation risks in developing countries impede factor flows. We explore how these restrictions interact, using a political economy approach that takes into account different generations' conflicting attitudes toward immigration and expropriation. We find that in the presence of mobility constraints larger demographic differences between countries need not result in an increase of factor flows.

JEL classification: D78, F21, F22, J10

Keywords: Demographic Change, Political Economy, Migration, Foreign Direct Investment

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1 Introduction

Virtually all industrialized countries and many developing countries are facing a decline in birth rates and an increase in life expectancy. However, demographic structures differ widely between industrialized and developing countries: in general, birth rates are much smaller in rich industrialized countries than in the developing world. Industrialized countries are thus characterized by a larger proportion of old relative to young individuals. Since individuals accumulate capital throughout their working life, developed countries dispose of relatively large stocks of productive capital per worker. This adds to high wages but low capital returns in comparison to developing countries. Consequently, large efficiency gains from international capital and labor movements seem possible.

The significance of demographic structures for international migration and foreign direct investment (FDI) has aroused international interest. Factor movements are discussed not only as a means to realize efficiency gains but also as a driver for economic growth in developing countries and to secure pension systems in industrialized countries. While the United Nations' report on replacement migration calculates the size of labor movements necessary to offset population aging in various low-fertility countries (see UNPD 2001), INGENUE (2001) and Brooks (2003) simulate the effects of demographic trends on international capital flows under the assumption that capital is perfectly mobile while labor is not. Brooks (2003) predicts that the US and the EU will be large capital exporters until their baby boomers retire around 2020.

However, political constraints to factor flows exist both in developing and developed countries. Developing countries with a favorable demographic structure to inward investment often do not offer the institutional framework for international investors to fully reap efficiency gains. Governments of industrialized countries in turn tend to be sensitive to native resentments toward the admission of immigrants. Observed international factor flows are indeed far too low to equalize the returns to capital and labor. Brooks (2003) notes that capital flows would be considerably lower than predicted by his model if institutional risk was taken into account. Concerning labor, Facchini and Mayda (2008) make restrictive immigration policies responsible for the low level of international flows.

To understand the determinants of factor flows we thus have to assess the political economy of mobility constraints. The political processes from which mobility constraints result are influenced by heterogeneous interests within a country's population. Since different attitudes of labor and capital owners are (basically) in line with different attitudes of young and old individuals,

mobility constraints are directly influenced by the demographic structures of populations. Demographic diversity thus has a twofold impact, on economic incentives for factor flows and on attitudes toward factor flows. While it unambiguously creates economic incentives for factor flows, its impact on the outcome of the political process requires detailed consideration.

Research on the impediments to international capital and labor flows is well established, but the simultaneous consideration of migration and investment policies has so far been neglected. This is a gap in the literature which we aim to fill with our paper. Accounting for both kinds of policies jointly does not simply imply that both migration and FDI are limited. Instead, the volume of factor flows is determined by the interplay of policies. In our model FDI constitutes a substitute to immigration from the industrialized country's point of view: the larger the share of capital invested in the developing country, the less immigrants are admitted to the industrialized country. Meanwhile, higher emigration from the developing country secures capital investments there. From the developing country's point of view migration and FDI are thus complements.

To capture the demographic effects on international factor flows, we consider a one-period setting with sequential decisions in two open economies, each populated by two generations. While the majority is young in the developing country, the reverse is true for the industrialized country. We assume policies to be determined by the respective median voter's preferences. The government's policy decision in the industrialized country is how many immigrants to admit, while in the developing country, imported capital can either be expropriated or not.

Our model explains several stylized facts in a straightforward way. Firstly, labor and capital flows are restricted by policies. Secondly, among poor countries, more developed countries have a higher propensity to expropriate. Thirdly, immigration preferences are driven by economic as well as non-economic motives. Furthermore, the model shows that more demographic diversity does not necessarily induce factor flows. Admitting immigrants is more attractive for the industrialized country's old median voter the younger the developing country's population. However, then, expropriation preferences of the young median voter are higher. The age structure in the industrialized country only affects expropriation preferences in the developing country via emigration. Although immigration preferences in the industrialized country may increase with the share of old, this need not be the case.

We set up the economic model in section 3. Section 4 analyzes equilibrium policies, given simultaneity of the investment and migration policy decisions. In section 5 we examine the impact of changes in parameters on the equilibrium, while section 6 extends our analysis to the case in which investment

takes place after the migration policy decision. Section 7 concludes.

2 Related Literature

Our analysis draws on two strands of literature. The first one deals with the impediments to capital flows from rich to poor countries. Contrary to Lucas (1990), Alfaro et al. (2008) find that bad institutional quality does play a major role in explaining the low level of capital investment in poor countries. Several authors deal explicitly with expropriation risk of FDI. Eaton and Gersovitz (1984), for example, argue that the mere existence of expropriation risk distorts FDI flows even if expropriation does not occur. Cole and English (1991) and Thomas and Worrall (1994) model dynamic games between international investors and a host-country government under the assumption that investors can punish the host country for expropriation by withholding future investment. The authors find that in order to avoid expropriation, FDI must not exceed a critical threshold.

Additionally, Harms (2002) shows in a theoretical model that a taxation of foreign capital is more likely if the host country is poor. Other than taxation, expropriation entails an additional cost, which grows with the technological deficit of developing countries: Jodice (1980) finds a curvilinear effect of development on expropriation risk, implying that the risk of expropriation is largest in intermediately developed countries. He conjectures that while very rich countries waive expropriation in favor of more subtle ways to seize foreign investors' revenues, very poor countries do not expropriate as they hinge on the technological knowledge of foreign investors.

The second strand of literature we build on deals with endogenous immigration policy. In the static models by Benhabib (1996) and Mazza and van Winden (1996), individuals support admitting immigrants if these are different from themselves. Preferences may be reversed if immigrants receive political rights. This is also an important prediction of the dynamic models of Dolmas and Huffman (2004) and Ortega (2005, 2010). In our model, old capital owners' immigration preferences are limited, even though immigrants do not have any political rights. This is because migration entails a non-economic disutility and because it raises the capital intensity and thus lowers returns on the share of capital invested in the developing country, although it raises capital returns in the industrialized country.

As we do, Sand and Razin (2007) analyze the impact of aging on immigration and also on redistribution policy. In their model the median voter's identity may change not only due to native population aging but also due to the immigration of individuals who have more children than natives. This

may restrain the old's preference for admitting immigrants. We focus on the effect of marginal changes in the population share of both generations. In contrast to Sand and Razin, we therefore assume that the median voter in the industrialized country is always old.

3 The Economic Model

We consider an industrialized country and a developing country, both populated by young and old individuals. The young individuals may potentially supply their labor in either country, while the old individuals are out of the labor force. The old individuals in the industrialized country own a given amount of capital. Meanwhile, the old in the developing country do not own any productive capital, only an endowment e^* which they can consume, as in Cole and English (1991). Assuming that the developing country's old own only a non-productive endowment is plausible since financial institutions are rudimentary in many developing countries, and savings often take the form of tangible assets. The size of the total population is normalized to one in both countries:

$$N^y + N^o = 1 \qquad \text{and} \qquad N^{y*} + N^{o*} = 1 \ ,$$

where the asterisk denotes the developing country's variables. We assume that the old are in the majority in the industrialized country, while the opposite holds for the developing country, that is $N^o > 0.5$ and $N^{o*} < 0.5$.

In both countries a homogeneous good is produced with a Cobb-Douglas production function:

$$Y = AK^{\alpha}L^{1-\alpha} \quad \text{and} \quad Y^* = \tilde{A}(K^*)^{\alpha}(L^*)^{1-\alpha} \ .$$

The size of the capital stock owned by the old generation in the industrialized country is $\bar{k} \cdot N^o$. Production in the developing country hinges on capital inflows from the industrialized country ($K^* = \bar{k} \cdot N^o - K$) since the developing country's inhabitants own no capital. We assume that foreign direct investment is administered by a mutual fund, which coordinates the single investment decisions.

The young in both countries exogenously supply one unit of labor. We set the depreciation rate to zero for simplicity.[1] We assume that total factor productivity (TFP) in the industrialized country A exceeds TFP in the

[1]Note that this simplification does not drive our results. In the limiting case with full depreciation, the net utility gain from expropriation is independent of the level of FDI.

developing country. This results from a less favorable business climate, for instance due to an inferior infrastructure, in the developing country. However, capital flows from the industrialized country are accompanied by technological expertise. Therefore, TFP $\tilde{A}$ exceeds the level A^* the developing country would achieve without the foreign expertise:

$$\tilde{A} = \frac{1}{\theta} A^* \quad \text{with} \quad 0 < \theta < 1 \; .$$

The foreign investors' productivity thus not only hinges on the initial conditions they find in the developing country (such as the state of the infrastructure and know-how, the regulatory burden etc.), but also on their know-how and their capacity to cope with these conditions.

Defining M as labor migration from the developing to the industrialized country, factor prices are given by

$$\begin{aligned} w &= (1-\alpha) A \left(\frac{K}{N^y + M} \right)^{\alpha} \quad , \quad r = \alpha A \left(\frac{K}{N^y + M} \right)^{\alpha - 1} \; , \\ w^* &= (1-\alpha) \tilde{A} \left(\frac{K^*}{N^{y*} - M} \right)^{\alpha} \quad \text{and} \quad r^* = \alpha \tilde{A} \left(\frac{K^*}{N^{y*} - M} \right)^{\alpha - 1} \end{aligned} \tag{1}$$

in the industrialized and the developing country respectively. [2]

Each country's government sets policy to maximize the respective median voter's utility. The policy decision in the developing country concerns the expropriation of foreign capital. Expropriation refers to the seizure of the capital stock, and, for simplicity, it is assumed to be always total. If there were no costs of expropriation, the developing country would be subject to a classical time-inconsistency problem and would always expropriate. Consequently, no capital would flow there. However, expropriation usually comes at some cost. As foreign investors lose control over invested capital after expropriation, it is sensible to assume them to withdraw their expertise, as in Eaton and Gersovitz (1984) as well as Harms and an de Meulen ().[3] The seized capital stock is still used for production, but TFP drops to A^* in the developing country, thereby lowering output and the young's wages. The old do not incur any cost from expropriation. We assume that the benefit from

[2] There is a large empirical literature on the effects of migration on wages, starting with Card (1990). The size of factor price effects is contingent on the substitutability between different factors of production and between immigrants and natives, see, for instance, Ottaviano and Peri (2008). Assuming a more general CES production function would allow a wider range of possible factor price elasticities with respect to migration and FDI.

[3] In a setting with a longer time horizon, one could also argue that expropriation reduces future capital inflows, see Cole and English (1991) and Thomas and Worrall (1994).

expropriation (the gross return to capital) is distributed equally among the developing country's old and those young who have not emigrated. Each inhabitant of the developing country thus receives a transfer t with

$$t = \frac{T}{1-M} = \frac{(1+\theta r^*)K^*}{1-M} \ . \tag{2}$$

The government of the industrialized country decides on the number of admitted immigrants. Immigration to the industrialized country affects its citizens' welfare in two ways. Firstly, it alters factor prices. The young generation clearly suffers since wages decline. The old generation benefits from increasing capital returns on the part of capital invested at home k and suffers from decreasing returns on that part invested in the foreign developing country k^*. Be aware that k and k^* do not denote the capital intensities in production (K/L and K^*/L^*) but rather the capital used in home and foreign production per investor (K/N^o and K^*/N^o). Secondly, we assume that immigration causes a disutility d to all of the industrialized country's citizens, proportional to the number of immigrants M.[4] This disutility parameter captures potential welfare effects of immigration not accounted for in individual incomes in a tractable way. For instance, natives may resent an increased heterogeneity of social norms and customs, as in Hillman (2002), or immigration may reduce the utility derived from public goods, as in Alesina and La Ferrara (2005). Individuals' utility is linear in consumption:

$$U^i = c^i - d \cdot M \quad \text{and} \quad U^{i*} = c^{i*} \ , \qquad i = y, o \ ,$$

with

$$\begin{aligned} c^y &= w \ , \\ c^o &= k(1+r) + k^*(1+r^*) \ , \end{aligned}$$

and

$$c^{y*} = \begin{cases} w & \text{in case of emigration} \\ w^* & \text{in case of non-expropriation} \\ \theta w^* + t & \text{in case of expropriation} \ , \end{cases}$$

$$c^{o*} = \begin{cases} e^* & \text{in case of non-expropriation} \\ e^* + t & \text{in case of expropriation} \ . \end{cases}$$

[4] We could also use the more general functional form d^γ. Since the choice of γ does not have any qualitative effect on our results we set γ equal to one. With $\gamma = 1$, the disutility caused by immigration increases linearly with the population share of immigrants.

We assume a sequence of events as illustrated in figure IV.1. First, the industrialized country's old allocate their capital to both countries and at the same time, the industrialized country's government determines maximum immigration. Second, the developing country's young migrate before third, the developing country's government decides whether to expropriate the foreign capital stock. Fourth, production and consumption take place. We solve the model by backward induction, that is, we start with the expropriation decision.

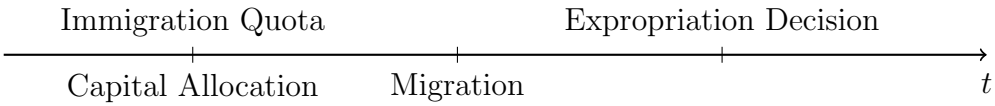


Figure IV.1: Sequence of Events

This sequence of events is chosen for the following reasons. Expropriation of the capital stock can only take place after capital has been installed. We assume the expropriation decision to be taken right before production starts, that is, after capital investment and labor migration. With respect to capital allocation and migration policy, we begin by assuming simultaneity. One could also argue that the implementation of migration policy decisions requires a longer lead time than the allocation of capital.[5] We therefore extend our model to this sequential timing in section 6.

4 Equilibrium Policy

We now come to the determination of equilibrium migration and FDI. We solve for the four equations determining the volume of individually optimal and politically determined factor flows, starting with the expropriation decision, which takes place in stage three. While we model four decisions, we show that factor flows are always restricted by the two policy decisions: FDI is restricted to the volume where the developing country abstains from expropriation, and migration takes on the level the industrialized country's old median voter prefers. Note that high emigration from the developing country may change the identity of the median voter there from a young to an old individual.

[5]Assuming that the investment decision takes place before the migration policy decision instead of simultaneity would yield exactly the same results, given that investors are atomistic and behave symmetrically in equilibrium.

Non-Expropriation Constraint

When deciding whether to expropriate in the third stage, the developing country's government faces given levels of capital imports K^* and migration M. We define the *non-expropriation constraint* K^{*max} as the level of FDI for which the median voter in the developing country is indifferent between expropriation and non-expropriation. If the median voter is old (because of high emigration, that is $M > N^{y*} - N^{o*}$), any foreign capital is always expropriated. We call the threshold value of migration for which there remain as many old as young individuals in the developing country M^{crit}, with $M^{crit} = N^{y*} - N^{o*}$. If $M < M^{crit}$, the median voter in the developing country is young. The young who have not emigrated benefit from the transfer like the old, but additionally suffer from a reduced wage rate due to a drop in TFP. A young median voter weakly prefers non-expropriation if the transfer does not compensate for the wage loss:

$$(1-\theta)w^* \geq t \; .$$

Using (2), this can be written as

$$(1-\theta)w^* \geq \frac{K^*}{1-M} + \frac{K^* \cdot \theta r^*}{1-M} \; . \tag{3}$$

An inflow of capital has three effects on expropriation preferences, a wage effect $(1-\theta)w^*$, a return effect $K^* \cdot \theta r^*/(1-M)$ and an effect on the seizable capital stock $K^*/(1-M)$. Subtracting the return effect on both sides and inserting (1) yields

$$\left[\frac{\frac{1-\theta}{\theta} A^*(1-\alpha) - \alpha A^*(N^{y*} - M)/(1-M)}{(N^{y*} - M)^\alpha} \right] (K^*)^\alpha \geq \frac{K^*}{1-M} \; .$$

Note that the sign of the term in squared brackets on the left hand side is independent of the level of FDI, K^*. A necessary condition for positive FDI for all M between 0 and N^{y*} is that the wage effect exceeds the return effect, which is fulfilled for sufficiently low θ:

$$\theta \leq \frac{1-\alpha}{(1-\alpha) + \alpha N^{y*}} \; .$$

This means that expropriation has to be costly.[6] Solving for K^* yields

$$K^* \leq (A^*)^{\frac{1}{1-\alpha}} \left[\frac{\frac{1-\theta}{\theta}(1-\alpha)(1-M) - \alpha(N^{y*} - M)}{(N^{y*} - M)^{\alpha}} \right]^{\frac{1}{1-\alpha}} .$$

Consequently, we can write the upper bound for capital imports, the *non-expropriation constraint*, as

$$K^{*max} = \begin{cases} 0 & \text{if } M > M^{crit} \\ (A^*)^{\frac{1}{1-\alpha}} \left[\frac{\frac{1-\theta}{\theta}(1-\alpha)(1-M) - \alpha(N^{y*} - M)}{(N^{y*} - M)^{\alpha}} \right]^{\frac{1}{1-\alpha}} & \text{if } M \leq M^{crit} \end{cases} , \tag{4}$$

for the case of an old and a young median voter respectively.

We can calculate the derivative of the young median voters' *non-expropriation constraint* with respect to emigration as

$$\frac{dK^{*max}}{dM} = \left(\frac{K^{*max}}{N^{y*} - M} \right)^{\alpha} \left[\frac{1-\theta}{\theta} A^* \left(\frac{\alpha(1-M)}{N^{y*} - M} - 1 \right) + \alpha A^* \right] . \tag{5}$$

The sign of this derivative is ambiguous. A positive effect of emigration on the critical level of FDI is sufficient for a unique equilibrium to exist in the case of a young median voter in the developing country (see proposition 1). Therefore, we assume the necessary and sufficient condition for $dK^{*max}/dM > 0$ for all M between 0 and N^{y*} given by

$$\theta > \frac{N^{y*} - \alpha}{(1+\alpha)N^{y*} - \alpha} ,$$

to be fulfilled.

Emigration has three effects on the *non-expropriation constraint*. Firstly, wages increase and so does the wage effect from expropriation. Secondly, capital returns and the return effect decrease. Both of these effects lower expropriation preferences. Thirdly, the number or recipients of a possible transfer decreases, making expropriation more attractive for the median voter. The parameter θ has two opposite effects on the derivative dK^{*max}/dM. Even though the marginal effect on the wage loss becomes smaller if θ increases, FDI to be distributed in case of expropriation decreases, as (4) shows.

In summary, expropriation has to be costly for non-expropriation compatible FDI to be larger than zero. However, the level of FDI compatible with

[6]Note that relaxing our assumption of no depreciation would decrease expropriation preferences due to a lower distributable capital stock. Given that the wage effect is larger than the return effect, expropriation would never take place in the limiting case with a depreciation rate of 100%.

non-expropriation only increases in emigration if expropriation costs are not too high, i.e. if θ is not too low. We have thus derived the *non-expropriation constraint*, resulting from the expropriation decision in the last stage, and its properties.[7]

Emigration Constraint

In the preceding stage, the developing country's young take their migration decision for a given level of FDI and for a given immigration policy in the industrialized country. In the absence of any immigration restrictions they would migrate until utility and thus wages in both countries are equal. This yields an *emigration constraint*:

$$M^{opt} = \frac{(\theta A/A^*)^{1/\alpha}(\bar{k}N^o - K^*)N^{y*} - K^*N^y}{(\theta A/A^*)^{1/\alpha}(\bar{k}N^o - K^*) + K^*} \ . \tag{6}$$

It is declining in the level of FDI since FDI reduces wage differences between both countries:

$$\frac{dM^{opt}}{dK^*} = -\frac{(\theta A/A^*)^{1/\alpha}(\bar{k}N^o - K^*)(N^y + N^{y*})}{\left[(\theta A/A^*)^{1/\alpha}(\bar{k}N^o - K^*) + K^*\right]^2} \qquad < 0 \ .$$

However, potential migrants have to obey the limit on immigration set by the industrialized country's government, the *immigration policy constraint* M^{max}, which we derive in the next subsection. While the potential migrants know the level of FDI, this is not the case for the industrialized country's government which decides on immigration policy. In our model the immigration restriction imposed by the industrialized country turns out to be binding, as we show below.

Immigration Policy Constraint

Immigration policy is determined by the preferences of the industrialized country's median voter, who is an old individual. Immigration policy is set simultaneously to the investors' allocation of capital. Immigration from the developing country raises the capital return on the part of capital invested in the industrialized country and decreases the capital return on the part

[7]Note that less elastic reactions of factor prices to factor supplies would translate into less elastic costs and benefits of expropriation in equation (3), implying a larger risk of expropriation. The effect of a growing seizable capital stock dominates the wage and return effects. Furthermore, weak reactions of factor prices may imply that expropriation preferences increase with emigration, since the number of transfer recipients declines.

invested in the developing country. Be aware that foreign capital returns only accrue to the industrialized country's investors if $K^* \leq K^{*max}$. For any volume of FDI exceeding the non-expropriation compatible level, the impact of migration on foreign capital returns is therefore not taken into account. However, we only consider the former case, since it is only optimal for investors to invest in the foreign country as long as returns are not expropriated (see below). Maximizing the old's indirect utility function assuming non-expropriation yields the following first-order condition for every value of K^* between zero and $\bar{k}N^o$:

$$k\frac{dr}{dM} + k^*\frac{dr^*}{dM} = d \,, \tag{7}$$

with

$$\frac{dr}{dM} = \frac{1-\alpha}{N^y + M}r \quad \text{and} \quad \frac{dr^*}{dM} = -\frac{1-\alpha}{N^{y*} - M}r^* \,,$$

and d denoting the non-monetary disutility related to a marginal increase in immigration. Equation (7) illustrates that immigrants are admitted as long as the marginal gain from immigration, $k(dr/dM)$, outweighs the marginal cost, $-k^*(dr^*/dM) + d$.[8] The first-order condition can also be written as

$$\frac{\alpha(w - w^*)}{1 - N^y} = d \,. \tag{8}$$

For unrestricted migration the wage rates in both countries are equal, and the left-hand side is zero. This is a solution for the *immigration policy constraint* only if $d = 0$, i.e. there are no costs of integrating immigrants. Intuitively, M^{max} must be smaller than unrestricted migration for any d exceeding zero. Hence, we can abstract from the *emigration constraint* as equilibrium migration is always determined by the industrialized country's policy.

For $K^* = 0$, we can show that

$$M^{max} = \bar{k}\left(\frac{(1-\alpha)\alpha A}{d}\right)^{1/\alpha}(N^o)^{(\alpha-1)/\alpha} - N^y \,. \tag{9}$$

With investment only taking place at home, the industrialized country's old favor admitting an infinite number of immigrants if there are no integration costs. The marginal return gain of additional immigration increases with the amount of capital each investor owns. The effect of a larger population share of the old generation is ambiguous since it is not only tantamount to a smaller domestic labor force but also implies a lower capital return level.

[8] Note that less elastic factor prices would imply that both marginal gains and costs decrease. M^{max} is then likely to be lower if the bulk of capital is invested at home.

For any $K^* > 0$, we cannot solve explicitly for M^{max}. However, using the implicit function theorem, we can show that the derivative of the industrialized median voter's preferred level of migration to FDI is

$$\frac{dM^{max}}{dK^*} = -\frac{\frac{r}{N^y+M} + \frac{r^*}{N^{y*}-M}}{\frac{K}{N^y+M} \cdot \frac{r}{N^y+M} + \frac{K^*}{N^{y*}-M} \cdot \frac{r^*}{N^{y*}-M}} \quad < 0 \, . \tag{10}$$

With larger capital exports, investors place a higher weight on foreign capital returns. These become large for low levels of migration. Therefore, chosen immigration is a declining function of FDI.

At the same time with the immigration policy decision, the industrialized country's old allocate their capital endowment. The investors have to take the political expropriation decision of the developing country into account.

Investment Constraint

In the absence of expropriation risk, the industrialized country's investors would export the share of capital necessary to equalize capital returns in both countries. We call the level of capital exports in the absence of expropriation risk K^{*opt}, the *investment constraint*, with

$$K^{*opt} = \frac{(A/\tilde{A})^{\frac{1}{\alpha-1}} \bar{k} \cdot N^o(N^{y*} - M)}{(N^y + M) + (A/\tilde{A})^{\frac{1}{\alpha-1}}(N^{y*} - M)} \, . \tag{11}$$

Obviously, the difference in capital returns and thus the optimal level of capital exports is lower the higher the immigration level, such that K^{*opt} is a declining function of M. It is straightforward to understand that no FDI exceeding the non-expropriation compatible level is an optimal choice. This is because in case of expropriation, investors only receive a positive return on the part of capital invested at home. Consequently, utility can be increased by investing a larger fraction of capital at home and reducing FDI. If the non-expropriation compatible level of FDI is not sufficient to equalize returns, it does not pay to further reduce FDI, foregoing high capital returns in the developing country. Therefore, actual FDI is given by the minimum of K^{*opt} and K^{*max}. The assumption that investors' capital is administered by a mutual fund solves the coordination problem between investors of ensuring that the sum of capital flows to the developing country does not exceed the level compatible with the *non-expropriation constraint*.

If the median voter in the developing country is old the *non-expropriation constraint* K^{*max} equals zero and thus always binds. However, in case of a young median voter the individually optimal level of capital exports, K^{*opt},

is not necessarily higher than the policy-induced level K^{*max} since in the interval $M < M^{crit}$ the former is a decreasing and the latter an increasing function of migration. However, we make the assumption that at the critical migration level M^{crit}, the young-median-voter's *non-expropriation constraint* binds, i.e. $K^{*max}(M^{crit}) < K^{*opt}(M^{crit})$. Then the *non-expropriation constraint* also binds for $M < M^{crit}$. Our equilibrium is thus characterized by the two equations (4) and (7).

Equilibrium

In a benchmark situation without political constraints, production would only take place in the country with the higher TFP, which is the industrialized country. Investors take into account that migration reacts to the capital allocation to equalize wages in both countries. Returns on capital are maximized if no FDI takes place, as then the entire workforce of the developing country emigrates to the industrialized country. This rather extreme outcome is due to the fact that we have not assumed any costs of migrating. In the presence of migration costs, different combinations of migration and FDI are possible, contingent on the relationship of TFP differences and migration costs.

Conversely, our political economy model can be summarized as a game between the industrialized country's investors and the industrialized country's government, subject to the *non-expropriation constraint*. $K^{*max}(M)$ is the investors' best response to the government's choice of immigration M. Hence, in equilibrium (K^*, M) combinations are located on the *non-expropriation constraint* where expropriation does not occur. Given no expropriation, the government's best response to any choice of FDI is given by the *immigration policy constraint* $M^{max}|_{K^*}$. The intersection of best responses then determines a Nash equilibrium. As we show below an additional equilibrium – not given by the intersection of these two policy functions – may exist with $M < M^{crit}$. Figure IV.2 shows the two policy equations and the equations for individually optimal migration and FDI in the absence of political constraints for $\alpha = 0.35$, $A = 1$, $A^* = 0.6$, $\theta = 0.75$, $N^y = 0.44$, $N^{y*} = 0.57$ and $d = 0.18$.

In choosing our benchmark parameters we adhere to common assumptions in the literature. According to Börsch-Supan et al. (2003), the production share of capital is usually set between 0.3 and 0.4, so our benchmark is $\alpha = 0.35$. We normalize TFP in the industrialized country A to 1, since what matters for our analysis is the relative size of A, $\tilde{A}$ and A^*. According to Dreher et al. (2007), developing countries' average TFP relative to the US is 0.53 if only official output is considered and 0.84 if the shadow economy is

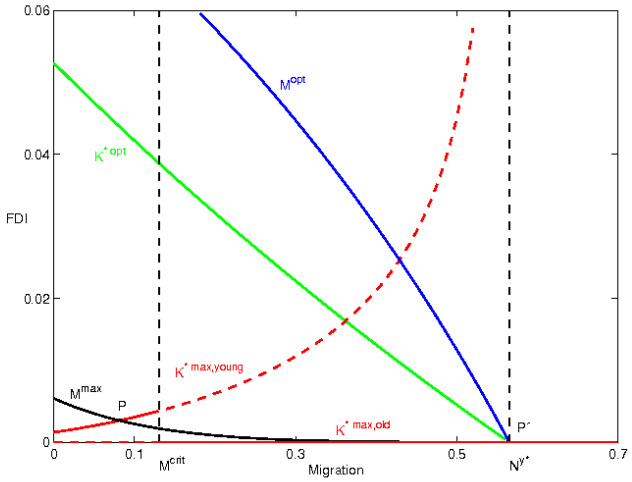


Figure IV.2: Migration and FDI in Equilibrium, $d > d^{crit}$

also taken into account. We set the developing country's TFP to $A^* = 0.6$ and the industrialized country's investors' TFP in the developing country to the intermediate value $\tilde{A} = 0.8$, which yields $\theta = 0.75$. In order to determine the relative sizes of the young and old generations, we look at the United Nations' Population Division's statistics on children per woman.[9] For the period of 2000-2005, total fertility in the world's more developed regions was about 1.6, while it was 2.6 for the world's less developed regions excluding the least developed regions. With the total population normalized to one in both countries, the resulting sizes of the young generations are $N^y = 0.44$ and $N^{y*} = 0.57$. We choose the level of the capital stock per investor to be $\bar{k} = 0.16$, implying an autarky capital intensity of about 0.2 in the industrialized country. The disutility parameter d is, of course, rather arbitrary since we have not explicitly modeled immigration-related costs. We define a critical immigration cost d^{crit}, which solves the *immigration policy constraint* (7) for $M = M^{crit}$ and $K^* = K^{*max}(M^{crit})$. Given that all other parameters are set to their benchmark values, $d^{crit} = 0.14$.

For $d > d^{crit}$, figure IV.2 illustrates two equilibria, an old-median-voter equilibrium labeled P' and a young-median-voter equilibrium labeled P. If both equilibria exist, we have to compare the industrialized country's old's indirect utility in order to determine which equilibrium is more plausible.[10]

[9] UNPD (2006)

[10] Although both equilibria may be realized, the one which generates higher utility for both players can be seen as a focal point.

Proposition 1 states the conditions for the existence of these two equilibria.

Proposition 1 *Given that $d \geq d^{crit}$, a young-median-voter equilibrium exists, as $dK^{*max}/dM > 0$. It is located at the intersection of $K^{*max}|_{M \leq M^{crit}}$ and M^{max}. Additionally, there is an old-median-voter equilibrium at $(K^* = 0, M^{max}|_{K^*=0})$ if $M^{max}|_{K^*=0} > M^{crit}$. This is fulfilled for sufficiently small d, i.e. $d < \frac{(1-\alpha)\alpha A \bar{k}^{\alpha}}{(2N^{y*}+N^{y}-1)^{\alpha} \cdot (1-N^{y})^{1-\alpha}}$*

Proof: Recall that the policy functions always determine the equilibrium. Since with $d \geq d^{crit}$, the developing country's young median voter's *non-expropriation constraint* and the *immigration policy constraint* intersect at $M \leq M^{crit}$, this is the young-median-voter equilibrium. It is unique if $M^{max}(K^* = 0) \leq M^{crit}$. Then, the industrialized country never admits more than M^{crit} migrants and the median voter's identity in the developing country never changes. Conversely, if $M^{max}(K^* = 0) > M^{crit}$, the intersection point of the *immigration policy constraint* with the old median voter's *non-expropriation constraint*, $(K^* = 0, M^{max}|_{K^*=0})$, is also an equilibrium.

Note that if migration does not cause any cost ($d = 0$), the industrialized country's median voter would like to admit an infinite number of immigrants. Nevertheless, N^{y*} is the upper bound for immigration. We find that the industrialized country's old always prefer the young-median-voter equilibrium, labeled P in figure IV.2. Starting from any point on the *immigration policy constraint*, utility decreases as we move marginally along the curve, increasing migration and decreasing FDI: the resulting utility change is approximately given by

$$dU^o = \frac{\partial U^o}{\partial M} dM + \frac{\partial U^o}{\partial K^*} dK^* \qquad < 0 \ ,$$

where $dM > 0$ and $dK^* < 0$ (see figure IV.2). Using the envelope theorem, $\partial U^o/\partial M = 0$, while $\partial U^o/\partial K^* > 0$ since $r^* > r$. Along M^{max} points with more FDI and less migration are thus clearly preferred.

If the industrialized country's inhabitants are sufficiently averse to immigration, the majority in the developing country is never reversed by labor flows. However, it is not possible to exclude an old-median-voter equilibrium theoretically. For the sake of completeness, we briefly discuss the case where $d < d^{crit}$. For any $d < d^{crit}$, the *immigration policy constraint* and the *non-expropriation constraint* intersect at some migration level larger than M^{crit}. Figure IV.3 shows the case $d < d^{crit}$ (for $d = 0.12$).

Proposition 2 *Given that $d < d^{crit}$, an old-median-voter equilibrium exists. Additionally, there may be a young-median-voter equilibrium which is characterized by $(M^{crit}, K^{*max}(M^{crit}))$.*

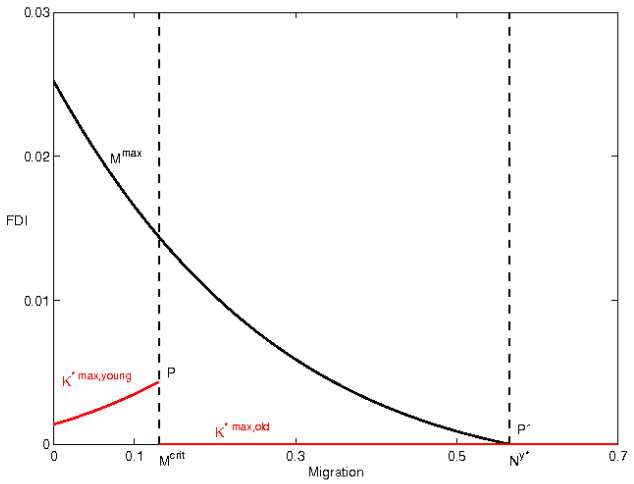


Figure IV.3: Migration and FDI in Equilibrium, $d < d^{crit}$

Proof: As argued in the proof of proposition 1, $(M^{max}|_{K^*=0}, K^* = 0)$ is the only possible equilibrium if migration exceeds its critical level. We cannot theoretically exclude the existence of an additional equilibrium for migration lower or equal to its critical level. Given $M \leq M^{crit}$ investors prefer a level of FDI lower or equal to K^{*max} as otherwise expropriation occurs. Within this area of possible equilibria, the highest utility is clearly achieved at $(M^{crit}, K^{*max}(M^{crit}))$, the point closest to utility maximizing K^{*opt} and M^{max}. While the investors would like to export more, the median voter favors admitting more immigrants. However, increasing FDI and admitting more immigrants would both lead to expropriation. In summary, neither the investors nor the industrialized country's median voter have an incentive to deviate from point $(M^{crit}, K^{*max}(M^{crit}))$.

We cannot rank these two equilibria without further restricting the model parameters: If $M > M^{crit}$ the old generation in the industrialized country benefits from the high return to capital at home. However, investors forgo proceeds in the developing country. If this opportunity cost is high (due to a high K^{*max}) and the difference between $M^{max}|_{K^*=0}$ and M^{crit} is low, the young-median-voter equilibrium is preferred to the old-median-voter equilibrium.

5 Comparative Statics

We now come to the effects of marginal changes in the model parameters on the young-median-voter equilibrium. Changes in the *immigration policy constraint* also apply to the old-median-voter equilibrium, while the old median voter's *non-expropriation constraint* always restricts FDI to zero. In the absence of political mobility constraints, larger demographic diversity would clearly boost both capital and labor movements. Now the level of factor flows is determined by policy.

A larger share of the old generation in the industrialized country's population implies a larger capital stock $\bar{k}N^o$. As N^o does not have any impact on expropriation preferences, FDI would only increase if migration rose. However, a larger share of old does not unambiguously boost migration. On the one hand, with an exogenous capital endowment per investor $\bar{k}$ and given FDI $K^* = K^{*max}$, the share of $\bar{k}$ invested at home must increase. Investors consequently place a higher weight on domestic capital returns, preferring higher migration. On the other hand, the impact of immigration on domestic capital returns is also altered. This change in the derivative is given by

$$\frac{\partial^2 r}{\partial M \partial N^o} = \frac{1-\alpha}{(N^y+M)^2} r + \frac{1-\alpha}{N^y+M}\frac{\partial r}{\partial N^o}$$

$$\text{with} \qquad \frac{\partial r}{\partial N^o} = -\frac{1-\alpha}{N^y+M} r \left[1 + \frac{\bar{k}(N^y+M)}{\bar{k}N^o - K^*}\right] \qquad < 0 \; .$$

Intuitively, the marginal effect of migration on the capital return in the industrialized country may be weakened by a larger share of old because the capital return itself is lowered not only by a decrease in the labor force but also by an increase in the capital stock. In summary, it is possible that a higher fraction of old in the industrialized country implies higher migration and thereby higher FDI, but this need not be the case. Using, again, the implicit function theorem, the derivative of M^{max} with respect to N^o can be shown to be

$$\frac{dM^{max}}{dN^o} = \frac{\frac{k^*}{N^o}\left[\frac{r}{N^y+M} + \frac{r^*}{N^{y*}-M}\right] + k\frac{1-\alpha}{N^y+M}\left[\frac{r}{N^y+M} + \frac{\partial r}{\partial N^o}\right]}{k\frac{\alpha}{N^y+M}\frac{r}{N^y+M} + k^*\frac{\alpha}{N^{y*}-M}\frac{r^*}{N^{y*}-M}} \; .$$

For our benchmark parameter values, a marginal increase in N^o would reduce factor flows. However, a substantial increase of the share of the old generation to 0.71 would enhance them, see figure 4(a). Nevertheless, factor flows are still restrained by policy.

Demographic diversity may also be caused by a high share of the young generation in the developing country. A larger N^{y*} affects the wage and return effects of FDI in the same way as lower emigration since both are equivalent to a larger labor force L^*. Wages decrease while capital returns increase, making expropriation more worthwhile for a given level of migration:

$$\frac{\partial K^{*max}}{\partial N^{y*}} = -\alpha A^* \left(\frac{K^{*max}}{N^{y*} - M}\right)^{\alpha} \left[1 + \frac{1-\theta}{\theta} \frac{1-M}{N^{y*} - M}\right] \qquad < 0 \; .$$

Conversely, the direct effect of a larger L^* on immigration policy is unambiguously positive. For a given international allocation of capital a larger labor force in the developing country reduces the negative marginal effect of emigration on the capital return there. The derivative is

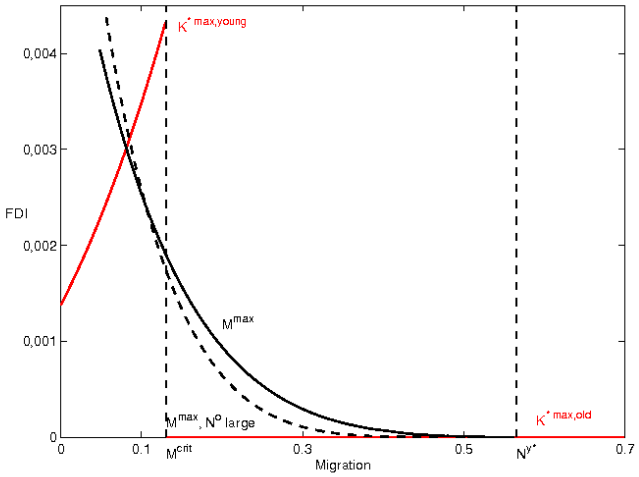
$$\frac{\partial M^{max}}{\partial N^{y*}} = \frac{k^* \frac{\alpha(1-\alpha)}{N^{y*}-M} \frac{r^*}{N^{y*}-M}}{k \frac{\alpha}{N^y+M} \frac{r}{N^y+M} + k^* \frac{\alpha}{N^{y*}-M} \frac{r^*}{N^{y*}-M}} \qquad > 0 \; .$$

Note that expropriation preferences in the developing country are weaker the more young workers emigrate, counteracting the direct negative effect of N^{y*} on FDI. On the contrary, the indirect effect on migration via lower FDI reinforces the direct effect. We can compute the total effects from

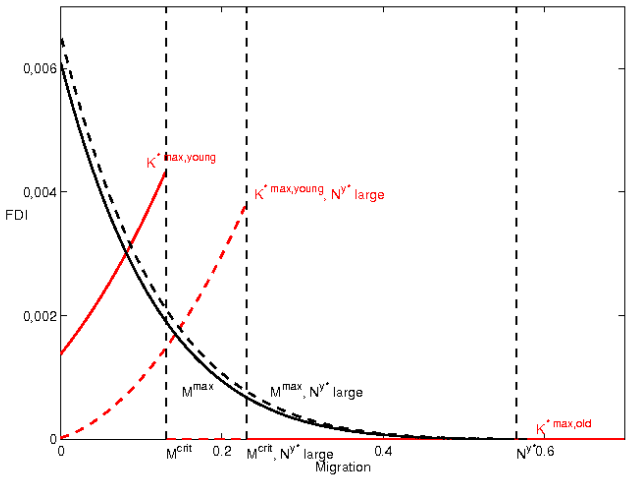
$$\begin{aligned} \frac{dM^{max}}{dN^{y*}} &= \frac{\partial M^{max}}{\partial N^{y*}} + \frac{dM^{max}}{dK^*} \cdot \frac{\partial K^{*max}}{\partial N^{y*}} \qquad > 0 \qquad \text{and} \\ \frac{dK^{*max}}{dN^{y*}} &= \frac{\partial K^{*max}}{\partial N^{y*}} + \frac{dK^{*max}}{dM^{max}} \cdot \frac{\partial M^{max}}{\partial N^{y*}} \qquad < 0 \; , \end{aligned}$$

using (5) and (10). Whereas the total effect of a larger N^{y*} on migration is obviously positive, the direct negative effect on FDI can easily be shown to dominate the positive migration-induced indirect effect, yielding a lower non-expropriation compatible level of FDI, see figure 4(b), where the new share of the young generation is set to 0.62.

Demographic structures do not only differ between industrialized and developing regions but also within seemingly homogeneous groups of countries. We have argued that the extent of international demographic diversity has no univocally enhancing effect on factor flows in a situation with politically induced mobility barriers. Analogously, there is a wide technological spread within less developed regions. Hence, we now investigate how factor movements are determined by the extent of technological diversity or of differences in productivity. In the absence of mobility constraints a developing country would attract more FDI and also more labor the higher TFP $\tilde{A}$. While we



(a) Effects of a larger N^o



(b) Effects of a larger N^{y*}

Figure IV.4: Effects of N^o and N^{y*} on Equilibrium Migration and FDI

use TFP in the industrialized country as a numeraire, the investors' productivity in the developing country $\tilde{A}$ is determined by the initial conditions in the developing country A^* as well as by investors' capacity to cope with these conditions θ, as we pointed out in section 3.

The *non-expropriation constraint* is relaxed as the developing country becomes more productive:

$$\frac{dK^{*max}}{dA^*} = \frac{1}{1-\alpha}\frac{1}{A^*}K^{*max} \quad > 0 \; .$$

The wage and return effect of FDI both increase by the same factor. Since the capital stock effect of FDI is not affected by A^*, the costs of expropriation increase by more than the benefits. Recall that the wage effect is larger than the return effect for any positive level of K^{*max}. The relaxation of the *non-expropriation constraint* hinges on the wage loss increasing with A^*, which holds because the productivity gap $\tilde{A} - A^* = [(1-\theta)/\theta]\, A^*$ increases with A^*. However, the direct effect on migration is negative:

$$\frac{\partial M^{max}}{\partial A^*} = -\frac{k^* \frac{\alpha}{A^*} \frac{1-\alpha}{N^{y*}-M} r^*}{k \frac{\alpha}{N^y+M} \frac{r}{N^y+M} + k^* \frac{\alpha}{N^{y*}-M} \frac{r^*}{N^{y*}-M}} \quad < 0 \; .$$

The marginal effect of migration on the capital return in the developing country is enhanced by a larger A^* because the capital return itself is higher. The indirect effect on migration via FDI is also negative, such that migration unambiguously declines. On the contrary, the positive direct effect on FDI is counteracted by declining migration. As a result the sign of the effect of A^* on K^{*max} is actually ambiguous. The total effects are given by:

$$\begin{aligned} \frac{dM^{max}}{dA^*} &= \frac{\partial M^{max}}{\partial A^*} + \frac{dM^{max}}{dK^*} \cdot \frac{\partial K^{*max}}{\partial A^*} \quad &< 0 \qquad \text{and} \\ \frac{dK^{*max}}{dA^*} &= \frac{\partial K^{*max}}{\partial A^*} + \frac{dK^{*max}}{dM^{max}} \cdot \frac{\partial M^{max}}{\partial A^*} \quad &\lessgtr 0 \; . \end{aligned}$$

For our benchmark parameter values an increase of A^* leads to reduced FDI flows. Our model thus replicates a result from the empirical literature on the determinants of expropriation: the effect of a country's gross domestic product on expropriation risk is curvilinear, see Jodice (1980) and Li (2009) among others. Expropriation rarely occurs in rich developed countries, which use more subtle ways of appropriation foreign returns. Meanwhile, the least developed countries lack the technological know-how necessary to compensate the productivity and wage increments FDI involves.

A low θ implies a large difference between $\tilde{A}$ and A^*. If θ increases, $\tilde{A}$ converges to A^* and less FDI is feasible: the wage income absent expropriation decreases, while seized capital returns and wage earnings in case of

expropriation do not change. An increment in θ thus attenuates the wage effect but leaves the return effect unchanged. Expropriation is less costly since the productivity gap $\tilde{A} - A^* = [(1-\theta)/\theta]\, A^*$ is smaller. The derivative of K^{*max} with respect to θ is given by

$$\frac{\partial K^{*max}}{\partial \theta} = -\frac{1-M}{(\theta)^2}\left(\frac{K^{*max}}{N^{y*}-M}\right)^{\alpha} \quad < 0\ .$$

While investments in the developing country become less secure if θ increases, this only holds for a given level of migration. However, since $\tilde{A}$ decreases with θ, the marginal capital return loss from developing-country emigration is reduced. Consequently, there is a positive direct effect of θ on migration:

$$\frac{\partial M^{max}}{\partial \theta} = \frac{k^* \frac{1}{\theta} \frac{1-\alpha}{N^{y*}-M} r^*}{k \frac{\alpha}{N^y+M} \frac{r}{N^y+M} + k^* \frac{\alpha}{N^{y*}-M} \frac{r^*}{N^{y*}-M}} \quad > 0\ .$$

This positive effect on migration counteracts the increased risk of expropriation. Thus, while the total effect on migration is unambiguously positive, the non-expropriation compatible level of FDI may increase or decrease:

$$\begin{aligned} \frac{dM^{max}}{d\theta} &= \frac{\partial M^{max}}{\partial \theta} + \frac{dM^{max}}{dK^*} \cdot \frac{\partial K^{*max}}{\partial \theta} \quad > 0 \qquad \text{and} \\ \frac{dK^{*max}}{d\theta} &= \frac{\partial K^{*max}}{\partial \theta} + \frac{dK^{*max}}{dM^{max}} \cdot \frac{\partial M^{max}}{\partial \theta} \quad \lessgtr 0\ . \end{aligned}$$

Using again simulations based on our benchmark parameter values we find that increasing θ leads to a reduction of FDI.

The political economy of factor movements is not only determined by the model parameters A^* and θ but by d as well. The parameter d raises the cost of immigration the respective median voter bears. Naturally, the higher individuals' disutility from integrating immigrants, the more restrictive is immigration policy. A policy that lowers this immigration related disutility would not only spur the integration of immigrants but also protect industrialized countries' FDI flows. Remember that this only holds as long as the young are in the majority in the developing country.

6 Extension: Equilibrium Policy in a Sequential Setting

We now investigate the sensitivity of the model results to the timing of the capital allocation and migration policy decisions. As we argued above, it is

quite plausible to assume that the implementation of migration policy decisions takes longer than the allocation of capital. Therefore, we now elaborate on the young-median-voter equilibrium with the immigration policy decision taking place before the capital allocation decision. The old-median-voter equilibrium is not contingent on the timing of decisions. Since a migration level above M^{crit} always corresponds to zero FDI, the optimal immigration level is still given by equation (9).

In this setting, the government in the industrialized country anticipates how investors react to the immigration policy decision: $K^* = \min\{K^{*opt}(M), K^{*max}(M)\}$, still assuming that capital is administered by a mutual fund. Recall that we made the assumption that at the critical immigration level M^{crit}, and thus for all levels of migration, the *non-expropriation constraint* binds. Consequently, the median voter's decision problem can be written as

$$\begin{aligned}
&\underset{M}{\text{Max}} \quad \frac{\bar{k}N^o - K^{*max}(M)}{N^o}(1+r) + \frac{K^{*max}(M)}{N^o}(1+r^*) - d \cdot M \ , \\
&\text{where} \quad r = \alpha A \left(\frac{\bar{k}N^o - K^{*max}(M)}{N^y + M} \right)^{\alpha - 1} \quad \text{and} \\
&r^* = \alpha \cdot \frac{1}{\theta} A^* \left(\frac{K^{*max}(M)}{N^{y*} - M} \right)^{\alpha - 1} \ .
\end{aligned}$$

The first-order condition for a maximum reduces to

$$\frac{\alpha}{1 - N^y} \left[(r^* - r) \frac{\partial K^{*max}}{\partial M} + (w - w^*) \right] = d \ . \tag{12}$$

Comparing equation (12) to equation (8), it is easy to verify that migration is now higher given that $r^* > r$. The difference is that the median voter can now loosen the *non-expropriation constraint* by choosing a higher level of migration. The industrialized country's old favor increasing FDI if $r^* > r$, implying that FDI is restricted by the *non-expropriation constraint*. In summary, this sequence of decisions results in higher levels of both migration and FDI.

7 Conclusion

This contribution has explicitly accounted for endogenous policies determined by immigration and expropriation preferences. The novel feature of our approach is the modeling of the interplay of policies in limiting factor flows. We have set up a one-period model of two countries with heterogeneous agents, young and old. Accounting for demographic diversity, we have assumed an

old median voter in the industrialized country but a young median voter in the developing country.

In equilibrium, factor flows are politically restricted, leaving room for efficiency gains from removing mobility barriers. For instance, if the immigration-related disutility that natives incur can be lowered, both migration and FDI increase. This clearly enhances efficiency. This result is subject to one caveat, as there is the possibility that emigration changes the median voter's identity in the developing country. Then FDI drops to zero, as the expropriation of foreign capital is certain. We therefore conclude that even though migration protects an aging country's stock of FDI, the aging country does not benefit from completely depriving host countries of their labor force.

While larger demographic diversity would boost factor flows in the absence of mobility constraints, it has an ambiguous effect in our setting. A large share of the old generation in the industrialized country implies that a large share of capital has to be invested at home. Capital returns achieved at home thus receive a higher weight, enhancing immigration preferences. However, it is possible that the positive effect of migration on these capital returns is now weaker. If migration does increase, this also has an indirect positive effect on FDI. A large share of the young generation in the developing country has an unambiguously negative effect on FDI and an unambiguously positive effect on migration. It is equivalent to a large labor force, implying low wages, and low wage losses in case of expropriation, and high capital returns to be distributed in case of expropriation. The positive effect on migration stems from the fact that high capital returns also lead to a reduced negative marginal effect of emigration. Enhanced migration attenuates the negative effect on FDI.

The model may further be extended in various directions. Firstly, we could allow for economic mobility barriers. If moving is costly for the migrants, our results do not change, however, unless the (political) demand for migrants would exceed individually optimal migration. Secondly, a wider range of elasticities could be allowed for in production. With weaker factor price effects, factor flows would be further restricted, and migration might not ease expropriation risk. Thirdly, since in industrialized countries much of the debate concerning migration and capital investment is related to the sustainability of pension systems, it would be promising to introduce a pension system to the model. Finally, replacing the median voter framework by a probabilistic voting framework would allow for an impact of both generations' preferences on equilibrium policies.

Part V

Population Aging and Individual Attitudes toward Immigration: Disentangling Age, Cohort and Time Effects

Lena Calahorrano

Abstract

In the face of rising old-age dependency ratios in industrialized countries like Germany, politicians and their electorates discuss the loosening of immigration policies as one policy option to ensure the sustainability of public social security systems. The question arises whether this policy option is feasible in aging countries: older individuals are typically found to be more averse to immigration. However, cross-sectional investigations may confound age with cohort effects. This investigation uses the 1999-2008 waves of the German Socio-Economic Panel to separate the effect of age on immigration attitudes from cohort and also from time effects. Over the life cycle stated immigration concerns are predicted to increase well into retirement and decrease afterward. Relative to other issues, immigration concerns are found to actually decrease over the life cycle.

JEL classification: D78, F22, J10

Keywords: Immigration, Demographic Change, Political Economy

1 Introduction

Rising old-age dependency ratios in industrialized countries like Germany pose a challenge to the viability of public pension and health systems. The loosening of immigration policies is often seen as one policy option to counter this challenge. The United Nations report on replacement migration (UNPD 2001) calculates that in order to keep the ratio of 15 to 64 year olds to over 64 year olds in the 15 old European Union countries constant until 2050, immigration would have to be more than 60 times its forecast. Such a huge increase in immigration is clearly unrealistic. However, other investigations have shown that even modest increases in immigration can have positive fiscal impacts, especially if immigrants are selected according to age and skill, see, for instance, Storesletten (2000) or Bonin et al. (2000).

As Rodrik (1995) argues, ultimately, voters' individual preferences are key to policy outcomes in any democracy.[1] In countries with aging populations, older individuals' attitudes should play an increasingly important role in shaping policy. This paper looks at the impact of age (and other characteristics correlated with age) on individual attitudes toward immigration. It uses a large representative panel survey, the German Socioeconomic Panel (SOEP). The sample is limited to those individuals eligible to vote, i.e. adults with German nationality.

Previous empirical investigations of the determinants of immigration attitudes have found negative or hump-shaped effects of age, without distinguishing life cycle from cohort or time effects, however. In any cross section, an individual's age and birth year are perfectly correlated. Yet they may have differential effects on attitudes toward immigration. For instance, a negative estimated effect of age on immigration attitudes is consistent with individuals growing more averse to immigration over the life cycle. But it is also consistent with older cohorts of individuals being less open toward immigrants, and growing older not having any effect on immigration attitudes at all.

In any time series in contrast, the effect of growing older on attitudes would be confounded with time effects. An increase in an individuals's opposition to immigration from one period to the next could be attributed to the fact that the individual has grown older or to changes in macroeconomic circumstances. Consequently, panel data are necessary to isolate the effect of growing older from cohort and time effects.

This paper follows two approaches to isolate the effect of age in an un-

[1] A recent publication modeling the mapping of individual immigration attitudes to immigration policy outcomes is Facchini and Mayda (2008).

balanced panel of German voters. Firstly, it includes year of birth or dummy variables for survey year as explanatory variables in addition to age. Secondly, models which only use the within variation of the data, the variation in time for each individual, are estimated.

Whereas individuals living in areas with low local birth rates have been found to be less averse to immigration (see Ivlevs), the present investigation finds mixed evidence for the political feasibility of policies aiming at increasing immigration as a country is aging. On the one hand, predicted concerns about immigration (based on the estimation sample) decrease only past age 70. On the other hand, relative to other areas of concern, predicted immigration becomes less prominent over the life cycle, whereas it is more prominent among older than among younger generations of individuals in the sample. Survey year is significant, with individuals most worried about immigration when unemployment is high. There is no time trend in predicted immigration concerns nor in the impact that different respondent characteristics have on immigration concerns.

The remainder of the paper is structured as follows. Section 2 summarizes previous findings on the political economy of immigration and on the determinants of immigration attitudes. The data and the empirical approach are introduced in section 3. Section 4 discusses the results. Section 5 summarizes the most important findings and outlines directions for further research.

2 Background and Related Literature

Theoretical research suggests that on economic grounds old individuals should be more open to immigration than younger ones. Assuming that immigration is predominantly labor migration, immigrants can be considered to be substitutes to workers and complements to (older) capital owners. The translation of heterogeneous interests among natives endowed with different amounts of capital into immigration policies is modeled by Benhabib (1996) and Mazza and van Winden (1996), for instance.

In addition to benefiting from an increase in capital returns, the closer an individual gets to the end of her life cycle the less she should be worried about immigrant workers who potentially have a higher number of offspring than natives changing the political balance in the future. The role of immigration in shaping the political balance plays a prominent role in dynamic political-economy models of immigration, see, e.g., Dolmas and Huffman (2004), Ortega (2005, 2010) and Sand and Razin (2007).

The conjecture that older natives are the ones who benefit from immigration is subject to some caveats, however. Firstly, the scope for immigration

to have an impact on factor returns diminishes when the movement of capital and goods is taken into account, see Hillman and Weiss (1999) and Calahorrano and an de Meulen (2009). However, there is evidence for negative effects of immigration on wages and/or employment, documented, for example, by Borjas (2003) and Angrist and Kugler (2003).

Secondly, the impact of immigration on consumption levels is also mitigated by pay-as-you-go pensions and contingent on the design of the pension system, see, e.g., Scholten and Thum (1996), Haupt and Peters (1998) and Calahorrano (2010). With flexible benefits, immigration has no effect on contributions and an ambiguous effect on benefits since it has offsetting effects on current wages and on the number of contributors to social security. With fixed pension benefits, native workers benefit from sharing the burden of pension contributions with immigrant workers.

Thirdly, immigrants who do not find employment are a fiscal burden on the welfare state and thus for natives of all ages. In this case, the design of the welfare system determines whether individuals with high or low incomes are most affected, as Facchini and Mayda (2009) explain.

Finally, immigration attitudes are shaped by non-economic as well as economic motives, and it is likely that these non-economic effects vary by age. For instance, older individuals may be more wary of change in general or more opposed to changes in social norms and customs.

In the last 15 years, a number of investigations have addressed labor market, welfare state and non-economic concerns. For the US, Espenshade and Hempstead (1996) and Citrin et al. (1997) test various hypotheses about the factors influencing immigration attitudes, using a CBS News / New York Times poll and the National Election Study, respectively. Both studies document a significant link between education and immigration attitudes: more educated individuals are less likely to favor reducing the number of admitted immigrants.[2]

This finding has two possible explanations. Firstly, education is likely to enhance tolerance or a group norm of tolerance. Secondly, in line with the predictions of neoclassical labor market models, high skilled natives are complements rather than substitutes to immigrants. This is the case if immigrants are less skilled than natives (or if there are increasing returns to scale to skilled labor as argued in World Bank 2008). The finding is in line with the results of virtually all other investigations. Additionally, several authors find evidence for the validity of the second explanation: education plays a larger role for those in the labor force than those outside the labor force, see,

[2]However, in the poll data, individuals who dropped out of high school were even less likely to favor reducing the number of immigrants.

e.g., Kessler (2001), Scheve and Slaughter (2001) and O'Rourke and Sinnott (2006).

Scheve and Slaughter (2001) systematically test the predictions of various international economy models concerning the distributional effects of immigration (and thus immigration preferences), with data from the US National Election Study. They find strong support for the Heckscher-Ohlin[3] model and the factor-proportions analysis model, which predict an opposition of low skilled native workers to low skilled immigration but not for the so called area-analysis model, which assumes geographically segmented labor markets.

Mayda (2006) and O'Rourke and Sinnott (2006) conduct similar analyses based on cross-country data, presuming that the estimated impact of skill on immigration attitudes should be contingent on the shares of high and low skilled workers in the population: being high skilled should have a stronger impact in countries with a high share of high skilled, attracting predominantly low skilled immigrants. The authors' results bear out this presumption.

Additionally, education plays a minor role in countries with an unequal income distribution, see O'Rourke and Sinnott (2006). Due to a high skill premium these countries can be assumed to attract skilled migrants. Furthermore, individuals in occupations with a high share of foreign workers are more likely to oppose immigration, see Mayda (2006).

Dustmann and Preston (2005) and Facchini and Mayda (2009) simultaneously model the impact of immigration on the labor market and on the welfare state. Facchini and Mayda (2009) predict that if welfare taxes rather than benefits are flexible, in richer countries (typically characterized by low skilled immigration) skill should have a positive impact on immigration preferences and income a negative one. The reverse should be true for poorer countries. Since skill and income are highly positively correlated, the estimated income coefficient is significantly positive when skills are not accounted for. However, when Facchini and Mayda (2009) include both variables and their interactions with per capita GDP, the predictions of the model with flexible welfare taxes and fixed benefits are confirmed.

Using data from the European Social Survey, Dustmann and Preston (2005) find that fiscal concerns matter more than labor market concerns. Facchini and Mayda (2009) reach less clear conclusions based on data from the International Social Survey Program. The importance of fiscal concerns is also shown by Dustmann and Preston (2007), based on British data. Mean-

[3]According to the Heckscher-Ohlin model, large immigration "shocks" may induce lower wages because a different set of goods is produced, whereas small shocks only alter the produced quantities of the different goods.

while, cross-country differences are also the focus of Bauer et al. (2000), who show that these differences cannot be ascribed to respondents' characteristics but are largely due to different immigration policies.

Individuals' attitudes toward immigration may further be affected by their preference for homogeneous social norms and customs, as in Hillman (2002). Dustmann and Preston (2007) show that in Britain opposition to immigration increases with ethnic and cultural distance to immigrants. Several other studies document the importance of non-economic factors in shaping immigration attitudes (Espenshade and Hempstead 1996, Chandler and Tsai 2001, Kessler 2001, Gang et al. 2002 and Mayda 2006 among others). Chandler and Tsai (2001) find that besides education, perceived cultural threats were the most important factor and Mayda (2006) finds that non-economic factors explained a larger share of the variance in attitudes than economic factors. Tucci (2005) discusses the "contact hypothesis", which assumes that contact with immigrants reduces prejudice.

A recent study on immigration attitudes explicitly takes into account the role of population aging, see Ivlevs (). Linking survey data from Latvia to data on local birth rates, Ivlevs () shows that individuals living in areas with low birth rates are less opposed to immigration. He presumes that local birth rates affect perceptions of national demographics and thereby perceptions of the necessity to make up for smaller cohorts of native workers by recruiting immigrant workers.

Virtually all other investigations include individual age as a control variable. Most investigations find a negative age effect, see, for instance, Chandler and Tsai (2001) for the US, Tucci (2005) for Germany, and Facchini and Mayda (2009) using the International Social Survey Program. However, also using the International Social Survey Program, Bauer et al. (2000) find that older people are more likely to think that immigrants are good for the economy, which is in line with labor market models.

Additionally, Brenner (2007) documents a sign change in the estimated coefficients of different age groups after accounting for family-fixed effects, whereas Miguet (2008) estimates a positive effect of age on votes cast for anti-immigration policies in 1988 but a U-shaped effect of age in 2000.

A reverse U-shaped (hump-shaped) age effect on opposition to immigration is found in some other papers, for instance, in Espenshade and Hempstead (1996) with individuals most opposed between ages 24 and 45, and in Ivlevs () with individuals most opposed between ages 50 in regions with low birth rates and 87 in regions with high birth rates. Although O'Rourke and Sinnott (2006) estimate a hump-shaped effect of age, they find that predicted opposition would only decrease beyond age 100.

The estimated effect of age thus appears to be highly sensitive to the

functional form imposed and to the included covariates. The present analysis attempts to include in the estimations all relevant variables correlated with age, such as income, wealth, health and life satisfaction. Additionally, it attempts to disentangle age from cohort and time effects. Due to the panel dimension of the data used, it is possible to include year of birth or time dummies as explanatory variables in addition to age. As an alternative, a model which only uses the within variation of the data is estimated.

3 Data and Empirical Specification

Most previous analyses of immigration attitudes use cross-sectional data. In order to identify the effect of growing older on immigration attitudes and to isolate it from the effect of belonging to a given cohort, it is, however, necessary to use panel data.

The present analysis is based on data from the 2008 release of the SOEP for the years 1999 to 2008.[4] The SOEP is a large representative panel survey, conducted on an annual basis, in which respondents have been asked about their attitudes toward immigration since 1999. It consists of several subsamples, starting with the original sample drawn in 1984. Refreshment samples were drawn in subsequent years to compensate for sample attrition. However, attrition is limited: out of the originally interviewed 5,921 households comprising 12,245 individuals, 3,154 households and 5,626 individuals were still interviewed in 2008.[5]

Three subsamples deliberately oversample certain groups of the population. Whereas the "high income" sample was excluded for the present analysis, respondents from the two immigrant samples were included if they had acquired German nationality. Since the analysis focuses on the voting population, it also excludes individuals below age 18 (the voting age). Out of the remaining 181,326 person-year observations, two were excluded because of missing information on their year of birth and 1,496 (less than 1%) because of missing information on their attitudes toward immigration. The baseline sample thus consists of 179,828 (person-year) observations.

The variable of interest is constructed from the question "What is your attitude toward the following areas - are you concerned about them?", where one of the mentioned areas is immigration to Germany. The possible an-

[4]The data used in this paper were extracted using the Add-On package PanelWhiz for Stata. PanelWhiz (http://www.PanelWhiz.eu) was written by Dr. John P. Haisken-DeNew (john@PanelWhiz.eu). See Haisken-DeNew and Hahn (2006) for details. Any data or computational errors in this paper are my own.

[5]For a detailed data description see Wagner, Frick, and Schupp (2007).

swers to this question are ordinal, ranging from *very concerned*, *somewhat concerned* to *not concerned*.[6] For the empirical analysis, the answers are coded 3, 2, and 1, respectively, such that higher values correspond to more concerns.

There is quite some variation in the given answers, between individuals and across time. Tables V.1 and V.2 display some summary statistics for the question "Are you concerned about immigration to Germany?". Overall 31% of the answers in the sample were "very concerned", 46% were "somewhat concerned" and 23% were "not concerned". However, almost 58% of respondents said at least once that they were very concerned, while 48% were not concerned at least once. Out of those somewhat concerned, about 58% were always somewhat concerned.

Immigration Concerns	**Overall**	**At Least Once**	**Always**
very concerned	31.12	57.58	53.29
somewhat concerned	45.95	78.76	57.63
not concerned	22.93	48.31	49.53

Percent of very concerned, somewhat concerned and not concerned answers in the estimation sample. Percent of respondents who stated to be very concerned, somewhat concerned and not concerned at least once. Percent of respondents who always stated to be very concerned, somewhat concerned and not concerned.

Table V.1: Shares of Immigration Concerns

The share of those who were very concerned in one year and not concerned in the next is very low, see table V.2. The same holds for the transition from being not concerned to being very concerned. However, about 33% of respondents who were either very concerned or not concerned said that they were somewhat concerned in the following year.

Immigration Concerns	very concerned	somewhat concerned	not concerned
very concerned	61.45	33.24	5.31
somewhat concerned	21.53	61.27	17.20
not concerned	6.90	33.26	59.83

Percent of respondents with a given stated concern in one period who stated to be very concerned, somewhat concerned and not concerned in the next period.

Table V.2: Transitions for Immigration Concerns

[6] Tucci (2005) and Brenner (2007) have used this variable for analyzing attitudes toward immigration.

There is no natural scale for measuring immigration concerns. The original SOEP question allows respondents to choose between three ordered categories. The distance between any two categories need not be equal (or meaningful at all). However, one can think of stated immigration concerns depending on latent continuous concerns about immigration. With y_{it}^* as latent concerns and y_{it} as stated concerns, it holds that

$$y_{it}^* = \mu + \alpha_i + x_{it}'\beta + \varepsilon_{it} \tag{1}$$

$$y_{it} = \begin{cases} 1 & \text{if} \quad -\infty < y_{it}^* \leq \gamma_1 \\ 2 & \text{if} \quad \gamma_1 < y_{it}^* \leq \gamma_2 \\ 3 & \text{if} \quad y_{it}^* > \gamma_2 \end{cases} . \tag{2}$$

Respondents state that they are "somewhat concerned" if their latent concern exceeds some threshold γ_1 and state that they are "very concerned" if their latent concern exceeds a higher threshold, γ_2. The parameters μ, β and $\gamma = (\gamma_1, \gamma_2)$' can then be chosen such as to maximize the likelihood of observing the sample on hand. This requires an assumption on the distribution of ε_i. Assuming a standard normal distribution function results in the ordered probit model, whereas assuming a standard logistic distribution function results in the ordered logit model. To identify the different parameter values, an additional normalization constraint is necessary. A commonly imposed constraint (applied also in this investigation) is to set μ equal to zero. The effect of the constant is then absorbed into the thresholds γ.

Due to the panel dimension of the data, age and year of birth or age and dummy variables for survey year can simultaneously be included in the vector of explanatory variables x_{it}. An alternative approach to isolate the effect of individual age is to estimate a transformed model, based on the within variation only (the variation in time for each individual). However, there are to date no pre-programed routines to incorporate this kind of transformation into ordered models. Therefore, the following transformed model is estimated by OLS:

$$y_{it} - \bar{y}_i + \bar{y} = \mu + \left(x_{it} - \bar{x}_i + \bar{x}\right)' \beta + \left(\varepsilon_{it} - \bar{\varepsilon}_i + \bar{\varepsilon}\right) . \tag{3}$$

Besides identifying the effect of age on immigration attitudes over the life-cycle, this model has the advantage that it eliminates any time-constant individual heterogeneity α_i which may be correlated with observable individual characteristics included in x_{it} and is otherwise subsumed into the error term. Equation (3) thus corresponds to a fixed effects (FE) model.

The SOEP includes information on additional areas people may be concerned about. Respondents are asked some questions with regard to their

own situation (their economic situation, their health and their job security, given that they were employed) and several questions on macro issues (general economic development, environmental protection, maintaining peace, crime in Germany and hostility toward foreigners in Germany). Since 2004, the SOEP also includes concerns about the enlargement of the European Union to the east, and since 2008 it includes concerns about terrorism.

Table V.5 in the appendix compares summary statistics for all categories of concerns. On average, respondents are most worried about crime, economic development and maintaining peace and least worried about their own situation. Note that immigration concerns have the largest standard deviation among all concerns. Stated immigration concerns thus reflect more than general worries.

However, the age pattern in average concerns is quite similar to the age pattern of immigration concerns as described below, see the left panel of figure V.1. Consequently, it is important to avoid confounding a life cycle effect on opposition to immigration with a life cycle effect on general worries or life satisfaction. In fact, life satisfaction has been shown to follow a U-shaped pattern in age, see, for instance, Clark, Oswald, and Warr (1996) and Blanchflower and Oswald (2008).

Both life satisfaction and other areas of concerns are thus included as controls in the regressions. As a robustness check, estimation results excluding other areas of concerns are presented. An alternative approach is using the difference between stated immigration concerns and other areas of stated concerns as a measure of immigration attitudes. Both measures are proxies for "true" immigration attitudes.

The left panel of figure V.1 shows mean immigration concerns by age. It reveals a hump-shaped correlation, with opposition to immigration at its strongest among the 70 year olds, and a lot of variation past age 85, probably due to the low number of observations. This panel also plots the age profile of an index of concerns with respect to the other areas, excluding EU enlargement, terrorism and job security, which were not asked of all respondents in all ten years.

The right panel of figure V.1 isolates the correlation between year of birth and immigration concerns. It seems to be the case that those born around 1930 are most concerned about immigration. However, the hump shape exhibits far more variation than the one plotted in the left panel.[7]

Additionally, there is quite some time variation in mean immigration attitudes, see figure V.2. Immigration concerns reach a peak in 2005, which

[7]Indeed, although the estimated effect of birth year is quite strong in all regressions, its sign turns out not to be not robust.

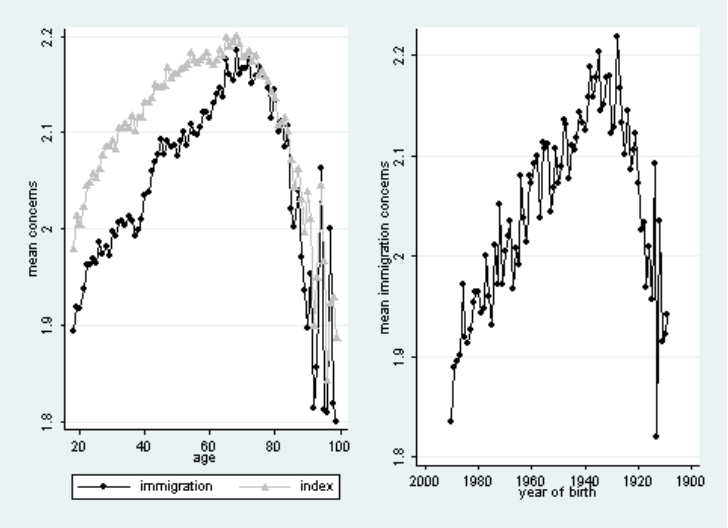


Figure V.1: Immigration Concerns as a Function of Age and Year of Birth

The figures show mean concerns by age and by year of birth. "Immigration" denotes concerns about immigration to Germany. "Index" denotes average concerns over the following categories: economic development, the environment, world peace, crime, the situation of foreigners in Germany and the respondent's own economic situation and health.

is also the year with the highest unemployment rate in the time frame considered. Contrary to Gang et al. (2002), who document an increase in opposition to immigration from 1988 to 1997, the ten periods observed in the SOEP do not suggest a time trend.

Table V.6 in the appendix shows summary statistics for the other explanatory variables included in x_{it}. The theoretical background sketched above presumes that individuals who draw social security incomes and individuals who own (financial) assets are more likely to be in favor of immigration. Therefore, information on income and asset ownership is taken into account. Income variables are taken from the SOEP's cross-national equivalent files, which contain imputed values easily comparable to income data from other data sets. Household income is used instead of personal income such as labor income in order to avoid limiting the sample to recipients of certain kinds of income. It is deflated using a price index for 2006. Furthermore, an equivalent household income (not shown in table V.6) is computed by adjusting for the number of household members, using the following formula[8]:

$$\text{adjusted income} = \frac{\text{income}}{1 + 0.5 \cdot (\text{adults} - 1) + 0.3 \cdot \text{kids}} .$$

[8]This is the so called "OECD modified equivalence scale".

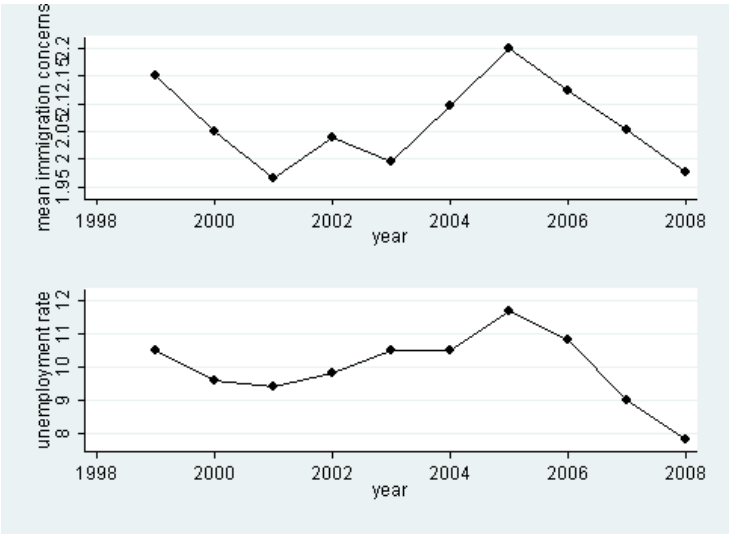


Figure V.2: Immigration Concerns and Unemployment Rate as a Function of Survey Year

Source: Bundesagentur für Arbeit (2011): Unemployment rate in the civilian labor force

SOEP respondents are asked about different kinds of incomes, but missing values are not imputed for all income variables. Therefore, dummy variables indicating whether an individual has a certain kind of income or asset, which have fewer missing values, are used in most estimations. 46% of respondents receive some public benefit. 11% declared not to own any assets, including a savings account. Individuals were asked specifically about financial assets in 2002 and 2007 only. Out of those observations 48% have some financial assets.

In addition to years of education, the SOEP provides education data categorized according to the UNESCO's international standard classification of education (ISCED), where those still in education are assigned a value of 0. The definition of categories 1 to 6 can be found in table V.7 in the appendix. Categories 3 to 5 are further aggregated into a "medium education" dummy, whereas categories 1 and 2 on the one hand and 6 on the other hand then correspond to low and high education, respectively.

Further controls include gender, marital status, the number of kids living in the household, whether a respondent lives in East or West Germany, immigration background[9] and labor force status. Furthermore, political interest

[9]It is likely that a large share of the immigrants in the voting population sample are descendants of Germans who automatically received citizenship upon immigration. Out of the 2,090 observations with an immigrant background and valid answers on whether

is included, with 1 meaning *very strong* and 4 *none at all*, as are the number of doctor visits in the three months prior to the interview as a measure for health or reliance on the health system.

Table V.3 shows the correlation coefficients between age and various other variables. Older individuals have lower household incomes, even after accounting for the number of household members and they are less likely to receive public benefits other than pensions. However, they are more likely to own assets and their financial assets are worth more. They are less satisfied with life and worry more, and they also rely more heavily on the health system.

Age	**Correlation Coefficient**
Equivalent HH income	−0.27
HH receives no benefits	0.43
HH owns no assets	−0.02
Owns financial assets	0.21
Value financial assets	0.10
Life satisfaction	−0.06
Index of concerns	0.10
Doctor visits	0.19

Equivalent household income is real household income, adjusted for the number of household members. Benefits include family allowances, unemployment benefits, care benefits and welfare, but not pensions. Assets include savings accounts, building savings contracts, life insurance, bonds, stock and firm capital. The index of concerns is the average value of concerns asked in all years to all respondents. The number of doctor visits in the three months prior to the interview is reported.

Table V.3: Correlation of Age with Other Variables

The next section extensively discusses results based on stated immigration concerns. This is the obvious measure for immigration attitudes. However, the regression results show that the estimated impact of some explanatory variables on immigration concerns is highly sensitive to whether additional concerns are included as controls. Including these other areas of concern may imply endogeneity problems whereas excluding them may induce an omitted variable bias. The difference between immigration and other concerns as a measure for immigration attitudes does not suffer from these problems and is also discussed.

they had a foreign parent only 51% stated to have a foreign parent.

4 Results

First, the estimation results for stated immigration concerns using ordered models are presented and compared to the estimation results using OLS. Whereas a first set of estimations includes time dummies in addition to age, a second set of estimations includes year of birth instead. Several robustness checks are discussed. Second, the results of estimating a pooled OLS model of stated immigration concerns are compared to the results from exploiting the within variation of the data only. Since time-invariant variables cancel out of the model in equation (3), only time-variant variables are used in both models in order to make the results comparable. Thirdly, the difference between immigration and other concerns is introduced as an alternative measure for immigration attitudes.

Stated Immigration Concerns: Ordered vs. Linear Models

As a first step, a regression model with a full set of covariates, including time dummies, is estimated by pooled OLS, ordered probit and ordered logit. Age, age squared, age to the power of three and age to the power of four are included because in regressions without other controls these first four powers proved to be significant. Table V.8 in the appendix contains a comparison of the regression results for these models.

The age terms are jointly but not individually significant in all three models when accounting for a full set of covariates. It is remarkable that age still has an independent effect on immigration concerns, even though a host of variables correlated with age like income and life satisfaction are controlled for. Compared to 1999, individuals were less concerned about immigration in all years but 2005, the year with the highest unemployment rate in the sample period.

Since the effect of age on immigration concerns is highly non-linear, it is best illustrated visually. Figure V.3, based on the ordered probit model,[10] shows the predicted probabilities of not being concerned, being somewhat concerned and being very concerned about immigration for different ages, for a male married respondent from West Germany who has no migration background, medium education, is working, does not receive any state benefits and owns some kind of assets. Other variables are set to their means.[11]

[10] The corresponding figure for the ordered logit model is available upon request.

[11] Both the mean probabilities in figures V.3 and V.4 and the statistics in table V.4 were simulated using the Stata program Clarify, see Tomz, Wittenberg, and King (2003). The usefulness of these simulations is demonstrated in King, Tomz, and Wittenberg (2000).

Ceteris paribus, predicted immigration concerns increase slightly with age. Across all ages, the predicted probability of being somewhat concerned is highest and the probability of not being concerned lowest. The probability of being very concerned increases slightly up to age 70 and then decreases markedly. The reverse pattern is observed for the probability of not being concerned. Immigration concerns thus seem to increase as individuals approach retirement and decrease only as they approach the end of their lives.

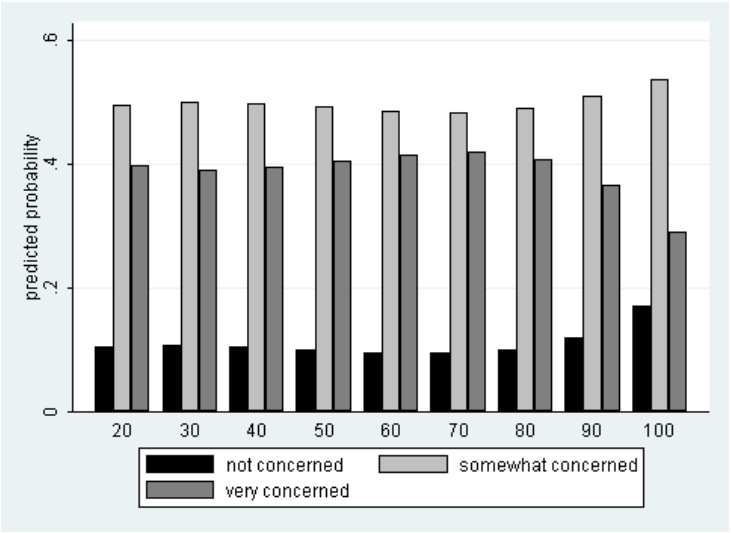


Figure V.3: Effect of Age on the Predicted Probabilities for Immigration Concerns, Ordered Probit Including Time Dummies

Simulations with Clarify based on table V.8, ordered probit model. Results for the ordered logit model are available upon request. To simulate the probabilities continuous variables were set to their means. Other covariates were set to male, married, from West Germany, no immigrant, medium education (ISCED 3/4/5), working, not receiving any state benefits but owning some kind of assets.

However, being retired instead of working has no significant effect on immigration attitudes, see table V.8. Neither do unemployed individuals voice more concerns, which is in line with the literature. Individuals who are in education, working irregularly or not in the labor force are less concerned about immigration. For the first and last group labor market competition from potential immigrants is obviously not an issue. Furthermore, individuals from all three groups are likely to have low incomes and therefore pay low welfare state contributions. If an increase in welfare costs due to immigration entails higher contributions rather than lower benefits, it makes sense that individuals with low incomes are less concerned.

This presumption is confirmed by the significantly positive coefficient of

household income: individuals in households with higher (equivalent) incomes are more concerned about immigration. Individuals who do not themselves benefit from any kind of state support and individuals who rely relatively little on the health system, proxied by the number of doctor visits, are also more concerned.

Labor market competition from immigrants seems to be more of an issue for natives with low education, who are significantly more concerned than those who have not yet completed their education, the reference category. Highly educated natives are significantly less concerned while those with medium education do not differ significantly from those who have not yet completed their education. This result is in line with labor market concerns about actual immigration patterns in Germany (immigrants have on average lower education than natives), but also with political correctness among the highly educated, as argued above.

The hypothesis that individuals with capital holdings favor immigration (presumably because it implies an increase in labor supply) is also confirmed. Individuals who do not own any assets are significantly more concerned about immigration than those who do own some assets. Admittedly, the dummy for household asset ownership is a very crude measure for wealth or capital holdings. The impact of other wealth indicators is discussed below, confirming the result that wealthy individuals are less opposed to immigration.

Immigrant workers, although nationalized, tend to be most negatively affected by further immigration, see, for instance, Ottaviano and Peri (2008). However, they can also be expected to have the smallest cultural distance to new immigrants. Since Dustmann and Preston (2007) find cultural distance to be a powerful predictor of opposition to immigration it is not surprising that immigrants state significantly less concerns.

Quite remarkable is the finding that being East German reduces concerns about immigration. In fact, East Germans are on average more concerned than West Germans, and the difference is significant. Living in the East has a positive effect on immigration concerns in univariate regressions. The effect of living in the East changes its sign when controlling for other concerns. This implies that the opposition of East Germans to immigration is due to different (observable) characteristics. Most importantly, East German respondents are generally more concerned than West German respondents, and East Germans with the same level of average concerns as West Germans are at least less likely to voice concerns about immigration.

In general, those who worry more also worry more about immigration, with the exception of concerns about the environment and world peace, two issues about which individuals on the left of the political spectrum are more

likely to worry.[12] Concerns about crime are the strongest predictor of concerns about immigration, followed by concerns about general economic development. Concerns about one's own economic situation are far less important, a result also in line with the literature, see, e.g., Citrin et al. (1997).

The estimation results for these respondent characteristics are similar when including year of birth as a control variable instead of the time dummies. Therefore, table V.9 only shows the estimated coefficients for the age terms and for year of birth. Before examining differences in the estimated age pattern of immigration concerns compared to figure V.3, the quantitative importance of selected other variables is discussed based on table V.4. This table reports the predicted probability of not being concerned, being somewhat concerned and being very concerned about immigration for the model which includes year of birth as a control. These predicted probabilities are calculated for a male married respondent from West Germany who has no migration background, medium education, is working, does not receive any state benefits and owns some kind of assets, whereas other variables are set to their means.

Economic variables like income and asset ownership turn out to have quite a weak effect on immigration concerns. Reliance on the health system is more important, and the effect of a change in labor force status from "working" to "in education" is also stronger, see table V.4. Education has an even stronger effect, with the highly educated 11 percentage points more likely not to be concerned and 15 percentage points less likely to be very concerned than those with low education. The strong negative effect of immigration background on concerns about immigration clearly mandates a cultural rather than economic interpretation. It is about as strong as the effect of education. Meanwhile, the effect of life satisfaction is quite weak.

The four age terms are still jointly but not individually significant, see table V.9. However, there is a sign change in the estimated coefficient for age, which is now positive. The estimated coefficient for year of birth is also positive, indicating that ceteris paribus younger cohorts are more averse to immigration. Table V.4 shows a pronounced difference between the youngest and oldest cohort in the sample: ceteris paribus the youngest individuals are predicted to be 17 percentage points less likely not to be concerned and more than 25 percentage points more likely to be very concerned than the oldest individuals. Consequently, the age pattern of predicted immigration concerns is far more pronounced when holding constant year of birth than when holding constant survey year, see figure V.4.

[12]Surprisingly, the same does not hold for being concerned about the situation of foreigners in Germany.

Variable	Change from to	Probability of not being concerned	Probability of being somewhat concerned	Probability of being very concerned
East German	no	0.011	0.007	−0.018
	yes	(0.003)	(0.002)	(0.005)
		[0.006; 0.016]	[0.004; 0.011]	[−0.027; −0.009]
Immigrant	no	0.113	0.029	−0.141
	yes	(0.006)	(0.002)	(0.006)
		[0.100; 0.124]	[0.025; 0.033]	[−0.153; −0.129]
Education	low	0.110	0.041	−0.151
	high	(0.005)	(0.003)	(0.006)
		[0.100; 0.120]	[0.035; 0.047]	[−0.164; −0.138]
Labor	working	0.057	0.026	−0.082
force status	in education	(0.007)	(0.002)	(0.009)
		[0.043; 0.070]	[0.021; 0.030]	[−0.099; −0.065]
Income	mean	−0.010	−0.008	0.018
	max	(0.002)	(0.002)	(0.004)
		[−0.015; −0.006]	[−0.012; −0.004]	[0.010; 0.027]
Benefits	no	0.007	0.005	−0.012
	yes	(0.003)	(0.002)	(0.004)
		[0.002; 0.012]	[0.001; 0.008]	[−0.020; −0.003]
Assets	yes	−0.008	−0.006	0.014
	no	(0.003)	(0.002)	(0.005)
		[−0.014; −0.003]	[−0.011; −0.002]	[0.005; 0.025]
Political	mean	0.033	0.018	−0.051
interest	very strong	(0.003)	(0.001)	(0.004)
		[0.028; 0.037]	[0.016; 0.021]	[−0.058; −0.044]
Life	mean	0.010	0.007	−0.017
satisfaction	max	(0.002)	(0.001)	(0.003)
		[0.007; 0.014]	[0.005; 0.009]	[−0.023; −0.012]
Doctor	mean	0.092	0.028	−0.120
visits	max	(0.027)	(0.003)	(0.027)
		[0.043; 0.148]	[0.020; 0.033]	[−0.171; −0.066]
Year	min	−0.169	−0.085	0.254
of birth	max	(0.025)	(0.008)	(0.033)
		[−0.217; −0.119]	[−0.101; −0.067]	[0.186; 0.315]

Mean effect, standard error in parentheses and 95% confidence interval in brackets. Simulations with Clarify based on table V.9, ordered probit model. Results for the ordered logit model are available upon request. To simulate the probabilities continuous variables were set to their means. Other covariates were set to male, married, from West Germany, no immigrant, medium education (ISCED3/4/5), working, not receiving any state benefits but owning some kind of assets.

Table V.4: Effect of Changes in Various Explanatory Variables on the Predicted Probabilities for Immigration Concerns, Ordered Probit

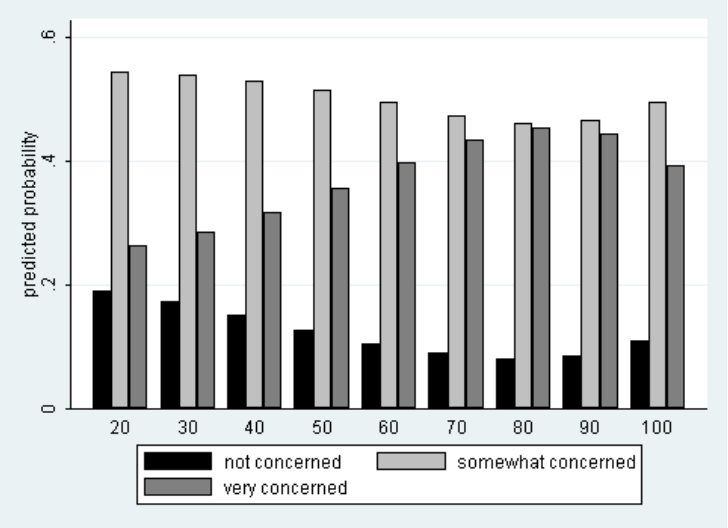


Figure V.4: Effect of Age on the Predicted Probabilities for Immigration Concerns, Ordered Probit Including Year of Birth

Simulations with Clarify based on table V.9, ordered probit model. Results for the ordered logit model are available upon request. To simulate the probabilities continuous variables were set to their means. Other covariates were set to male, married, from West Germany, no immigrant, medium education (ISCED 3/4/5), working, not receiving any state benefits but owning some kind of assets.

The probability of being very concerned now increases up to age 80 and is still quite high at age 90. Age appears to be quite a strong predictor of immigration concerns: ceteris paribus an 80 year old is predicted to have an about 10 percentage points lower probability of not being concerned and an almost 20 percentage points higher probability of being very concerned than a 20 year old. The comparison of figures V.3 and V.4 yields evidence for distinct life cycle and cohort effects on immigration attitudes. Whereas older cohorts seem to be less concerned about immigration, concerns grow over the life cycle.

Table V.8 has shown that there are significant differences in immigration concerns across different years. As a robustness check, separate ordered probit models are estimated for each year.[13] Since age and year of birth are perfectly collinear in each cross section, year of birth has to be excluded. The estimated age effect thus confounds life cycle and cohort. The four age terms are jointly significant in seven out of ten years. There is no time trend, however. Being highly educated is significant in all years, as are immigration background, gender, political interest and most concerns. All other variables turn insignificant in some years. Also, being unemployed significantly enhances immigration concerns in 2005 and 2006. Since unemployment rose in 2005, it is likely that individuals who became unemployed voiced significantly higher concerns.

An additional robustness check is estimating separate regressions for East and West Germany. The age effect is estimated with far less precision for East Germany. Since birth rates are much lower in East Germany, this confirms the finding by Ivlevs () that age is less significant in regions with low birth rates.

Additionally including a dummy for personal ownership of *financial* assets reveals that people who own financial assets are less concerned. However, the *value* of financial assets has no significant effect on immigration concerns. The four age terms are still jointly significant when controlling for ownership of financial assets.

Table V.10 shows detailed regressions results for replacing the "no assets" dummy by dummy variables for the ownership of different *types* of assets. These types are savings accounts, building loans, life insurance, bonds, firm capital and stocks. Whereas ownership of firm capital or stocks diminishes immigration concerns, ownership of bonds or building loans enhances them.

The difference between bond and stock holders is their willingness to take risks, likely to be positively correlated with general open-mindedness, but

[13]The estimation results for this and the following two robustness checks are available upon request.

also their financial literacy, positively correlated with education. However, education is still highly significant. Furthermore, the value of firm capital is most clearly positively affected by an increase of domestic labor supply, whereas the returns on bonds and building loans may not be related to labor supply at all. The difference between different types of assets is thus in line with the theoretical results sketched in section 2.

The signs and significance levels are the same across all three models in tables V.8 and V.9. The sole problem with OLS is then that the quantitative interpretation of the estimated coefficients need not make much sense. Nonetheless, figures based on the estimated coefficients from the linear models are instructive because they confirm marked differences between life cycle and cohort effects on immigration attitudes.

Figure V.5 shows the derivative of immigration concerns with respect to age and its 95% confidence interval. This is the combined marginal effect of all four age terms. The left panel represents the OLS model which includes time dummies as controls and the right panel shows the model which includes year of birth. Whereas in the model with time dummies, the marginal effect of age on immigration concerns is significantly positive for a limited range of ages only, it is positive up to age 80 and above when controlling for year of birth. Note, however, that the figure only ranges from age 18 to age 85. For very old ages, the marginal effect of age is subject to a lot of uncertainty.

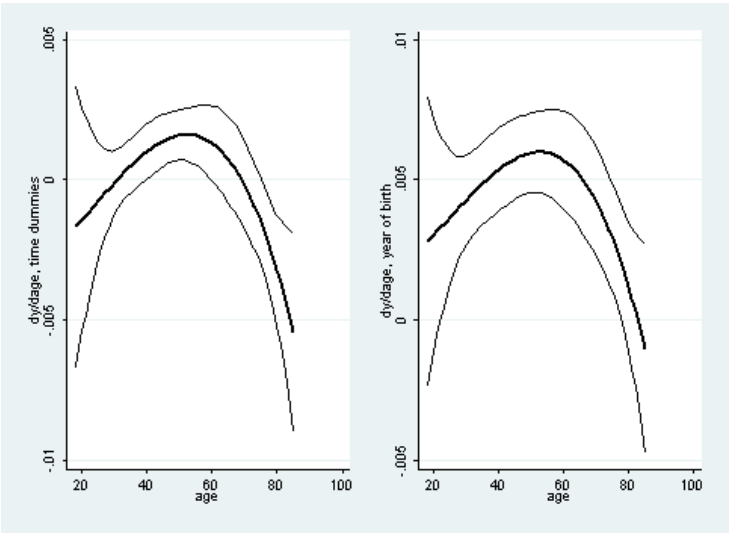


Figure V.5: Marginal Effect of Age on Immigration Concerns, OLS Including Time Dummies vs. Including Year of Birth

In summary, immigration concerns differ across time and between differ-

ent cohorts of individuals. There is also quite a strong life-cycle effect on immigration concerns with individuals growing more concerned up to age 80. However, age does not have a significant impact on stated immigration concerns in all years, and the age effect is estimated with less precision for East than for West Germany. Highly educated individuals are least concerned about immigration. Other labor market and welfare state related variables are also significant but quantitatively less important. Owners of assets with variable returns, like firm capital and stocks, voice significantly less concerns about immigration. Among the non-economic variables, own immigration background has the strongest positive impact on immigration attitudes.

Stated Immigration Concerns: Within-Transformed Model

As an alternative way of isolating the effect of growing older on immigration concerns, a model which only uses the within variation of the data, as in equation (3), is compared to a pooled OLS model with a full set of time variant controls. The within or FE model has the additional advantage that it eliminates any unobserved heterogeneity between individuals which is time-invariant. For these comparisons only individuals who remained in the panel for at least two years are used.

Table V.11 in the appendix displays complete regression results. The first column shows estimation results for OLS, leaving out the explanatory variables with little or no time variation (gender, immigration background, both year of birth and time dummies, and living in East Germany). The number of person-year observations is reduced only slightly to $171,636$. Furthermore, the overall R^2 , the signs and significance levels are comparable to the first column of table V.8.[14]

Individuals remained on average 5.9 years in the sample, and the number of individuals who spent at least two years in the panel is $29,299$, such that it should be possible to detect significant life cycle effects. However, some variables vary very little over the life cycle. Therefore, it is not surprising that the within model has fewer significant coefficients than the pooled OLS model. The four age terms are jointly significant in both models.

Figure V.6 illustrates the derivative of immigration concerns with respect to age for the OLS and within models up to age 85. In the OLS model, age has a significantly positive (enhancing) effect on concerns between ages 40 and 60. Over the life cycle, growing older enhances immigration concerns up to age 80 almost and it is significant at the 5% level for a much larger range

[14]Only concerns about the environment turn insignificant, whereas being on maternity leave turns significant. The sizes of the estimated coefficients change slightly.

of ages, see the right panel of figure V.6. This is in line with the ordered models and also with the pooled OLS model which includes birth year as a control, see figure V.5.

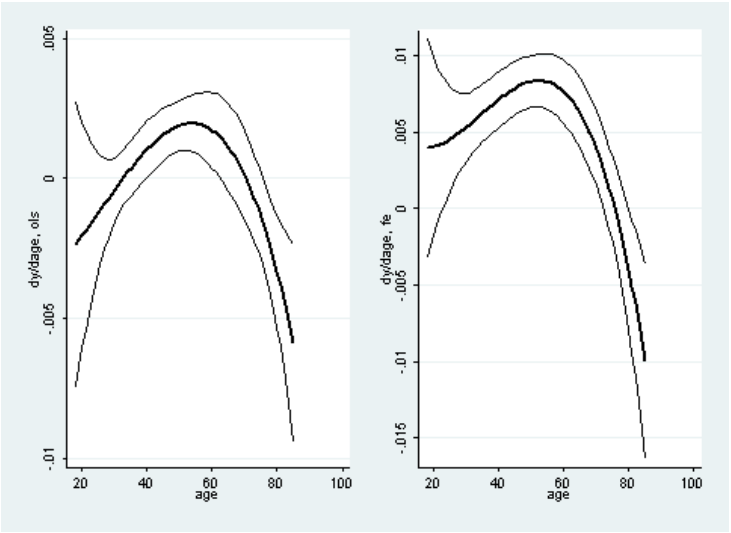


Figure V.6: Marginal Effect of Age on Immigration Concerns, OLS vs. FE

Although the differences between the two columns in table V.11 may indicate that unobserved individual heterogeneity is indeed a problem, the difference in the estimated effect of age on immigration concerns is similar to the one which is observed when comparing models with and without year of birth as in figure V.5: whereas in a pooled OLS model, the estimated effect of age confounds growing older with belonging to a given cohort, the FE model isolates the effect of growing older.

There are some additional differences. The asset ownership dummy turns insignificant in the within estimation. However, a robustness check (not displayed) has shown ownership of individual *financial* assets to be significant over the life cycle. The argument that capital owners are less opposed to immigration thus still seems to be valid. The impact of welfare state concerns is partly confirmed: whereas the dummy for receiving state support is significant in both specifications, income apparently has no effect over the life cycle. Furthermore, individuals become less opposed as they rely more heavily on the health system.

Life satisfaction and other concerns also have life cycle effects, with some notable differences for different areas of concerns: individuals who become more concerned over the life cycle in any area also become more concerned about immigration. Some variables with little within variation such as mar-

ital status, education and political interest are not significant over the life cycle.

Figure V.7 illustrates the predicted value of immigration concerns as a function of age, based on the sample distribution of respondent characteristics by age, also up to age 85. The OLS model predicts a hump-shaped age profile, with immigration concerns most pronounced among the 70 year olds. Immigration concerns over the life cycle are predicted to increase more sharply. A predicted value of 2 corresponds to being somewhat concerned. The predicted value for the youngest individuals is about 1.8. Predicted concerns reach a peak of about 2.2, also around age 70, and then decrease. Despite changes in other characteristics over the life cycle, such as reliance on social security, older individuals thus seem to feel more concerned about immigration attitudes well into their retirement.

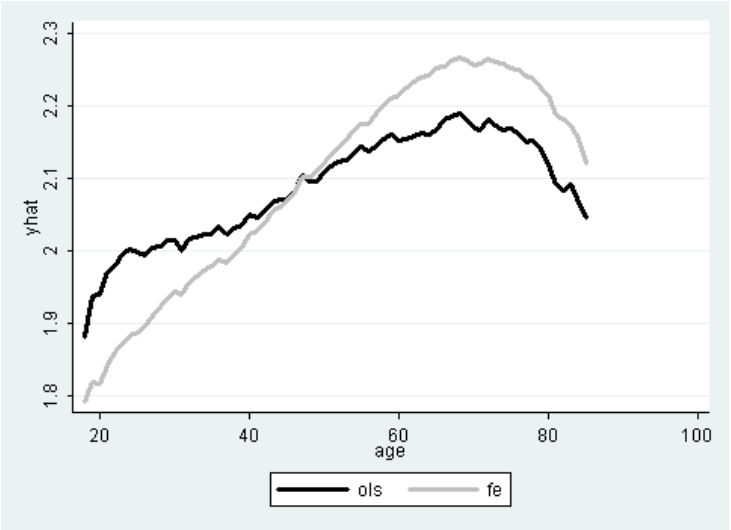


Figure V.7: Predicted Immigration Concerns by Age, OLS vs. FE

Difference in concerns

This section introduces an alternative measure for immigration concerns. As discussed in section 3, immigration concerns are highly correlated with other areas of concerns and also follow a similar age profile. Furthermore, immigration and other concerns are likely to be jointly determined, such that it is difficult to argue that being concerned about some other issue has an exogenous impact on immigration concerns.

The first column of table V.12 in the appendix replicates the complete regression results for the OLS model of stated immigration concerns with year of birth included as a control. The second column *excludes* other concerns as explanatory variables. Indeed, the model's explanatory power decreases quite sharply.[15] There are a few sign changes, suggesting that immigration concerns measure more than just general worries. However, these sign changes may also indicate that the two regressions are affected by endogeneity and omitted variable bias, respectively.

East Germans tend to voice more concerns than West Germans, including more concerns about immigration. Being East German thus significantly enhances immigration concerns when other concerns are *not* accounted for. Given other concerns, being East German reduces stated immigration concerns. A similar effect is observed for the number of doctor visits: individuals who visit a doctor more frequently voice more immigration concerns, presumably because they are generally more concerned. When controlling for other concerns, individuals with a higher number of doctor visits in the three months prior to the interview stated less concerns about immigration. Furthermore, household income turns insignificant as other concerns are excluded. Whereas respondents with higher incomes have less reason to be concerned, concerns about the fiscal impact of immigration increase with income, given other concerns.

The comparison of the first two columns of table V.12 also shows that the estimated age pattern is strongly affected by the inclusion of other concerns as controls. Year of birth is significant with the opposite sign when excluding other concerns. That is, younger generations are estimated to be *less* concerned about immigration.

The marginal effect of age also changes somewhat, see figure V.8. In both models the age effect is estimated with little precision below age 30. However, there are also significant differences. When excluding other concerns the age effect turns negative for somewhat younger ages (around age 70), and the estimated negative effect for older ages is much stronger than in the model which includes other concerns.

These changes could in principle be related to the strong multicollinearity between age and year of birth since excluding other concerns leads to a negative effect of birth year on immigration concerns but at the same time to a stronger negative effect of age for very old ages, see figure V.8. However, this does not seem to be the problem, as a robustness check revealed: FE models

[15] Adding selected variables like the frequency of eating out, or a dummy for whether someone has a foreign parent, did not increase explanatory power much. Political party preference was found to increase explanatory power but is likely to suffer from similar endogeneity problems as different areas of concerns.

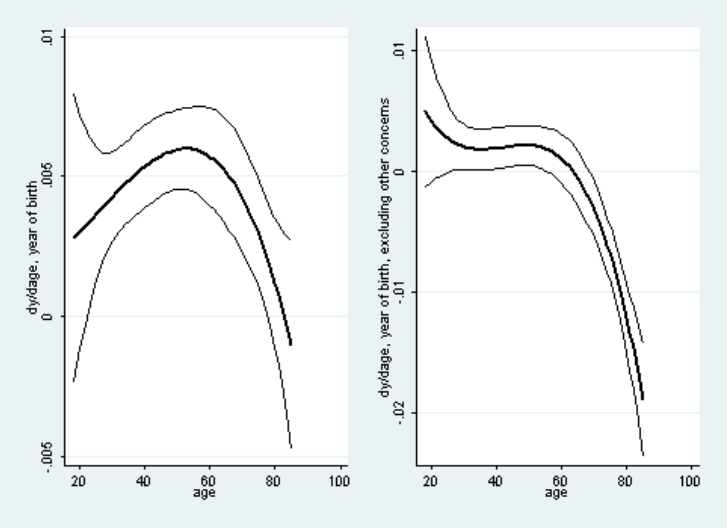


Figure V.8: Marginal Effect of Age on Immigration Concerns, OLS Including vs. Excluding Other Concerns

of stated immigration concerns were compared to between effects (BE) models, which only use the variation *between* individuals. These regressions were run on the sample of individuals who remained in the panel for the whole ten-year period. The estimated age effect in the BE models then corresponds to a cohort effect. The BE models additionally allows for non-linearities in the cohort effect.

However, the estimated cohort effect is not consistent across the two models with and without other concerns excluded either.[16] The distinct estimated age and cohort effects are thus not robust to the exclusion of additional concerns.

To circumvent possible biases while separating immigration from other concerns, the difference between immigration concerns and average concerns is used as a measure for immigration attitudes. This variable has over 30 different outcomes between -2 and 2 such that linear models seem appropriate. For about 10% of individuals the value of average concerns is exactly equal to the value of immigration concerns.

The third and fourth column of table V.12 show regression results for the difference between immigration and average concerns. Whereas the third column includes year of birth as a control, the fourth column includes time dummies. There are no large differences in the estimated coefficients between

[16]These regression results are available upon request.

the two models. Furthermore, many of the variables that have a significant impact on stated immigration concerns also have a significant impact on this alternative measure of immigration attitudes. There are a few exceptions.

Being East German, the frequency of doctor visits and household income are significant with the same sign as in the model which includes other concerns as controls in the first column, confirming the above discussion. Additionally, higher life satisfaction reduces the relative prominence of immigration concerns. Individuals with low life satisfaction are likely to worry about other things than immigration. However, year of birth is still significant with the opposite sign. Older cohorts thus seem to be more concerned about immigration than about other issues. At the same time growing older lessens concerns about immigration relative to other concerns, see the left panel of figure V.9.

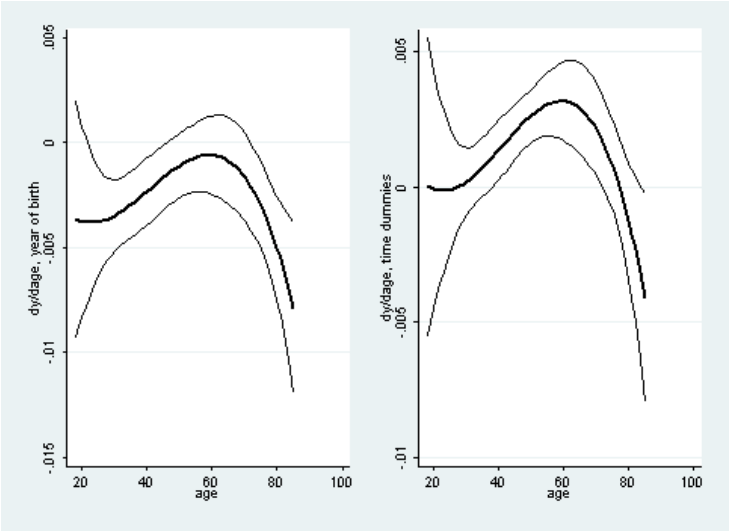


Figure V.9: Marginal Effect of Age on the Difference between Immigration and Other Concerns, OLS Including Year of Birth vs. Including Time Dummies

The comparison with the estimated age pattern from the model with time dummies instead of year of birth, see the right panel of figure V.9, confirms the existence of distinct cohort and life cycle effects. In this model age significantly enhances the importance of immigration relative to other issues individuals may be concerned about, at least between ages 40 and 70. The estimated age coefficients are likely to capture the negative effect of birth year. The fourth column shows that immigration concerns were most prominent relative to other issues in the base year 1999, and least prominent

in 2003. Note that 2003 was the year of the Iraq war and also the year far-reaching labor market reforms were passed in Germany.

As a robustness check on the estimated age pattern, a within-transformed model of the difference in concerns is estimated and compared to the OLS model. Regression results can be found in table V.13 in the appendix. Figure V.10 shows the marginal effect of age on the difference in concerns in the two models. The age pattern is consistent with figure V.9: whereas the OLS model which excludes both year of birth and time dummies estimates an enhancing effect of age on the new measure of immigration concerns, the FE model in the right panel shows a decline in immigration concerns over the life cycle.

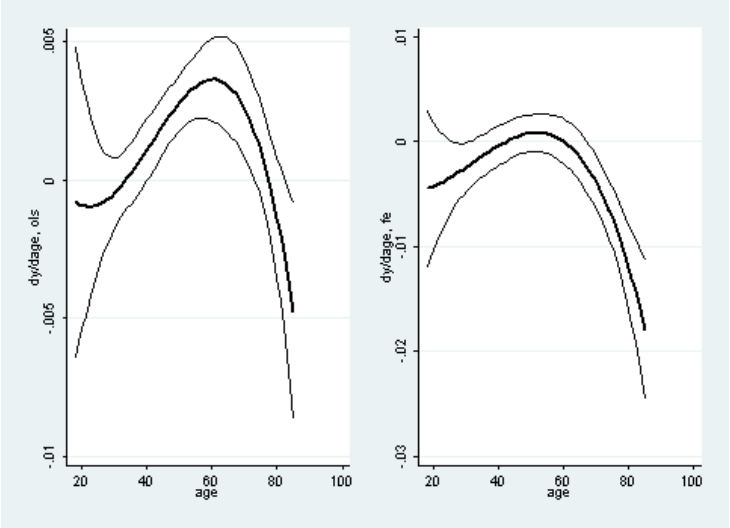


Figure V.10: Marginal Effect of Age on the Difference between Immigration and Other Concerns, OLS vs. FE

The predicted difference in concerns based on the sample distribution of respondent characteristics is negative for all ages as figure V.11 shows. Note that observed average concerns are also more pronounced than immigration concerns for all ages, see figure V.1. The OLS model predicts an increase in the relative importance of immigration concerns with age, with a few dips in between. The dip in concerns about immigration relative to other concerns past age 60 is quite interesting. In terms of birth year, these are the cohorts born shortly after World War Two. These cohorts may also be the first to enter retirement worrying about the future of pensions.

Over the life cycle, individuals are predicted to be most concerned about immigration when they are young and least concerned when they are old.

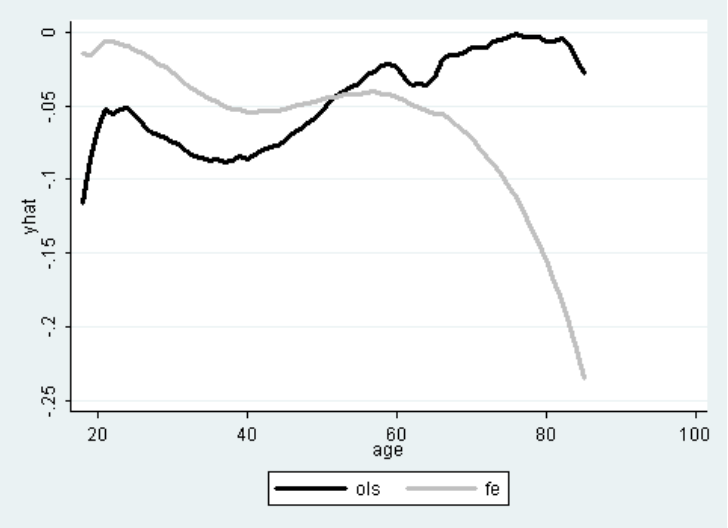


Figure V.11: Predicted Difference in Concerns by Age, OLS vs. FE

There is a slight increase in concerns between ages 40 and 60, but around age 60, predicted concerns are still much lower than around age 20.

In summary, using the difference between immigration and other concerns as a measure for immigration attitudes leads to predictions concerning the impact of growing older and belonging to a given cohort which are contrary to the predictions based on using stated immigration concerns. Over the life cycle, stated immigration concerns are found to increase well into retirement and decrease only as individuals approach the end of their lives. Meanwhile, relative to other areas of concerns immigration concerns decrease over the life cycle. Among older cohorts immigration is more prominent relative to other issues than among young cohorts. However, the cohort effect on *stated* immigration concerns is not robust.

5 Conclusion

This analysis has attempted to disentangle the effect of individual age on immigration attitudes from cohort and time effects to answer the question whether people grow more averse to immigration over the life cycle. To achieve this goal the paper followed two approaches. Firstly, year of birth was included as a control in addition to individual age. Time dummies were also included in some regressions instead of year of birth. Secondly, models which use the within variation of the data only were estimated. Furthermore,

two different measures of immigration attitudes were analyzed.

Several presumptions concerning the impact of different individual characteristics correlated with age were derived from previous theoretical research. Firstly, older individuals who draw larger shares of their income from (domestic) capital were presumed to be in favor of labor inflows. This presumption was not borne out for ownership of all types of capital, but confirmed for firm capital, stocks and financial assets in general.

Secondly, older individuals were presumed to be less concerned about possible changes in the political balance induced by immigration. Indeed, stated immigration concerns were found to decrease strongly after age 80 whereas relative to other concerns immigration concerns decrease over most of the life cycle.

Thirdly, even with flexible pension benefits pensioners do not necessarily favor labor immigration since it has offsetting effects on the level of wages and the number of contributors. Workers may favor labor immigration if pension contributions are adjustable to keep benefits stable. In fact, no significant difference between workers' and pensioners' attitudes was found, whereas individuals outside the labor market for other reasons were found to be less averse to immigration.

Fourthly, the contributors to welfare were presumed to be more opposed to immigration than beneficiaries, assuming that welfare contributions rather than benefits are adjustable. This presumption was also borne out: for given education levels, individuals with high incomes were found to be more concerned, whereas those who benefit from some kind of state support or who rely relatively heavily on the health system were found to be less concerned.

The predicted age profile of stated immigration concerns and of the difference between immigration and other concerns is non-linear. *Over the life cycle*, individuals are predicted to state the highest concerns in their seventies. However, relative to other issues, immigration causes most concerns at young ages.

At the same time, older *cohorts* were found to be more concerned about immigration than about other issues. The effect of birth year on stated immigration concerns is not consistent over different specifications *Survey year* also turned out to significantly influence immigration attitudes with stated immigration concerns highest when unemployment is high.

The regressions which include other areas of concerns as explanatory variables seemed to suffer from endogeneity problems. However, excluding these other areas of concern may lead to an omitted-variable bias. Additionally, the share of the variance in stated immigration concerns explained by the other controls is quite low. The findings in this paper thus suggest extending the analysis by including additional variables, although this would come at

the cost of reducing the sample to non-random subsamples. Possibly, valid exclusion restrictions for each area of concern could be found.

Although no pre-programed routines exist for estimating within-transformations of ordered models, incorporating within-transformations is possible under certain assumptions, see, e.g., Frijters and Geishecker (2008). Finally, the SOEP data can be disaggregated regionally when extended security provisions are satisfied. Linking the data to regional birth rates would make it possible to verify the finding by Ivlevs (), that individuals in areas with lower birth rates are less concerned about immigration, for Germany.

A Descriptive Statistics

Concerns about	Obs.	Mean	Std.Dev.	very concerned	somewhat concerned	not concerned
Immigration	179,828	2.08	0.73	31.12	45.95	22.93
Index	177,722	2.13	0.39			
Economic Development	179,531	2.26	0.63	36.37	53.66	9.97
Environment	179,427	2.13	0.62	26.22	60.23	13.55
Peace	179,459	2.26	0.69	39.84	46.23	13.93
Crime	179,533	2.39	0.64	47.88	43.30	8.82
Foreigner situation	179,149	2.09	0.67	27.73	53.84	18.42
EU Enlargement	88,649	2.03	0.72	27.36	48.63	24.01
Terrorism	16,906	2.22	0.67	35.95	49.75	14.30
Own Economic Situation	179,446	1.93	0.70	21.27	50.58	28.15
Own Health	179,505	1.86	0.69	17.86	50.66	31.48
Own Job Security	102,386	1.72	0.72	15.70	40.35	43.95

The values assigned to not concerned, somewhat concerned and very concerned are 1, 2 and 3, respectively. "Index" is the average concern over the categories other than immigration asked in all years to all respondents, that is excluding terrorism, EU enlargement and job security. The last three columns show the percentage of respondents who stated to be very concerned, somewhat concerned and not concerned, respectively.

Table V.5: Summary Statistics for Different Concerns

Variable	Obs.	Mean	Std.Dev.	Min	Max
Demographic characteristics					
Age	179,828	47.90	17.43	18	100
Male	179,828	0.48	0.50	0	1
Married	179,828	0.60	0.49	0	1
Number kids in HH	179,828	0.51	0.88	0	10
East German	179,828	0.27	0.45	0	1
Immigrant	179,828	0.06	0.24	0	1
Education					
Education (ISCED)	176,399	3.51	1.42	0	6
Labor force status					
Working	179,828	0.59	0.49	0	1
Retired	179,828	0.18	0.39	0	1
In education	179,828	0.03	0.17	0	1
Unemployed	179,828	0.05	0.22	0	1
On maternity leave	179,828	0.02	0.13	0	1
Working irregularly	179,828	0.02	0.15	0	1
Not working (other)	179,828	0.11	0.31	0	1
Income					
Gross HH income (yearly)	179,828	39513.95	38352.18	0	1,032,387
HH receives no benefits	178,935	0.54	0.50	0	1
Assets					
HH owns no assets	178,241	0.11	0.31	0	1
HH owns savings account	156,047	0.88	0.33	0	1
HH owns bonds	55,914	0.66	0.47	0	1
HH owns stocks	64,793	0.71	0.46	0	1
HH owns firm capital	28,957	0.34	0.48	0	1
HH owns building savings contract	179,701	0.45	0.50	0	1
HH owns life insurance	179,701	0.57	0.50	0	1
Owns financial assets	35,379	0.48	0.50	0	1
Value financial assets	13,881	31,524	111,887	1	6,000,000
Other variables					
Political interest	179,616	2.69	0.80	1	4
Life satisfaction	179,539	6.93	1.78	0	10
Doctor visits (last 3 months)	179,202	2.58	4.14	0	99

Household income is deflated to 2006. Political interest ranges from 1 (very strong) to 4 (none at all).

Table V.6: Summary Statistics for Control Variables

Value	Definition
1	Primary education or first stage of basic education
2	Lower secondary or second stage of basic education
3	(Upper) secondary education
4	Post-secondary non-tertiary education
5	First stage of tertiary education
6	Second stage of tertiary education

Table V.7: International Standard Classification of Education

B Detailed Regression Results

Immigration concerns	OLS	Ordered Probit	Ordered Logit
Age	-0.00336	-0.00618	-0.0130
	(0.0113)	(0.0210)	(0.0356)
Age^2	0.0000204	0.0000315	0.000175
	(0.000361)	(0.000673)	(0.00114)
Age^3	0.00000131	0.00000256	0.00000217
	(0.00000482)	(0.00000899)	(0.0000152)
Age^4	-1.38e-08	-2.65e-08	-3.25e-08
	(2.27e-08)	(4.24e-08)	(7.19e-08)
2000	-0.0803***	-0.149***	-0.250***
	(0.00629)	(0.0117)	(0.0199)
2001	-0.160***	-0.294***	-0.495***
	(0.00653)	(0.0121)	(0.0206)
2002	-0.0997***	-0.185***	-0.314***
	(0.00657)	(0.0122)	(0.0208)
2003	-0.160***	-0.294***	-0.499***
	(0.00695)	(0.0129)	(0.0220)
2004	-0.0637***	-0.117***	-0.199***
	(0.00693)	(0.0129)	(0.0220)
2005	-0.00117	-0.0000432	-0.0000484
	(0.00698)	(0.0132)	(0.0223)
2006	-0.0287***	-0.0526***	-0.0841***
	(0.00697)	(0.0130)	(0.0221)
2007	-0.0461***	-0.0849***	-0.143***
	(0.00713)	(0.0133)	(0.0226)
2008	-0.0972***	-0.181***	-0.300***
	(0.00714)	(0.0133)	(0.0226)
Male	0.0869***	0.163***	0.278***
	(0.00575)	(0.0107)	(0.0181)
Married	0.0384***	0.0705***	0.119***

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Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The models account for clustering at the individual level. HH income is the natural logarithm of real household income, adjusted for the number of household members. The reference category for education is "in school". The reference category for labor force status is "working". Political interest ranges from 1 (very strong) to 4 (none at all).

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Immigration concerns	OLS	Ordered Probit	Ordered Logit
	(0.00652)	(0.0121)	(0.0205)
Number kids in HH	-0.0205***	-0.0382***	-0.0646***
	(0.00371)	(0.00689)	(0.0117)
East German	-0.0265***	-0.0513***	-0.0887***
	(0.00678)	(0.0125)	(0.0213)
Immigrant	-0.235***	-0.429***	-0.720***
	(0.0108)	(0.0200)	(0.0340)
Isced 1 2	0.0536***	0.0962***	0.177***
	(0.0191)	(0.0358)	(0.0613)
Isced 3 4 5	0.0173	0.0289	0.0625
	(0.0191)	(0.0358)	(0.0613)
Isced 6	-0.188***	-0.349***	-0.578***
	(0.0208)	(0.0389)	(0.0665)
Retired	-0.00292	-0.00544	-0.00676
	(0.0125)	(0.0233)	(0.0393)
In education	-0.128***	-0.239***	-0.407***
	(0.0138)	(0.0260)	(0.0445)
Unemployed	0.000433	-0.000232	-0.00589
	(0.00959)	(0.0179)	(0.0306)
On maternity leave	-0.0149	-0.0263	-0.0460
	(0.0144)	(0.0265)	(0.0447)
Working irregularly	-0.0385***	-0.0700***	-0.120***
	(0.0128)	(0.0236)	(0.0404)
Not working (other)	-0.0150*	-0.0288*	-0.0499*
	(0.00865)	(0.0160)	(0.0270)
HH income	0.00506***	0.00953***	0.0152***
	(0.00127)	(0.00238)	(0.00402)
Receives no benefits	0.0175***	0.0319***	0.0551***
	(0.00635)	(0.0118)	(0.0200)
Owns no assets	0.0196***	0.0368***	0.0658***
	(0.00735)	(0.0139)	(0.0235)
Political interest	0.0442***	0.0824***	0.137***
	(0.00339)	(0.00639)	(0.0109)
Life satisfaction	-0.00834***	-0.0156***	-0.0264***
	(0.00139)	(0.00262)	(0.00445)
Doctor visits	-0.00181***	-0.00342***	-0.00592***
	(0.000497)	(0.000928)	(0.00160)
Concerns			
Economic Development	0.173***	0.322***	0.554***
	(0.00380)	(0.00706)	(0.0122)
Environment	-0.0127***	-0.0213***	-0.0373***
	(0.00423)	(0.00792)	(0.0136)
Peace	-0.0316***	-0.0594***	-0.107***
	(0.00388)	(0.00720)	(0.0124)
Crime	0.409***	0.742***	1.296***

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Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The models account for clustering at the individual level. HH income is the natural logarithm of real household income, adjusted for the number of household members. The reference category for education is "in school". The reference category for labor force status is "working". Political interest ranges from 1 (very strong) to 4 (none at all).

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Immigration concerns	OLS	Ordered Probit	Ordered Logit
	(0.00401)	(0.00771)	(0.0135)
Foreigner situation	0.0857***	0.162***	0.283***
	(0.00398)	(0.00754)	(0.0132)
Own economic situation	0.0604***	0.113***	0.192***
	(0.00370)	(0.00687)	(0.0117)
Own health	0.0373***	0.0699***	0.118***
	(0.00377)	(0.00699)	(0.0119)
Constant	0.437***		
	(0.121)		
γ_1		2.127***	3.676***
		(0.225)	(0.383)
γ_2		3.639***	6.262***
		(0.225)	(0.383)
Observations	171,762	171,762	171,762
(Pseudo) R^2	0.270	0.147	0.149
Joint significance	$F(4, 29424) = 4.79$	$\chi^2(4) = 19.28$	$\chi^2(4) = 16.54$
of all age terms	$Prob > F = 0.0007$	$Prob > \chi^2 = 0.0007$	$Prob > \chi^2 = 0.0024$

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The models account for clustering at the individual level. HH income is the natural logarithm of real household income, adjusted for the number of household members. The reference category for education is "in school". The reference category for labor force status is "working". Political interest ranges from 1 (very strong) to 4 (none at all).

Table V.8: Regression Results for Immigration Concerns, Including Time Dummies, OLS vs. Non Linear Models

Immigration concerns	OLS	Ordered Probit	Ordered Logit
Age	0.00155	0.00293	0.00204
	(0.0113)	(0.0209)	(0.0355)
Age^2	0.00000374	-0.000000720	0.000139
	(0.000361)	(0.000669)	(0.00113)
Age^3	0.00000152	0.00000294	0.00000257
	(0.00000482)	(0.00000894)	(0.0000151)
Age^4	-1.47e-08	-2.80e-08	-3.40e-08
	(2.27e-08)	(4.22e-08)	(7.13e-08)
Year of birth	0.00442***	0.00811***	0.0140***
	(0.000607)	(0.00113)	(0.00190)
Other controls	yes	yes	yes
Observations	171,762	171,762	171,762
(Pseudo) R^2	0.265	0.144	0.146
Joint significance	$F(4, 29424) = 19.21$	$\chi^2(4) = 75.36$	$\chi^2(4) = 74.20$
of all age terms	$Prob > F = 0.0000$	$Prob > \chi^2 = 0.0000$	$Prob > \chi^2 = 0.0000$

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The models account for clustering at the individual level. The other control variables are the same as in table V.8, excluding time dummies.

Table V.9: Regression Results for Immigration Concerns, Including Year of Birth, OLS vs. Non Linear Models

Immigration concerns	OLS	Ordered Probit	Ordered Logit
Age	0.0122	0.0231	0.0367
	(0.0123)	(0.0229)	(0.0390)
Age^2	-0.00000135	-0.0000179	0.000107
	(0.000390)	(0.000730)	(0.00124)
Age^3	0.00000138	0.00000280	0.00000225
	(0.00000519)	(0.00000972)	(0.0000165)
Age^4	-1.31e-08	-2.56e-08	-2.90e-08
	(2.44e-08)	(4.57e-08)	(7.77e-08)
Year of birth	0.0144***	0.0268***	0.0459***
	(0.000756)	(0.00142)	(0.00241)
HH income	0.00435***	0.00795***	0.0130***
	(0.00132)	(0.00249)	(0.00420)
HH receives no benefits	0.0220***	0.0403***	0.0681***
	(0.00675)	(0.0127)	(0.0214)
HH owns savings account	-0.00914	-0.0168	-0.0319*
	(0.00563)	(0.0106)	(0.0180)
HH owns building loan	0.0168***	0.0316***	0.0516***
	(0.00548)	(0.0102)	(0.0173)
HH owns life insurance	0.00667	0.0143	0.0215
	(0.00562)	(0.0105)	(0.0179)
HH owns bonds	0.0178***	0.0343***	0.0561***
	(0.00610)	(0.0113)	(0.0191)
HH owns firm capital	-0.0298***	-0.0553***	-0.0895**
	(0.0113)	(0.0211)	(0.0359)
HH owns stocks	-0.0297***	-0.0537***	-0.0925***
	(0.00571)	(0.0106)	(0.0179)
Other controls	yes	yes	yes
Observations	139,976	139,976	139,976
(Pseudo) R^2	0.278	0.152	0.154
Joint significance	$F(4, 26150) = 95.38$	$\chi^2(4)375.22$	$\chi^2(4) = 374.87$
of all age terms	$Prob > F = 0.0000$	$Prob > \chi^2 = 0.0000$	$Prob > \chi^2 = 0.0000$

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The models account for clustering at the individual level. The other control variables are the same as in table V.8, excluding time dummies.

Table V.10: Effects of Different Assets on Immigration Concerns, OLS vs. Non Linear Models

Immigration concerns	OLS	FE
Age	-0.00418	0.00805
	(0.0114)	(0.0153)
Age^2	0.0000149	-0.000267
	(0.000366)	(0.000486)
Age^3	0.00000176	0.00000694
	(0.00000488)	(0.00000651)
Age^4	-1.73e-08	-5.01e-08
	(2.30e-08)	(3.10e-08)
Married	0.0371***	0.00584
	(0.00658)	(0.00862)
Number kids in HH	-0.0229***	-0.00833*
	(0.00376)	(0.00441)
Isced 1 2	0.0450**	0.00294
	(0.0194)	(0.0227)
Isced 3 4 5	0.0196	0.0202
	(0.0194)	(0.0217)
Isced 6	-0.190***	0.0168
	(0.0210)	(0.0287)
Retired	-0.00911	-0.0106
	(0.0126)	(0.0111)
In education	-0.137***	-0.0121
	(0.0140)	(0.0131)
Unemployed	-0.00642	0.00116
	(0.00976)	(0.00826)
On maternity leave	-0.0511***	-0.00175
	(0.0144)	(0.0121)
Working irregularly	-0.0392***	-0.0227**
	(0.0129)	(0.0105)
Not working (other)	-0.0350***	-0.0162**
	(0.00866)	(0.00791)
HH income	0.00694***	0.00167
	(0.00127)	(0.00121)
HH receives no benefits	0.0228***	0.0104*
	(0.00642)	(0.00569)
HH owns no assets	0.0175**	0.00375
	(0.00751)	(0.00653)
Political Interest	0.0289***	-0.00151
	(0.00338)	(0.00306)
Life satisfaction	-0.0104***	-0.00473***
	(0.00140)	(0.00119)
Doctor visits	-0.00208***	-0.00193***
	(0.000509)	(0.000428)
Concerns		
Economic development	0.182***	0.0913***
	(0.00359)	(0.00291)

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Standard errors in parentheses. $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The models account for clustering at the individual level and include a constant. HH income is the natural logarithm of real household income, adjusted for the number of household members. The reference category for education is "in school". The reference category for labor force status is "working". Political interest ranges from 1 (very strong) to 4 (none at all).

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Immigration concerns	OLS	FE
Environment	-0.00681	0.0298***
	(0.00421)	(0.00335)
Peace	-0.0493***	0.0169***
	(0.00374)	(0.00297)
Crime	0.410***	0.197***
	(0.00397)	(0.00336)
Foreigner situation	0.0839***	0.203***
	(0.00400)	(0.00318)
Own economic situation	0.0578***	0.0374***
	(0.00371)	(0.00308)
Own health	0.0338***	0.0180***
	(0.00381)	(0.00316)
Observations	171,636	171,636
Individuals	29,299	29,299
Average time in panel	5.9	5.9
Overall R^2	0.256	0.177
Within R^2		0.122
Between R^2		0.199
Joint significance	$F(4, 29298) = 5.79$	$F(4, 29298) = 29.18$
of all age terms	$Prob > F = 0.0001$	$Prob > F = 0.0000$

Standard errors in parentheses. $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The models account for clustering at the individual level and include a constant. HH income is the natural logarithm of real household income, adjusted for the number of household members. The reference category for education is "in school". The reference category for labor force status is "working". Political interest ranges from 1 (very strong) to 4 (none at all).

Table V.11: Regression Results for Immigration Concerns, OLS vs. FE

Immigration Attitudes	Immigration concerns	Immigration concerns excluding other concerns	Difference in concerns	Difference in concerns including time dummies
Age	0.00155	0.0200	0.00150	0.00524
	(0.0113)	(0.0140)	(0.0124)	(0.0124)
Age^2	0.00000374	-0.000687	-0.000269	-0.000273
	(0.000361)	(0.000449)	(0.000398)	(0.000398)
Age^3	0.00000152	0.0000113*	0.00000547	0.00000555
	(0.00000482)	(0.00000602)	(0.00000531)	(0.00000531)
Age^4	-1.47e-08	-6.80e-08**	-3.35e-08	-3.39e-08
	(2.27e-08)	(2.85e-08)	(2.50e-08)	(2.50e-08)
Year of birth	0.00442***	-0.00143**	-0.00368***	
	(0.000607)	(0.000678)	(0.000635)	
Male	0.0866***	0.0385***	0.131***	0.130***
	(0.00575)	(0.00712)	(0.00643)	(0.00642)
Married	0.0381***	0.0845***	0.0399***	0.0398***
	(0.00652)	(0.00807)	(0.00725)	(0.00724)
Number kids in HH	-0.0208***	-0.0149***	-0.0161***	-0.0158***
	(0.00371)	(0.00461)	(0.00405)	(0.00405)
East German	-0.0261***	0.0560***	-0.0346***	-0.0353***
	(0.00678)	(0.00806)	(0.00747)	(0.00747)
Immigrant	-0.234***	-0.229***	-0.276***	-0.276***
	(0.0108)	(0.0132)	(0.0115)	(0.0114)
Isced 1 2	0.0548***	0.0570***	0.0789***	0.0767***
	(0.0191)	(0.0220)	(0.0209)	(0.0208)
Isced 3 4 5	0.0184	0.0154	0.0347*	0.0325
	(0.0191)	(0.0221)	(0.0209)	(0.0209)
Isced 6	-0.186***	-0.300***	-0.196***	-0.200***
	(0.0208)	(0.0243)	(0.0229)	(0.0228)
Retired	-0.000754	-0.00483	-0.00400	-0.00666
	(0.0125)	(0.0153)	(0.0139)	(0.0138)

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Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. HH income is the natural logarithm of real household income, adjusted for the number of household members. The reference category for education is "in school". The reference category for labor force status is "working". Political interest ranges from 1 (very strong) to 4 (none at all).

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Immigration Attitudes	Immigration concerns	Immigration concerns excluding other concerns	Difference in concerns	Difference in concerns including time dummies
In education	-0.126***	-0.198***	-0.139***	-0.140***
	(0.0138)	(0.0164)	(0.0155)	(0.0155)
Unemployed	0.000520	0.0183	-0.00523	-0.00490
	(0.00961)	(0.0111)	(0.0103)	(0.0103)
On maternity leave	-0.0140	-0.00401	-0.00563	-0.00726
	(0.0144)	(0.0170)	(0.0153)	(0.0154)
Working irregularly	-0.0390***	-0.0572***	-0.0739***	-0.0734***
	(0.0128)	(0.0144)	(0.0142)	(0.0142)
Not working (other)	-0.0151*	-0.0248**	-0.0166*	-0.0160*
	(0.00864)	(0.0107)	(0.00951)	(0.00951)
HH income	0.00517***	0.000299	0.00912***	0.00906***
	(0.00127)	(0.00154)	(0.00138)	(0.00138)
HH receives no benefits	0.0174***	0.0340***	0.0219***	0.0218***
	(0.00635)	(0.00778)	(0.00703)	(0.00702)
HH owns no assets	0.0211***	0.0424***	0.0209***	0.0187**
	(0.00736)	(0.00901)	(0.00792)	(0.00790)
Political interest	0.0452***	0.0239***	0.0664***	0.0643***
	(0.00338)	(0.00418)	(0.00384)	(0.00385)
Life satisfaction	-0.00826***	-0.0332***	0.0120***	0.0121***
	(0.00139)	(0.00164)	(0.00151)	(0.00151)
Doctor visits	-0.00195***	0.00119**	-0.00704***	-0.00696***
	(0.000498)	(0.000581)	(0.000538)	(0.000537)
Other concerns	yes	no	no	no
2000				-0.0697***
				(0.00654)
2001				-0.154***
				(0.00676)

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Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. HH income is the natural logarithm of real household income, adjusted for the number of household members. The reference category for education is "in school". The reference category for labor force status is "working". Political interest ranges from 1 (very strong) to 4 (none at all).

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Immigration Attitudes	Immigration concerns	Immigration concerns excluding other concerns	Difference in concerns	Difference in concerns including time dummies
2002				-0.120***
				(0.00684)
2003				-0.240***
				(0.00696)
2004				-0.0997***
				(0.00712)
2005				-0.0370***
				(0.00718)
2006				-0.0852***
				(0.00726)
2007				-0.111***
				(0.00742)
2008				-0.147***
				(0.00747)
Observations	171,762	171,762	171,762	171,762
R^2	0.265	0.061	0.049	0.057
Joint significance	$F(4, 29424) = 19.21$	$F(4, 29424) = 25.78$	$F(4, 29424) = 6.00$	$F(4, 29424) = 8.95$
of all age terms	$Prob > F = 0.0000$	$Prob > F = 0.0000$	$Prob > F = 0.0001$	$Prob > F = 0.0000$

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. HH income is the natural logarithm of real household income, adjusted for the number of household members. The reference category for education is "in school". The reference category for labor force status is "working". Political interest ranges from 1 (very strong) to 4 (none at all).

Table V.12: Regression Results for Immigration Concerns vs. Difference in Concerns

Difference in concerns	OLS	FE
Age	0.00560	-0.00279
	(0.0127)	(0.0159)
Age^2	-0.000337	-0.000176
	(0.000405)	(0.000505)
Age^3	0.00000691	0.00000589
	(0.00000541)	(0.00000676)
Age^4	-4.19e-08	-4.60e-08
	(2.55e-08)	(3.22e-08)
Married	0.0427***	0.00563
	(0.00735)	(0.00890)
Number kids in HH	-0.0167***	-0.00876*
	(0.00415)	(0.00455)
Isced 1 2	0.0731***	0.00663
	(0.0213)	(0.0235)
Isced 3 4 5	0.0408*	0.0284
	(0.0213)	(0.0226)
Isced 6	-0.197***	0.0277
	(0.0233)	(0.0298)
Retired	-0.0220	-0.00934
	(0.0140)	(0.0115)
In education	-0.154***	-0.00852
	(0.0158)	(0.0137)
Unemployed	-0.0134	-0.0185**
	(0.0105)	(0.00855)
On maternity leave	-0.0653***	0.0108
	(0.0154)	(0.0126)
Working irregularly	-0.0752***	-0.0319***
	(0.0144)	(0.0110)
Not working (other)	-0.0443***	-0.0140*
	(0.00957)	(0.00820)
HH income	0.0114***	0.00308**
	(0.00138)	(0.00125)
HH receives no benefits	0.0330***	0.0138**
	(0.00716)	(0.00590)
HH owns no assets	0.0127	0.00648
	(0.00813)	(0.00678)
Political interest	0.0429***	0.0163***
	(0.00387)	(0.00317)
Life satisfaction	0.0107***	0.0112***
	(0.00152)	(0.00121)
Doctor visits	-0.00748***	-0.00476***
	(0.000554)	(0.000445)

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Standard errors in parentheses. $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The models account for clustering at the individual level and include a constant. HH income is the natural logarithm of real household income, adjusted for the number of household members. The reference category for education is "in school". The reference category for labor force status is "working". Political interest ranges from 1 (very strong) to 4 (none at all).

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Difference in concerns	OLS	FE
Observations	171,636	171,636
Individuals	29,299	29,299
Average time in panel	5.9	5.9
Overall R^2	0.031	0.002
Within R^2		0.003
Between R^2		0.001
Joint significance	$F(4, 29298) = 9.16$	$F(4, 29298) = 9.19$
of all age terms	$Prob > F = 0.0000$	$Prob > F = 0.0000$

Standard errors in parentheses. $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The models account for clustering at the individual level and include a constant. HH income is the natural logarithm of real household income, adjusted for the number of household members. The reference category for education is "in school". The reference category for labor force status is "working". Political interest ranges from 1 (very strong) to 4 (none at all).

Table V.13: Regression Results for the Difference in Concerns, OLS vs. FE

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