CAN IMMIGRATION ALLEVIATE THE DEMOGRAPHIC BURDEN?*

by

Holger Bonin, Bernd Raffelhüschen, and Jan Walliser

Manuscript Accepted: October 21, 1999

Manuscript Revised: November 28, 1999

JEL Classification: F22, E62.

* We wish to thank Christoph Borgmann and Daniel Besendorfer for excellent research assistance. We also thank participants of the TMR conference in Deidesheim and the ESPE conference in Amsterdam for helpful comments. The opinions expressed in this paper do not necessarily reflect the views of the International Monetary Fund.

1 Introduction

Within the next three decades, most OECD countries are expected to experience pronounced population aging. Permanently low birth rates and rising life expectancy will lead to a marked increase in the population share of the elderly, generating strong pressure on public budgets. The rising ratio of pensioners to workers in particular threatens the viability of pay-as-you-go financed social insurance systems. Immigration is frequently proposed as a measure to mitigate these negative impacts of population aging since an inflow of young working-age immigrants may rejuvenate the resident population. Hence, not only traditional immigration countries like the US, Australia or Canada debate the demographic and economic impact of immigration, but also western European countries, which generally do not view themselves as immigration countries.

The extent to which migration inflows alleviate the fiscal burden induced by an aging society depends on immigrants' remaining lifetime net payments to the public sector after taking residency. Several attempts have been made to estimate the fiscal contribution of the resident population of foreign origin.[1] However, none of these cross-sectional studies captures the long-run fiscal effects of prospective immigration. Felderer (1994) and Börsch-Supan (1994) examine the impact of immigration on the long-run development of German social insurance finances, but limit their analysis to the demographic aspects of immigration, rather than treating immigrants as a fiscally distinct subgroup of the population. Moreover, by focusing on pay-as-you-go social insurance programs, these studies fail to incorporate the overall public revenue and expenditure effects of immigration. Estimating the lifetime net

[1] Pioneering attempts were undertaken by Simon (1984) and Blau (1984) for the United States. A more recent paper is Borjas and Trejo (1991). Among others, Ripahn (1998), Steinmann and Ulrich (1994), and Simon (1994) have studied the position of foreigners in the German welfare system.

fiscal contribution of migrants arriving in Sweden within the context of a stylized life-cycle approach, Storesletten (1999) has shown that immigration could improve fiscal sustainability.

In this paper, we use the device of generational accounting developed by Auerbach, Gokhale and Kotlikoff (1991, 1992) to investigate the impacts of immigration on the long-term sustainability of public sector finances in Germany. We explicitly incorporate immigrants into the conventional generational accounting method, which enables us to model the particular fiscal characteristics of immigrants by exploiting an advanced set of survey data.[2] Generational accounts indicate the lifetime net tax payments of future generations that are necessary to balance the intertemporal budget constraint of the government if current fiscal policy is maintained for those alive in the base year. Immigration enters into the average net tax payment required from future cohorts since the migrants' net fiscal contribution to the public purse after taking residency changes the aggregate intertemporal public budget deficit that is levied on future generations. Furthermore, the offspring of the immigrant population increases future cohort sizes.

Using Germany as a case study for western European countries, we show that the net contribution of prospective immigrants to the public sector is positive if their fiscal behavior is similar to that observed in the current cross-section of migrant residents. Therefore, migration seems attractive for future natives because it lowers their total tax burden. As is revealed by the sensitivity analysis, the positive effect of immigration can be substantially strengthened by a selective immigration policy, which favors skilled immigrants and supports the labor market integration of migrants after taking residency. Still, although the overall impact of immigration is significant, even very high levels of immigration are insufficient to eliminate the severe intertemporal redistribution to the disadvantage of future generations that is associated with demographic aging.

The remainder of the paper is organized as follows. Section 2 starts with a short introduction to generational accounting methodology and explains how future immigration enters into the calculations. In a second part, we introduce the underlying demographic projections and discuss our fiscal data and parameter estimates. The impact of immigration on fiscal sustainability is assessed in Section 3. Section 4 concludes with the policy implications of our findings.

2 Calculating Generational Accounts

2.1 Fiscal Sustainability and Immigration

Generational accounting is based on the intertemporal budget constraint of the public sector.[3] Over an infinite time horizon, the aggregate present value of net taxes, i.e. tax payments net of transfers received, collected from living and future generations, must be equal to the present value of government consumption and debt service. Singling out the net tax payments of prospective immigrants, this constraint on future fiscal policy can be broken down as

$$(1) \qquad \sum_{y=t}^{\infty} G_y + B = \sum_{k=t-D}^{t} P_{t,k}\, GA_k + \sum_{k=t+D}^{\infty} P_{k,k}\, GA_k + \sum_{y=t}^{\infty} \sum_{k=y-D}^{y} M_{y,k}\, GA^{M}_{y,k}$$

with G_y denoting government consumption in year y in present value terms of the base year t, and B denoting the value of base year public debt, which equals the present value of future debt service. The left-hand side of equation (1) aggregates prospective non-transfer expenditure of the public sector. These spending commitments must be financed out of three possible sources, which are assembled on the right-hand of equation (1). In the first term, $P_{t,k}$

---

[2] A similar approach has recently been employed by Auerbach and Oreopoulos (1999). Ablett (1997) discusses the impact of immigrants in Australia within the framework of generational accounts.

[3] A technically more detailed account of the method is given by Raffelhüschen (1999a). For recent cross-country surveys of the results, see Kotlikoff and Raffelhüschen (1999) and Raffelhüschen (1999b). Among others, Buiter (1997), Fehr and Kotlikoff (1997), Raffelhüschen and Risa (1997), Diamond (1996) and Havemann (1994) have critically debated generational accounting.

stands for the number of agents born in year k who are residents in base year t. GA_k represents the generational account of cohort k, which is defined as the present value of the per capita net taxes that agents born in year k are expected to pay over their remaining life span. The generational accounts are constructed by subjecting the average net taxes allocated to different age groups to age-specific mortality rates.[4] With the maximum age given by D, the first right-hand term of equation (1) adds up the present value of prospective net tax payments made by the base year population.

In a similar fashion, the second right-hand term encompasses the aggregate net tax payments made by future generations who remain residents throughout their life. $P_{k,k}$ measures the size of generations born in each future year whose generational accounts are again expressed in present value terms of the base year. The final right-hand term measures the aggregate net tax payments to be made by future immigrants. Immigrants enter the intertemporal budget constraint with the base year present value of their remaining lifetime net tax payments after taking residence, denoted $GA^M_{y,k}$ for immigrants born in year k who arrive in the host country in year y. For each future year and for all age cohorts, the double summation weighs the migrant-specific generational accounts with the corresponding absolute number of migrants, given by $M_{y,k}$.

In order to assess the intertemporal sustainability of public finances, generational accounting computes the aggregate value of both sides of the government's intertemporal budget constraint, relying on long-term projections of the underlying fiscal and demographic variables. Fiscal policies that fail to meet the constraint are called unsustainable, while the difference between the aggregate public revenue demand, indicated on the right-hand side,

---

[4] Conventionally, generational accounting infers age-specific mortality rates from variations in cohort size between consecutive age groups. In the presence of immigration, this approach distorts the generational accounts of living generations (Ablett, 1997). We therefore derive the generational accounts making direct use of life-table survival ratios.

and the predicted aggregate net tax revenue is referred to as sustainability gap. If the sustainability gap is positive, public non-transfer spending must be cut, or generational accounts must be raised for at least one generation. How policymakers would eventually balance the intertemporal public budget is unclear. In accordance with recent practice in generational accounting, we assume that policymakers adjust all taxes by a uniform proportion so that future born resident cohorts lose an equal fraction of their pre-tax life-cycle income. This policy experiment allows us to express the intergenerational redistribution in terms of the resulting difference of the lifetime tax payments imposed on base year and future agents. In an intertemporally balanced situation these payments, corrected for income growth, would be identical.

Immigration affects the intertemporal generational imbalance of lifetime tax burdens through two different channels. First, it changes the size of the sustainability gap, as is immediately evident from the third term on the right-hand side of equation (1). However, to assess the full impact of immigration on the sustainability gap, possible variations in general government spending, induced by the presence of migrants, must be taken into account. If the aggregate generational accounts allocated to the immigrant population, net of additional government consumption, are positive, the corresponding decline in the sustainability gap is distributed among all future cohorts, which lowers the life-cycle tax burden of prospective resident generations.

Secondly, for a given sustainability gap, immigration increases the number of future taxpayers who share the additional tax payments required to meet the intertemporal public budget. This demographic effect on the future tax base works both directly and indirectly. In the immigrant term included in equation (1), the stylized fiscal policy change underlying the calculation of future generational accounts also raises the rest-of-life net taxes allocated to those immigrant cohorts born in years $k > t$. These immigrant cohorts share in the burden of residents born after the base year. In addition, the offspring of the immigrant population

enlarge the cohorts born in the country, $P_{k,k}$, which, through the second right-hand term of the public budget constraint, lowers the generational accounts of this population group further. Due to the favorable tax base effect, immigration could reduce the intergenerational fiscal imbalance for newborn residents even if the immediate net aggregate contribution to the intertemporal public sector budget by the immigrant population is negative.

2.2 Migration Scenarios, Data and Parameter Estimates

The calculation of the various generational accounts aggregated on the revenue side of the intertemporal public budget constraint is required to combine a long-term forecast with a projection of cohort-specific average net tax payments. Because reliable data to estimate the fiscal characteristics of future migrants are scarce, we proceed by assuming that they could resemble those of current residents of foreign origin (in the following also referred to as migrant residents). In order to deduce the impact of migration on fiscal sustainability, we carry out the demographic and fiscal projections distinguishing between native and migrant residents within each birth cohort.[5] Our analysis of migrants' fiscal contribution over time starts from the year 1996, the most recent year for which the necessary data is available.

For the baseline generational accounts, our assumptions on demographic parameters broadly follow the central variant of the most recent population forecast conducted by the Federal Bureau of Census (Sommer, 1994). However, in the light of evidence on cohort-specific mortality provided by Dinkel, Höhn and Scholz (1996), we adopt a less conservative assumption on the future development of longevity. To be specific, we maintain the base year total fertility rate of West German natives (1.3) during the entire projection period. Total fertility of East Germans (0.95) catches up with the Western level until year 2005. The

[5] The disaggregation of generational accounts for distinct population groups is well-established in the generational accounting literature. It is typically used to distinguish the net tax burdens of males and females. As long as transitions between the distinct groups can be excluded, the generational account for the entire cohort is a weighted average of the subgroup accounts.

fertility pattern of alien residents (1.5), which we also apply to future immigrants, is kept unchanged above the natives' rate. The likely demographic (and economic) assimilation of second generation foreigners is modelled by strictly adopting the principle of *ius solis*. After the base year, all children born to alien residents are treated as German natives.[6] With respect to mortality, we refrain from differentiating between natives and resident aliens and migrants, to ensure that variations in the generational accounts within a living cohort only reflect differences in net taxes across population groups. Mortality rates are gradually adjusted so that life-expectancy at birth increases from 75.7 years in the base year to 80.9 years in 2021 (Birg et al., 1998), and remains constant thereafter.

In line with the official assumptions, our baseline population projection accounts for a constant influx of 200,000 net migrants per year from year 2000 on, marginally less than the 220,000 net immigrants of foreign origin observed in the base year. In addition, we consider the predicted inflow of migrants with German ethnicity mainly from Eastern Europe, totalling about 600,000 migrants, which ceases by year 2010. To distribute future aggregate migration figures by age, we rely on the base year age composition of net migrants for the entire projection. The age pattern of net immigration has been comparatively stable in the recent past, and the favorable 1996 structure might well be representative. Accordingly, future immigration is assumed to take place at a very early stage of the life-cycle. When taking residence, about three quarters of the immigrants are below age 28, and 90 percent are younger than 40. Future net migrants are, on average, almost 17 years younger than the base year resident population.

Despite the favorable age composition of migrants, demographic rejuvenation from immigration does not prevent the aging process caused by fertility rates lying below

---

[6] This assumption, which is in contrast to the valid *ius sanguinis* principle, may be too optimistic about the duration of the assimilation process. It would be preferable to distinguish between first-generation and second-generation immigrants, as is done by Auerbach and Oreopoulos (1999). We opt for a simpler approach due to the scarcity of appropriate data.

replacement levels and ever-increasing life-expectancy. Under baseline demographic conditions, we predict that the old-age dependency ratio – measured as the number of individuals aged 65 and above per hundred individuals aged 18 to 64 – increases from 23.9 percent in year 1996 to a maximum of 54.0 percent in year 2038, and stabilizes above 50 percent in the long term. To understand the specific effects of immigration, these results need to be judged against a demographic projection that excludes migratory flows. Without any migration, the old-age dependency ratio would increase to more than 65 percent in year 2038, and would range at about 68 percent from year 2060 on.

The no-migration benchmark may well provide a lower bound of plausible migration developments, although it seems unlikely from today's perspective that Germany could successfully bar immigration. To consider an upper bound, we start from the upper migration variant used by the Bureau of Census, accounting for 300,000 net migrants annually from year 2000 onward. In year 2020, when this level of immigration becomes insufficient to prevent a population decline, we switch to an alternative rule. Aggregate net migration is derived endogenously, whilst maintaining the 2020 total resident population of 84.8 million. The age composition of the population will nonetheless change, because the age structure of immigrants differs from that of the initial resident population.

This constant population scenario requires a maximum influx of about 622,000 net migrants in year 2050. In the long term, migration figures stabilize around 520,000 immigrants per year. The high level of immigration brings additional demographic relief, though the reduction in old-age dependency evolves rather gradually. In the peak year 2038, the dependency ratio would be only 5.8 percentage points lower than under the migration baseline. A quarter of a century later, however, the differential would already exceed 11 percentage points. Favorable demographic effects notwithstanding, the high migration ratios underlying the constant population scenario have only a small chance of realization, because of the potentially high social costs of integration. In our high migration scenario, the fraction

of foreign born residents in the population increases steadily from 9.0 percent in the base year to 23.4 percent in year 2030, and raises beyond 30 percent after 2055. Under the baseline migration assumptions, the population share of foreigners would not exceed 20 percent until that date. To project cohort-specific net tax payments by nativity, we start from a set of cross-sectional profiles measuring average tax payments and transfer receipts by age, which were retrieved mainly from the 1993 German Consumer Expenditure Survey (CES). Additional profiles were taken from social insurance data (VDR, 1997; BMA, 1996) and school enrolment statistics (BBF, 1998).[7] In particular, we use cohort-profiles for labor and capital income tax payments, seigniorage, value-added taxes, several excise taxes, the insurance tax and the different payroll contributions to social insurance. With respect to transfers, we distinguish between the receipts from the various branches of social insurance, welfare benefits, housing, youth and maternity support, and several types of education attendance. As a general rule, incidence is supposed to fall directly on the respective taxpayer or transfer recipient.

(Table 1 about here)

Since the estimated micro profiles are not immediately consistent with the corresponding public budget aggregates, all tax and transfer profiles were revaluated to fit base year public revenue and spending as quantified in Table 1. The public sector budget, which incorporates federal, state and local governments, as well as the entire social insurance system, was constructed following the conventions used by Raffelhüschen and Walliser (1999). Note that some figures reported in Table 1 are not directly comparable with the

[7] The differences in net tax payments in reunified Germany are still significant even now. We therefore employ separate profiles for East and West Germans. Adapting the macroeconomic catching-up process specified in Bröcker and Raffelhüschen (1997), we suppose full regional convergence by year 2010. Foreigners are assumed to reside in western Germany.

national account statistics from which all public budget data were originally drawn. For example, administrative costs and non-insurance-related expenditure of the social insurance system are counted as government consumption. Furthermore income tax payments of the self-employed are partially allocated as labor income taxes.

The set of revaluated tax and transfer profiles obtained at this stage does not as yet disaggregate age-specific net tax burdens by nativity, since residents of foreign origin are not reliably represented in the CES. To overcome this deficiency, we resort to additional survey data on personal tax payments and transfer receipts taken from the German Social-Economic Panel (GSOEP). This survey distinguishes between the two population subgroups which in turn allows us to estimate, for most taxes and transfers considered, the fiscal position of migrant residents relative to natives within each age cohort. These relative fiscal weights can be employed to disaggregate the profiles drawn from the CES, noting that the latter represent a weighted average, which depends on the cohort share of the two demographic groups and their relative fiscal position.[8] However, we deviate from this procedure on two occasions. Firstly, since the GSOEP does not collect personal consumption data, it is not possible to determine the cohort-specific relation of natives' and migrants' indirect tax payments. Therefore, we infer the respective consumption pattern of the two population groups from their relative life-cycle pre-tax income position. Secondly, since evidence on morbidity differentials by nativity is inconclusive (Ulrich, 1992), we do not distinguish between natives and immigrants for the allocation of health and long-term care transfers.

After the base year, the initial sets of age-specific tax and transfer payments by nativity are subjected to uniform labor productivity growth. For the baseline, we employ an annual rate of 1.5 percent reflecting average economic growth during the past two decades. In

---

[8] In principle, we could have based our entire analysis directly on the cohort profiles by nativity taken from the GSOEP. We still prefer to work with the CES, which, being the much larger sample, consistently provides more reliable age profiles.

addition, in order to obtain more precise estimates of the government's prospective net tax revenue, we take into account various, already enacted, fiscal policy measures that either change the general level of specific taxes and transfers, or the age distribution of payments.[9] Reforms are assumed to affect native and migrant residents alike, according to their respective relative fiscal position indicated by the cohort profiles. If it is not otherwise indicated, all future public spending and revenue is discounted to the base year at a rate of 5 percent per annum.

To project aggregate net public expenditure, not included as a personal transfer in the generational accounts, we neither differentiate by age nor by nativity. Aggregate government consumption in the base year ($327.9 billion) is extrapolated by assuming that per capita spending grows at the same rate as labor productivity. Thus, migrants are expected to induce additional government purchases. Note that government consumption in the present context does not correspond to the statistical definition of the national accounts. It includes, for example, net public subsidies and investment and has been corrected for revenue from public sector's tangible assets. Since the market value of tangible assets is approximated by the corresponding infinite revenue stream that reduces government consumption, government wealth in the intertemporal budget constraint is limited to net financial assets. In 1996, reported financial liabilities of the overall public sector including all off-budget funds surpassed $1,400 billion, or 60.4 percent of GDP.

---

[9] To be specific, our forecast incorporates the removal of wealth tax in 1997, the increase of the social security payroll tax in the same year, the gradual introduction of the long-term care insurance with concomitant reductions in general welfare spending until 1998, the cut in the solidarity surcharge on income taxation by two percentage points in 1998, and the value-added tax raise in 1999. Moreover, we take into account predicted increases in retirement age effectuated by the 1992 Pension Reform Act, and the maturing of social security pensions.

3 How Much Do Immigrants Contribute?

3.1 Generational Accounts by Resident Group

Firstly, it is instructive to analyze the generational accounts for living native and migrant residents. Prospective immigrants are more likely to resemble current migrant residents than natives. Provided that immigrants' rest-of-life net tax payments, after taking residency at a given age, are similar to the generational accounts of migrant residents of the same age, the identification of tax and transfer profiles by nativity helps to measure the potential fiscal contribution of migrants more accurately. Tables 2 and 3 summarize the cohort-specific accounts and their composition by taxes and transfers for the two population groups in the base year 1996. Note that due to the strictly forward looking computation, which omits payments prior to the base year, generational accounts are not comparable across age cohorts. Within a cohort, however, they serve to indicate variations in the net tax burden of fiscally distinct demographic groups.

(Tables 2 and 3 about here – two consecutive pages if possible)

Irrespective of citizenship, we find the typical life-cycle pattern of generational accounts. The present value of lifetime net tax payments is positive for the average person born in the base year i.e. taxes paid exceed transfers received in present value. For cohorts not yet in the labor force the generational accounts steadily increase, since transfer receipts are sizeable during childhood and youth and the tax and contribution payments during working life are less heavily discounted. The peak of the rest-of-life net tax burden is reached for cohorts aged 25 to 30. Recently established in the labor force, they face particularly high direct and indirect tax payments, whilst the period of high transfer receipts during old age is still far away. For older cohorts in the labor force, the shorter period of labor income tax payments and reduced discounting of social security transfers offset the effects of rising

average income. Their generational accounts gradually decrease, turning negative for cohorts aged between 50 and 55. Retirees receive public pensions and other old-age benefits, but they no longer pay income taxes. Hence, in this purely forward-looking method, their accounts are large and negative. The gradual reduction in expected future transfer receipts for current pensioner cohorts mainly reflects their shorter remaining life span.

Comparing natives with migrant residents, we observe significant differences in the respective age-specific net tax burdens. Over the entire life-cycle, the fiscal contribution of natives is almost three times as high as that of migrant residents. Base year newborns representing the two demographic groups are expected to pay $41,300 and $14,200, respectively. The differences in generational accounts seem less marked for cohorts already in the labor force in the base year. For cohorts aged between 20 and 45, migrant residents' net tax payments are only about 20 percent smaller than the generational accounts of native residents of the same age. This difference is mainly attributable to the less propitious income position of migrant residents whose life-cycle wage income, according to our estimates, amounts to only 80.3 percent of natives' income in present value terms. Therefore, as the result of a comparison of the disaggregated generational accounts in Tables 2 and 3 reveals, residents of foreign origin pay less income taxes and payroll taxes, but also less indirect taxes. Migrant residents earn less than natives since they are on average less qualified, which is reflected by their lower receipt of education transfers during youth. Occupying less qualified jobs, non-natives face a considerably higher risk of being unemployed than natives. Accordingly, the average rest-of-life transfers received from unemployment insurance are markedly higher for all migrant resident cohorts.

At approximately age 50, the net fiscal position of the two demographic groups changes. For cohorts at the end of their working life or already in retirement, the generational accounts of migrant residents exceed those of natives. At this stage of the life-cycle, rest-of-life net taxes are dominated by transfer receipts from social security, which are closely linked

to individual earnings histories. Due to their lower wage earnings and a significantly shorter working career, pensions received by current migrant residents amount to only about 50 percent of the social security benefits paid to natives. Comparatively high social welfare receipts in old age only partially compensate for the low pension income. The overall net public transfer to resident pensioner cohorts of foreign origin remains 30 to 40 percent below the rest-of-life transfers to natives of the same age.

3.2 The Net Contribution of Future Immigrants

When evaluating the potential fiscal contribution of immigrant cohorts the age pattern of generational accounts reported in Table 3 serves as our benchmark. We ascribe to each future migrant entering the country at a given age the remaining lifetime net tax payments expected by a migrant resident of the same age (uprated for productivity growth and considering the effect of fiscal reforms). However, the extent to which immigrants affect the sustainability gap does not only depend on their tax payments net of benefits in the host country, but also on the change in government purchases induced by the immigrant population. Therefore, in order to find the overall net contribution of future immigrants to the public sector, their generational accounts need to be adjusted for the per capita present value of additional government spending. As noted above, we project government consumption on a per capita basis independent of age. Accordingly, the present value of government spending assigned to immigrants depends only on their remaining life span at the age of immigration.

(Figure 1 about here)

Figure 1 depicts the net contributions to the public sector, which are allocated to base year immigrant cohorts under the baseline. These payments are determined by subtracting the rest-of-life present value of government consumption by age from the generational accounts of current migrant residents. The reported age pattern is also representative for migrants

taking residency after the base year, since changes in fiscal policy incorporated in the calculation are of minor importance. For young immigrants, the induced increment in non-transfer public spending leads to a negative lifetime contribution to the public coffers, which increases the sustainability gap. In present value terms, government spending attributed to them exceeds their rather low rest-of-life net tax payments after taking residence. At age 12, net tax payments begin to exceed additional government consumption. Net contributions to the public sector reach a maximum of $136,800 for immigrants aged 30, and remain positive for all immigrants taking residency before age 46. Although they induce less additional government spending, older immigrants impose a fiscal burden on the public sector because they receive large transfers.

If our baseline assumptions are appropriate i.e. if the fiscal behavior of future immigrants indeed resembles that of current migrant residents, and immigrants uniformly induce additional government consumption, then Figure 1 suggests that it is particularly favorable for the resident population to attract immigrants aged between 12 and 45 whose positive net contributions would directly reduce the sustainability gap. In the base year, nearly three quarters of net immigration occurred in this fiscally favorable age range. As a consequence, the average net contribution of immigrants is significantly positive. Considering the age composition of immigrants, the average rest-of-life net payment of an immigrant who takes residency in the base year is as high as $55,400. Thus, if the observed age pattern of migrants is representative for the future, we expect that immigration is beneficial for the intertemporal state of the public budget.

3.3 Do Future Generations Opt for Immigration?

We are now prepared to turn to the main focus of our analysis: can future immigrants help defray the fiscal costs of demographic aging in Germany and if so, to what extent can immigration policy play an active role in improving the intertemporal sustainability of fiscal

policy? The first part of this question is answered by Table 4, which reports the intertemporal fiscal imbalance for our different migration scenarios, comparing the generational accounts of base year and future newborn natives.[10]

(Table 4 about here)

Immigration by itself is not sufficient to achieve long-run sustainability of public finances in Germany. Under baseline assumptions, despite an inflow of 200,000 net immigrants per year, the life-cycle net tax payment required from future generations of natives, amounting to $176,400, is more than three times higher than that of base year newborns who are expected to pay $41,400. The sizeable redistribution of consumption possibilities from future to current generations in Germany is a well-established result. It is attributable to both the fiscal burdens induced by German reunification (Gokhale, Raffelhüschen and Walliser, 1995) and the ageing process, which is only partially offset by demographic rejuvenation from migration as shown in Section 2.

Judging the baseline scenario against the polar no-migration case reveals the sizeable intertemporal generational impact of the immigrant population. Without immigration, intergenerational redistribution aggravates, as future newborns face net taxes of $244,600. Hence baseline immigration appears desirable for future native residents who could gain a tax reduction of $68,300 per capita. The positive effect of baseline immigration on intertemporal fiscal balance is robust, although the absolute tax relief for future natives is quite sensitive to variations in the underlying growth and interest rates. For real interest rates between 3 and 7 percent and growth rates between 1 and 2 percent, future natives' fiscal gain from immigration ranges between $52,600 and $132,400.

[10] As we apply the *ius solis* principle, we do not observe future newborn residents of foreign origin.

Since the average migrant's net contribution to the intertemporal public budget turns out to be large, fiscal sustainability improves considerably with the total number of future immigrants. Consequently the future generational account of native residents further decreases in the high migration scenario. Natives' net taxes fall by $38,500 compared to the baseline, and by $106,700 compared to the no-migration benchmark. Irrespective of the economic parameters employed, our baseline finding stands in marked contrast to results for the United States reported by Auerbach and Oreopoulos (1999), which suggest that the impact of immigration on fiscal imbalance could be extremely small. Their results reflect the much less dramatic aging of the population and the already large share of foreign-born residents in the United States.

The very favorable long-term budget implications of immigration found in our baseline, are based on the fiscal characteristics of current migrant residents who settled in Germany decades ago, under very favorable labor market conditions. The computations thereby fail to incorporate a considerably longer assimilation process of migrants (Schultz, 1998), in particular, if high unemployment on the regulated German labor market persists. Furthermore, the baseline perpetuates the skill structure of past immigrants, although the quality of immigrant cohorts to Germany has worsened considerably as a consequence of restrictive immigration policy directed against labor immigration. The current legal setting strictly bars immigration to Germany except for ethnic Germans, citizens of the European Union, family reunions of migrant residents and a limited number of migrants seeking refuge from ethnic or political persecution. Therefore, the socio-economic structure of current immigrants granted resident status, is likely to be noticeably different from that of the resident *guestworker* population that settled in a period of active labor recruitment in the 1960s and 1970s. However, a forecast about the future evolution of immigrants' quality seems difficult. After all, changes in the attitude to immigration could quickly alter the characteristics of immigrants that can currently be observed.

To test the validity of our results in face of these arguments, we have modelled the assimilation process of future immigrants in the labor market, which is typically accompanied by low tax payments and high public transfer assistance. We assume that during the integration period, immigrants receive the same educational training, maternity assistance, health and long-term care benefits as residents of foreign origin. With respect to all other taxes and transfers, immigrants' age-specific per capita payments are gradually adjusted from a zero level when entering the country, to the payments observed for residents of foreign origin. In addition, until they are fully integrated into the labor market, migrants are expected to receive increased welfare benefits, as compared to settled migrant residents.[11] For both net taxes and the additional welfare benefits we adopt an exponential adjustment process, which places the major part of the adjustment in the final years of the assimilation process.

Allowing for a period of fiscal assimilation reduces the typical immigrant's net contribution to the public households and hence future natives' gain from immigration. If for example, migrants can be integrated into the labor market with only a delay of two years, the average rest-of-life payment of base year immigrants falls to $46,400. Accordingly the gain of future born natives from baseline immigration declines to $50,300, down from $68,300 under the baseline. The unfavorable effect becomes more pronounced if fiscal assimilation of immigrants takes more time. If future migrants require five rather than two years to adopt to the net tax payments made by migrant residents, future natives are left with a generational account of $201,300 and their fiscal gain from immigration is reduced to $43,300. Note that the increment in the tax burden of future native cohorts is a non-linear function of the number of years upon full assimilation, due to the assumed non-linear adaptation process.

[11] In the year they take residence, all migrants irrespective of age are assumed to gain their living exclusively from this additional welfare payment, which is fixed at subsistence level. When the average migrant has become integrated into the labor market, the extra benefit reaches zero.

Provided that full assimilation requires 10 years, the overall net payment of future migrants to the public budget is close to zero. Base year migrants, on average, would contribute not more than $1,300 to reduce the sustainability gap. Although the sustainability gap is not cut in this scenario, baseline immigration relieves future natives to a considerable extent, as it raises the cohort size of future newborns, who share in the additional tax burden necessary to meet the intertemporal public constraint. Future born natives are burdened by a life-cycle net tax payment of $212,300, which is still $32,300 less than in the no-immigration benchmark case. Since the aggregate direct fiscal payments of the immigrant population approach zero, the last figure measures the indirect fertility effect of migration on future generational accounts. Under baseline conditions, this purely demographic impulse accounts for almost 50 percent of natives' total benefits from immigration.

The assimilation experiment underlines the fact that the speed of fiscal integration is a decisive determinant of the extent to which future immigration is beneficial for the native population. Evidence from traditional immigration countries demonstrates that active screening of potential immigrants may successfully improve the labor market performance of immigrants (Miller, 1999). Skills and age of migrants seem to provide particularly useful screens. To assess the chances of improving fiscal sustainability through active labor migration policy, we first assume that selection among potential immigrants successfully raises their average skill level above that observed in the current cross-section of migrant residents.

As an upper bound of realistic scenarios, we assume that the remaining lifetime net taxes paid by immigrants, immediately after taking residency, resemble the generational accounts of native resident cohorts, rather than those of migrant residents. Under these assumptions, the average base year migrant would contribute $92,900 net of government consumption to the public coffers. As a result, future natives' gains from immigration rise by almost 30 percent compared to the baseline, reaching $89,600. Hence, baseline immigration

reduces the intertemporal imbalance by almost one half with improved immigrant quality. Whereas future natives have to pay $203,300 more in net taxes than current newborns in the absence of migration, this difference declines to $113,700 for a quite optimistic view on prospective immigrant quality.

For a second policy experiment, we vary the age composition of future migrants. It is assumed that immigrants are screened by age so that the share of immigrants taking residency in the age range from 20 to 35 (which is of particular fiscal benefit) is augmented by 20 percent, while the absolute inflow of immigrant is maintained at baseline level. Our findings suggest that the fiscal gain of natives from selecting immigrants by age is probably rather modest. In the specified scenario, the tax burden of future natives required to achieve balance of the intertemporal public budget amounts to $173,300, which is only $3,000 less than under baseline conditions. In Germany, self-selection of current immigrants seems sufficient to guarantee a fiscally beneficial age composition, which could hardly be improved by explicit policy means. Certainly, the more essential task of future immigration policy is to support fast integration of future immigrants into the labor market.

4 Conclusion

The generational accounting viewpoint provides a number of valuable insights into the interplay between immigration and the long-term sustainability of current public finances indicated by the fiscal burden of future generations. First, it seems unlikely that intertemporal generational balance will be achieved exclusively through immigration. In the German country study (which could be interpreted as representative for European countries that do not pursue a systematic immigration policy) fiscal policy remains markedly disadvantageous for future generations, even in a high-immigration scenario that would prevent a drastic population decline. Since the adverse budgetary effects of the future demographic aging process are only partially offset by immigration, there is a clear need for revisions of

government's current tax and spending policy, and in particular for reforms of pay-as-you-go financed social insurance.

Secondly, according to the available data on immigrant residents, natives' fiscal gain from admitting labor migration is potentially large. If the aggregate net payments made by the immigrant population are distributed evenly among future born natives, their net tax burden falls by approximately 30 percent, assuming a constant annual immigrant inflow in the magnitude of 0.25 percent of the initial resident population, and by almost 45 percent in the high migration case. The positive fiscal impact of immigration stems from two sources. Firstly, due to the immigrants' favorable age composition, their average payment to the public sector is positive, even when taking into account additional government consumption induced by migrants. Secondly, immigration raises the cohort size of future born native generations who share in the additional tax burden required to meet the intertemporal public budget constraint. Both the fiscal and the demographic impulse account for about one half of the overall positive impact.

Finally, the positive fiscal contribution of the average migrant is significantly reduced if assimilation of prospective immigrants is slow. Therefore selective migration policy that screens potential immigrants by their skill level and promotes the labor market integration of arriving migrants is an effective instrument to improve the sustainability of fiscal policy through immigration.

Figure 1: Present Value Lifetime Net Fiscal Contribution of Immigrant Cohorts

Thousands of Dollar, growth rate 1.5 %, discount rate 5 %

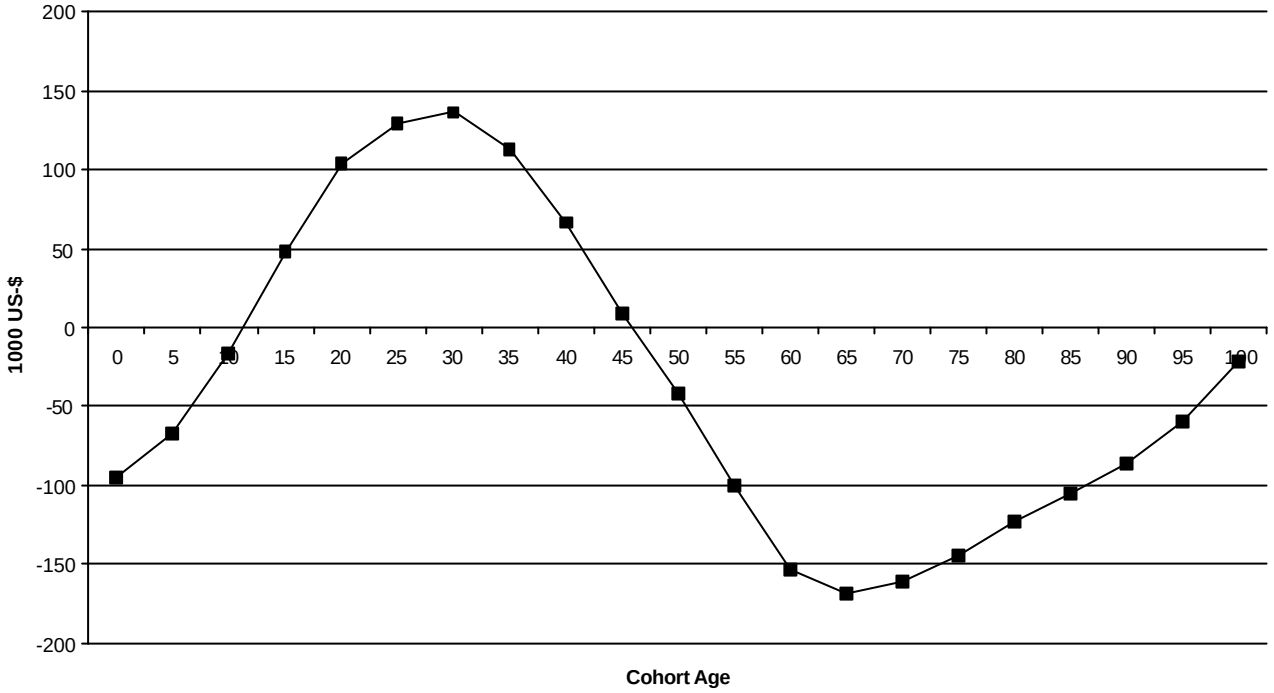

Table 1: Public Revenue and Expenditure, 1996 (Billions of Dollar)

Revenue		Expenditure	
Taxes		Social Insurance	
Labor Income	209.9	Social Security	257.4
Capital Income	72.2	Health	154.6
Seigniorage	4.7	Long-term Care	13.6
Value Added[a]	162.1	Unemployment	70.1
Excise	22.4	Accident	11.9
Gasoline	45.4	Maternity Assistance	4.6
Insurance	9.5	Child Allowance	24.8
Vehicle	9.1	Youth Support	17.2
Other	1.3	Social Welfare	33.3
Contributions		Housing Support	4.4
Social Security	199.0	Education	81.1
Health	156.0	Government	327.9
Long-term Care	15.0		
Unemployment	59.0		
Accident	13.2		
Deficit	109.7	Interest Payments	86.8
Total	1087.7	Total	1087.7

Table 2: The Composition of Generational Accounts, Natives

Thousands of Dollar (1996 present value), growth rate 1.5 %, discount rate 5 %

Genera-tions Age	Genera-tional Account	Tax Payments						Transfer Receipts					
		Labor Income	Capital Income	Seignio-rage	VAT	Excise/ Other	Social Insurance Contrib.	Social Security/ Accident	Health/ Long-term Care	Unem-ployment	General Welfare/ Housing	Youth/ Maternity	Education
0	41.4	7.2	13.3	0.8	41.3	21.5	100.5	29.2	42.6	10.1	11.0	33.0	57.4
5	75.1	56.1	15.8	1.0	49.1	25.5	119.3	34.7	42.6	12.0	10.7	30.5	61.2
10	130.0	66.5	18.8	1.1	57.7	30.1	141.2	41.1	46.0	14.3	10.4	24.2	49.2
15	194.3	78.4	21.9	1.4	66.9	35.3	166.2	48.7	49.7	17.4	10.5	16.0	33.5
20	255.3	91.7	25.4	1.6	75.0	39.3	192.3	57.7	53.0	21.5	10.9	7.6	19.3
25	278.1	99.9	28.5	1.8	76.2	39.2	204.0	68.3	55.9	24.0	10.9	4.5	7.9
30	273.3	100.7	31.2	2.0	75.4	37.7	201.9	80.5	58.4	23.8	10.4	1.7	0.8
35	237.6	96.1	32.4	2.1	72.9	34.9	187.3	94.8	61.0	22.7	9.1	0.5	0.0
40	183.6	87.8	31.7	2.1	68.2	31.2	167.1	110.9	63.5	21.6	8.2	0.1	0.0
45	110.6	73.2	30.0	2.0	61.7	36.9	140.4	129.6	66.1	20.5	7.4	0.0	0.0
50	18.7	50.2	27.4	1.8	53.3	22.2	107.2	151.1	68.0	17.7	6.8	0.0	0.0
55	-80.8	26.7	24.0	1.6	44.7	17.4	70.6	176.7	69.2	13.4	6.5	0.0	0.0
60	-171.6	9.6	20.5	1.3	37.4	13.2	43.4	214.9	70.1	5.6	6.4	0.0	0.0
65	-195.5	2.3	17.1	1.1	30.6	9.6	30.3	210.0	69.7	0.2	6.6	0.0	0.0
70	-189.8	0.9	13.3	0.9	24.3	6.5	26.3	187.6	67.2	0.0	7.2	0.0	0.0
75	-176.0	0.4	9.5	0.6	18.1	4.3	22.5	161.1	62.2	0.0	7.6	0.0	0.0
80	-144.8	0.0	6.6	0.4	13.1	2.6	16.7	121.1	55.3	0.0	7.8	0.0	0.0
85	-118.7	0.0	4.5	0.3	9.1	1.7	12.6	91.6	47.4	0.0	7.9	0.0	0.0
90	-93.3	0.0	3.0	0.2	6.3	1.1	9.3	67.8	38.1	0.0	7.3	0.0	0.0
95	-64.2	0.0	1.9	0.1	4.2	0.7	6.1	44.7	26.9	0.0	5.6	0.0	0.0
100	-21.3	0.0	0.5	0.0	1.2	0.2	1.9	14.3	8.3	0.0	2.5	0.0	0.0

Table 3: The Composition of Generational Accounts, Resident Aliens

Thousands of Dollar (1996 present value), growth rate 1.5 %, discount rate 5 %

Genera-tions Age	Genera-tional Account	Tax Payments						Transfer Receipts					
		Labor Income	Capital Income	Seignio-rage	VAT	Excise/ Other	Social Insurance Contrib.	Social Security/ Accident	Health/ Long-term Care	Unem-ployment	General Welfare/ Housing	Youth/ Maternity	Education
0	14.2	36.8	10.7	0.7	33.2	17.2	85.9	16.2	42.6	16.7	11.7	32.8	50.3
5	41.5	43.9	12.07	0.8	39.4	20.5	102.3	19.2	42.7	19.9	12.0	30.4	53.9
10	89.6	52.3	15.1	0.9	46.7	24.3	121.4	22.7	46.0	23.7	12.6	23.5	42.6
15	151.5	62.7	17.9	1.1	55.3	28.7	144.5	26.9	49.7	28.2	13.5	14.7	25.7
20	205.9	73.7	20.8	1.3	62.7	32.2	166.7	31.9	53.1	32.9	14.6	6.0	13.0
25	228.3	82.8	23.5	1.4	63.4	32.3	179.9	36.9	55.7	38.0	15.5	2.4	6.3
30	231.1	87.6	25.9	1.6	62.7	31.2	181.3	42.7	57.8	41.4	16.0	0.7	0.6
35	203.4	84.0	27.3	1.7	61.1	29.1	165.7	50.1	60.5	38.8	16.0	0.2	0.0
40	152.5	74.0	27.3	1.6	58.1	26.2	140.0	59.5	63.4	35.9	15.9	0.0	0.0
45	89.9	59.6	26.1	1.6	53.0	22.7	112.1	70.2	66.3	33.2	15.5	0.0	0.0
50	32.1	46.0	23.7	1.4	45.7	18.9	89.3	77.9	67.5	32.0	15.5	0.0	0.0
55	-33.0	28.3	20.8	1.2	38.8	15.1	60.6	87.0	68.2	26.9	15.2	0.0	0.0
60	-93.8	10.9	18.1	1.1	32.2	11.6	31.3	103.8	69.0	12.1	13.9	0.0	0.0
65	-117.6	0.8	15.3	0.9	26.6	8.6	14.8	102.8	68.9	0.2	12.7	0.0	0.0
70	-177.4	0.0	11.8	0.7	21.1	6.0	12.3	90.4	66.5	0.0	12.4	0.0	0.0
75	-109.6	0.0	8.5	0.5	15.9	4.1	10.3	75.5	61.1	0.0	12.3	0.0	0.0
80	-95.7	0.0	6.0	0.3	11.5	2.6	7.8	57.7	54.3	0.0	11.9	0.0	0.0
85	-85.0	0.0	4.2	0.2	8.1	1.7	6.4	47.0	47.3	0.0	11.3	0.0	0.0
90	-70.4	0.0	2.8	0.2	5.6	1.1	5.0	36.8	38.2	0.0	10.1	0.0	0.0
95	-49.2	0.0	1.8	0.1	3.7	0.7	3.3	24.3	27.1	0.0	7.4	0.0	0.0
100	-17.7	0.0	0.6	0.0	1.2	0.2	1.2	9.1	8.7	0.0	3.1	0.0	0.0

Table 4: Generational Accounts of Current and Future Native Cohorts
Thousands of Dollar (1996 present value), growth rate 1.5 %, discount rate 5 %

	Immigration Scenario		
	No Migration	Baseline	High Migration
Current Newborns	41.4	41.1	41.4
Future Newborns	244.6	176.4	137.9
Generational Imbalance	203.3	135.0	96.8
Immigration Gain	—	68.2	106.7

References

Ablett, J., 1997, A Set of Generational Accounts for Australia: Baseyear 1994/95, The Economic and Labor Relations Review, 8, pp. 90-109.

Auerbach, A. and J. Gokhale, and L. Kotlikoff, 1991, Generational Accounting: A Meaningful Alternative to Deficit Accounting, in: D. Bradford (ed.), Tax Policy and the Economy, Vol. 5, pp. 55-110.

Auerbach, A. and J. Gokhale, and L. Kotlikoff, 1992, Generational Accounting: A New Approach to Understanding the Effects of Fiscal Policy on Saving, Scandinavian Journal of Economics, 94, pp. 303-318.

Auerbach, A. and J. P. Oreopoulos, 1999, Analyzing the Fiscal Impact of U.S. Immigration, American Economic Revue, Papers and Proceedings, 89, pp. 176-180.

BBF – Bundesministerium für Bildung und Forschung, 1998, Grund- und Strukturdaten 1998/99, Bonn.

Birg, H. et al., 1998, Simulationsrechnungen zur Bevölkerungsentwicklung in den alten und neuen Bundesländern im 21. Jahrhundert, Materialien des Instituts für Bevölkerungsforschung und Sozialpolitik, Vol. 45, Bielefeld.

Blau, F., The Use of Transfer Payments by Immigrants, 1984, Industrial and Labor Relations Review, 37, pp. 222-239.

BMA – Bundesministerium für Arbeit, 1996, Bundesarbeitsblatt, 9/96, Bonn.

Borjas, G. and S. Trejo, 1991, Immigrant Participation in the Welfare System, Industrial and Labor Relations Review, 44, pp. 195-211.

Bröcker, J. and B.~Raffelhüschen, 1997, Fiscal Aspects of German Unification: Who is Stuck with the Bill?,' Applied Economics Quarterly, 45, pp.~139-162.

Börsch-Supan, A., 1994, Migration, Social Security Systems, and Public Finance," in: H. Siebert (ed.), Migration: A Challenge for Europe, Tübingen, pp. 119-142.

Buiter, W., 1997, Generational Accounts, Aggregate Saving and Intergenerational Distribution, Economica, 64, pp. 605-626.

Diamond, P., 1996, Generational Accounts and Generational Balance: An Assessment, National Tax Journal, 49, pp. 597-607.

Dinkel, R., C. Höhn, and R. Scholz, 1996, Sterblichkeitsentwicklung – unter besonderer Berücksichtigung des Kohortenansatzes, Munich.

Fehr, H. and L. Kotlikoff, 1997, Generational Accounting in General Equilibrium, Finanzarchiv, N.F. 54, pp. 1-27.

Felderer, B., 1994, Can Immigration Policy Help to Stabilize Social Security Systems, in: H. Giersch (ed.), Economic Aspects of International Migration, Berlin, pp. 197-226.

Gokhale, J., B. Raffelhüschen, and J. Walliser, 1995, The Burden of German Unification: A Generational Accounting Approach, Finanzarchiv, N.F. 52, pp. 141-165.

Haveman, R., 1994, Should Generational Accounts Replace Public Budgets and Deficits, Journal of Economic Perspectives, 8, pp. 95-111.

Kotlikoff, L. and B. Raffelhüschen, 1999, Generational Accounting Around the Globe, American Economic Review, Papers and Proceedings, 89, pp. 161-166.

Miller, P., 1999, Immigration Policy and Immigrant Quality: The Australian Points System, American Economic Review, Papers and Proceedings, 89, pp. 192-197.

Raffelhüschen, B., 1999a, Aging, Fiscal Policy and Social Insurances: A European Perspective, in: A. Auerbach and R. Lee (eds.), Demographic Change and Fiscal Policy, Chicago, forth.

Raffelhüschen, B., 1999b, Generational Accounting in Europe, American Economic Review, Papers and Proceedings, 89, pp. 167-170.

Raffelhüschen, B. and A. Risa, 1997, Generational Accounting and Intergenerational Welfare, Public Choice, 93, pp. 149-163.

Raffelhüschen, B. and J. Walliser, 1999, Unification and Aging: Who Pays and When?, in: A. Auerbach, L. Kotlikoff and W. Leibfritz (eds.), Generational Accounting around the World, Chicago, pp. 277-298.

Riphahn, R., 1998, Immigrant Participation in the German Welfare Program, Finanzarchiv, N.F. 55, pp. 163-185.

Schultz, T., 1998, Immigrant Quality and Assimilation: A Review of the US Literature, Journal of Population Econcomics, 11, pp. 239-252.

Simon, J., 1984, Immigrants, Taxes and Welfare in the United States, Population and Development Review, 10, pp. 55-69.

Simon, J., 1994, On the Economic Consequences of Immigration: Lessons for Immigration Policies, in: H. Giersch (ed.), Economic Aspects of International Migration, Berlin, pp. 227-248.

Sommer, B., 1994, Entwicklung der Bevölkerung bis 2040, Ergebnis des achten koordinierten Bevölkerungsvorausschätzung, Wirtschaft und Statistik, pp. 497-503.

Steinmann, G. and R. Ulrich, 1994, The Economic Consequences of Immigration to Germany, Heidelberg.

Storesletten, K., 1999, Sustaining Fiscal Policy Through Immigration, Journal of Political Economy, forth.

Ulrich, R., 1992, Der Einfluß der Zuwanderung auf die staatlichen Einnahmen und Ausgaben in Deutschland, in: G. Buttler, H.-J. Hoffmann-Nowotny and G. Schmitt-Rink (eds.), Acta Demographica 1992, Heidelberg, pp. 189-208.

VDR – Verband Deutscher Rentenversicherungsträger, 1997, Rentenbestand am 31. Dezember 1996, VDR Statistik, Vol. 120, Würzburg.

Abstract

This paper investigates the impact of immigration on intertemporal public budgets. A modified generational accounting framework is employed to compute the average net contribution of migrants to the public sector budget in Germany. Our findings suggest that the overall fiscal contribution of immigrants is positive if they resemble current migrant residents in their economic characteristics. Therefore, immigration can decrease the fiscal burden of future resident generations. We also show that active migration policy favoring high-skilled immigrants to facilitate their labor market assimilation, may considerably enlarge the positive impact of immigration on the tax burden of native residents. However, even high immigrant inflows only partially remove the intergenerational fiscal imbalance induced by aging in Germany.

Kurzfassung

Diese Studie untersucht die Auswirkungen von Immigration auf die langfristige Entwicklung öffentlicher Haushalte in Deutschland. Mit Hilfe einer erweiterten Generationenbilanzierung werden die durchschnittlichen Nettosteuerzahlungen von Zuwandererkohorten geschätzt. Unter der Voraussetzung, dass künftige Einwanderer der beobachteten Migrantenbevölkerung ähneln, ist der Gesamtbeitrag von Zuwanderern zu den öffentlichen Haushalten deutlich positiv. Immigration erscheint somit als ein geeignetes Instrument, langfristig steigende Steuerlasten in einer alternden Gesellschaft zu verringern. Eine aktive Einwanderungspolitik, die zu Gunsten hoch qualifizierter Zuwanderer diskriminiert, um ihre Integration in den Arbeitsmarkt zu beschleunigen, vergrößert die positiven Wirkungen auf die Steuerlast der einheimischen Bevölkerung. Allerdings können auch hohe Zuwanderungen gut ausgebildeter Erwerbspersonen die von einer alternden Bevölkerung ausgelösten intergenerativen Umverteilungsprozesse nur teilweise aufheben.

Holger Bonin
Insitute for Public Finance
University of Freiburg
Platz der Alten Synagoge 1
79085 Freiburg
Germany
Phone: +49-761-203 2356
holbonin@vwl.uni-freiburg.de

Bernd Raffelhüschen
Institute for Public Finance
University of Freiburg
Platz der Alten Synagoge 1
79085 Freiburg
Germany
Phone: +49-761-203 2354
raffelhu@vwl.uni-freiburg.de

Jan Walliser
Fiscal Affairs Department
International Monetary Fund
700 19th Street, NW
Washington, DC 20431
USA
jwalliser@imf.org