Sustaining Fiscal Policy Through Immigration[1]

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Abstract

Using a calibrated general equilibrium overlapping generations model, which explicitly accounts for differences between immigrants and natives, this paper investigates if an immigration policy reform alone could resolve the fiscal problems associated with the ageing of the baby boom generation. Such policies are found to exist and are characterized by increased inflow of working-age high- and medium-skilled immigrants. One particular feasible policy involves admitting 1.6 million 40–44 year old high-skilled immigrants annually. These findings are illustrated by computing the discounted government gain of admitting additional immigrants, conditional on their age and skills.

1 Introduction

The fiscal implications of immigration to the US are, potentially, very large, not only because the inflow of immigrants is strong - about 1.1 million per year - but also since immigrants are younger than Americans and have a wider distribution of skills. If skilled workers immigrate and immediately start paying taxes, the net fiscal effects are likely to be large and positive, even when the gains are traded off with the subsequent costs of retirement. Moreover, young immigrants would alleviate the current demographic imbalance, but without a twenty-year period of childhood. Thus, selective immigration should be able to mitigate some of the fiscal burden associated with the ageing of the baby boom generation and might, to some extent, serve as an alternative to tax hikes or spending cuts for financing future fiscal deficits.[1]

This paper explores if a selective immigration policy alone could be used as an instrument to balance the budget and avoid fiscal reform altogether. The findings are illustrated by computing the net government gain, in present value terms, of admitting one additional immigrant, conditional on skills and age at the time of immigration.

The framework is a dynamic equilibrium model of population transition, closely related to Auerbach and Kotlikoff (1987). Immigration is given by a selective immigration policy determining the age and skill structure and the annual inflow of new immigrants. Natives and immigrants in the model economy differ in age, skills, and fertility. In addition, immigrants are differentiated by age at the time of immigration and by their legal status. The overlapping generations framework captures the first-order effects of immigration: an inflow of working-age immigrants increases tax revenues per capita and reduces government debt and government expenditures per capita. When immigrants retire, these effects are reversed. A general equilibrium analysis is required since the government budget is also affected through increases in interest rates and decreases in wages, due to a rise in the labor-capital ratio (assuming capital does not flow into the country in response to immigration). Higher interest rates increase the cost of servicing the public debt, and lower wages reduces tax revenues.

I find that selective immigration policies, involving increased inflow of working-age high- and medium-skilled immigrants, can remove the need for a future fiscal reform. In contrast, increased inflow of immigrants with the age- and skills-composition of average *current* immigrants cannot, in itself, induce long-run budget balance. As a benchmark, I compute the smallest increase in annual immigration required to balance the budget, given that the government is free to choose the distribution of age and skills of new immigrants, while restricted to keeping the current tax and spending policies unchanged. This minimum change involves increasing annual immigration from 0.44% to 0.62% of the population, or about 1.6 million, provided all new immigrants are high-skilled and 40–44 years old. Admitting adult immigrants but excluding their children may not be politically feasible, however. If immigrants were instead admitted in family units, the minimum number of immigrants required would increase to 1.08% of the population annually - assuming the head of the family to be high-skilled and 45–49 years old. While admitting 1.6 million immigrants annually might seem like a considerable policy change, it is illuminating to contrast this to an alternative fiscal reform: income taxes would have to increase by 4.4% points if one opted for changing taxes instead of immigration policy or government expenditures. Thus, it seems sensible to consider at least marginal immigration policy reforms as part of a larger fiscal reform package.

These findings are driven by the following results: Under the current fiscal policy and the immigration policy outlined above, the discounted value of future tax receipts less government expenditures associated with an additional immigrant varies considerably with age and skills and reaches a maximum of $177,000, or seven times GNP per capita, for high-skilled immigrants arriving when they are 40–44 years old. This includes the cost of future descendants. The average NPV of representative high-, medium-, and low-skilled legal immigrants are found to be $96,000, -$2,000, and -$36,000, respectively. In comparison, the NPV of a newborn native is -$88,000.

All age profiles of NPV for new immigrants are hump-shaped and peak between the age of 35 and 44. The timing of the peak is robust to several changes in the model setup, due to a basic trade-off between a longer remaining working life on the one hand, and a smaller number of new children on the other. Abstracting from the cost of future children would increase the average discounted gain by $20,000 and make the age profiles peak earlier. If, alternatively, family migration is considered (immigrants bringing existing children when immigrating), the maximum NPV falls to $140,000 per 40-44 year old high-skilled head of household.

To the extent that one is willing to consider using the immigration policy for enriching public coffers, the paper offers several immediate policy implications. The analysis suggests which groups of immigrants to target, if the aim is to maximize the public coffer contribution per immigrant. For instance, the Canadian "point system" for allocating visas to prospective immigrants favors skilled immigrants in the age group 20–40. My calculations suggest, however, that focusing on high-skilled immigrants in the age group 20–49 would make more sense if the objective is to maximize the public gain, as the NPV of high-skilled immigrants between 40 and 49 far exceeds that of 20–24 year old high-skilled immigrants.

Moreover, the results indicate that the discounted government cost of new illegal immigrants can be as large as $54,000 per immigrant, compared with $36,000 for legal low-skilled immigrants. If curbing illegal immigration is infeasible, these results suggest that converting young illegal immigrants to legal ones, along the lines of the Immigration Reform and Control Act of 1986, is beneficial, provided the flow of illegal immigrants is not affected by this amnesty policy.

Finally, I find that return migration decreases the discounted contribution of high-skilled immigrants under 50. Thus, policies which lower the return migration probability for this group might improve public finances. Straightforward examples of such reforms would be to make the rules for allocating visas and green cards to immigrants already working in the US less strict, and to automatically grant green cards to foreign students upon graduation.

Despite the strong implications of immigration for public finance, surprisingly few studies address the cost-benefit aspect of immigration.[2] Borjas (1994), Huddle (1993) and Passel (1994) compute the net government surplus in a particular year, stemming from the cross-section of immigrants currently residing in the US. The key shortcomings of this approach are that the instantaneous fiscal impact of immigrants changes with their age structure, and that costs and expenditures occurring later in the life of an immigrant (e.g. pensions) should be discounted. Simon (1984) and Akbari (1989) compute the tax revenues and government expenditures directly associated with different immigration cohorts. These are used as a stand-in for a time profile of net contributions which, in turn, are discounted to get a crude measure of the "net public gain". These studies ignore the descendants of immigrants, the changes in the age- and skill-profiles of immigrants, and the general equilibrium interaction between immigrants and an ageing population. Canova and Ravn (1998) study the macroeconomic effects of low-skilled immigration in an infinitely lived agent model, ignoring life-cycle aspects altogether. Auerbach and Oreopoulos (1999) and Bonin, Raffelhuschen and Walliser (1997) include dynamic effects of immigration through partial equilibrium generational accounting exercises for the US and Germany, respectively. Lastly, Storesletten (1995, 1996) and Lee and Miller (1997) (on which Chapter 7 in Smith and Edmonton (1997) is based upon) compute the net present value of the fiscal impact of new immigrants, including their decendants.

The paper then proceeds as follows. The model economy and the competitive equilibrium are defined in Section 2. The parameterization of the economy is described in Section 3, and the results are reported in Section 4. Section 5 concludes.

2 The model

2.1 Population process and heterogeneity

The economy is populated by agents who live a maximum of I periods. Agents differ in age, skills, legal status (native, legal immigrant, or illegal immigrant), and, if an immigrant, the age at the time of immigration. The "type" of an agent is denoted by (i, s), where i is age, $s(1)$ is the age at the time of immigration (natives have $s(1) = 1$), $s(2)$ is skill, and $s(3)$ is legal status. The key difference between natives and legal immigrants in the model is in terms of labor productivity and fertility. Distinguishing immigrants by legal status is important because illegal immigrants might be very different from legal ones, with respect to their impact on public coffers. Moreover, illegal immigration constitutes a substantial share of the migration to the US (Chiswick (1988)).

The immigrants' skills (or education) take on three values; low-skilled, medium-skilled and high-skilled. Skills are exogenous and do not change during an agent's lifetime. For simplicity, the skills of natives are assumed to be homogeneous (conditional on age).

Children of immigrants, born after their parents immigrated, are considered as natives. Thus, the skills of second-generation immigrants are assumed to be independent of the skills of their parents. Following Lee (1974) and Ríos-Rull (1992), the number of newborn natives in period t is given by

$$\#\ \text{newborn}_t = \sum_{i,s} \phi_{i,s}\mu_{i,s,t} + y_t, \tag{1}$$

where $\mu_{i,s,t}$ is the number of type (i,s) agents in period t, $\phi_{i,s}$ are type-specific fertility rates averaged over time, and y_t is a deterministic process. Agents do face longevity uncertainty, however, and the probability of surviving to age $i+1$, conditional on being alive at age i, is given by π_i.

A selective immigration policy is chosen by the government and determines annual immigration and the distribution of age and skills of new *legal* immigrants, as a function ψ of the state of the economy. I assume that the government cannot alter the flow of illegal immigrants. There are numerous ways of specifying the possible immigration policies. I focus on a very simple type of policies where the inflow of each age and skill group is some fixed fraction of the size of the population.

Empirical studies have documented that as many as 18-20% of the new immigrants return to their respective home countries within ten years after their first arrival to the US (Borjas and Bratsberg (1996), Jasso and Rosenzweig (1982) and Warren and Peck (1980)). The probability of return migration, η_j, is assumed to simply depend on the length of the spell in the host country (where j stands for years since immigration). Moreover, to ensure that immigrants do not take the event of return migration into consideration when making decisions, I assume that the agents who return migrate will face the same prices, transfers, and taxes in their home country as they would have faced in the US.

2.2 Preferences, technology, and government

Agents derive utility from leisure $1-n$ and a standard consumption good c. Those below age ζ are defined as children. They consume the transfers they get from the government and do not work. Furthermore, agents do not care about their children and have no bequest motives, although they may end up leaving accidental bequests. At age ν, all agents retire. A type s agent maximizes her expected lifetime utility, given by

$$\max_{\{c_i,n_i\}} \mathrm{E} \sum_{i=\max\{s(1),\zeta\}}^{I} \beta^i u(c_i,n_i) = \max_{\{c_i,n_i\}} \sum_{i=\max\{s(1),\zeta\}}^{I} \beta^i \frac{(c_i^{\alpha}(1-n_i)^{1-\alpha})^{1-\gamma}}{1-\gamma} \prod_{j=s(1)}^{i-1} \pi_j, \qquad (2)$$

subject to the intertemporal budget constraint and the pension system.

Output in period t is given by a standard constant return to scale production function $z_t f(K_t, N_t)$ with aggregate labor N_t and capital K_t as inputs. The exogenous productivity level, z_t, is growing at a deterministic rate. Output is used for consumption and investment in new capital. Labor productivity of an agent is measured in equally productive efficiency units, which implies that native and immigrant labor are perfect substitutes, and that N_t is given by the sum of efficiency units supplied by agents. Firms rent labor and capital on spot markets at a given wage rate W_t and a net rental rate R_t and solve a standard profit maximzation problem, $\max_{K,N} \{z_t f(K,N) - (R_t+\delta)K - W_t N\}$, where δ is the depreciation rate for capital.

Fiscal policy is given exogenously and consists of a tax rule, a public spending rule, and a transfer rule. The tax rule specifies a constant payroll tax rate τ_p, and a constant tax rate τ on capital and labor income. Natives and legal immigrants are taxed at the same rates. Illegal immigrants differ from their legal counterparts in that they pay no taxes and receive no government transfers. They are assumed, however, to incur public consumption at the same rate as their legal counterparts.

Public consumption is given by a rule determining government purchases of goods and services as a function of population and time:

$$G_t \equiv (1+\Gamma)^t \sum_{i,s} g_i \, \mu_{i,s,t}, \qquad (3)$$

where g_i is government consumption per agent of age i in period zero and Γ is the rate of growth in GNP per capita in steady state. Conditioning the incidence of public consumption on age is important, since large components of government purchases of goods and services are age dependent (e.g. the schooling system).

The Social Security system is modeled explicitly. Old Age Insurance benefits (OAI) are paid to retired agents only and are a function $h(.)$ of the individual's average indexed monthly earnings (AIME) during her time in the work force. The remaining components of Social Security, plus all other government transfer programs, are modeled as age-specific lump sum transfers ξ_i.[3] All benefits are assumed to be tax exempted. The results are very robust to this assumption (Storesletten (1999)).

Residence in the US when retired is not a requirement for collecting benefits. Let $\hat{\mu}_{i,s,t}$ denote the number of living return migrated legal immigrants of type s who qualify for full Social Security benefits, let $\hat{\xi}_i$ be their lump sum transfers, and assume that only a fraction κ of these actually collect their benefits. The aggregate government transfers in period t can then be computed as

$$T_t \equiv \sum_{s\in\mathcal{L}} \Bigg\{ \sum_{i=s(1)}^{\nu} \mu_{i,s,t}(1+\Gamma)^t \xi_i + + \sum_{i=\nu+1}^{I} \Big(\mu_{i,s,t} \left((1+\Gamma)^t \xi_i + h(d_{i,s,t})\right) + \kappa\hat{\mu}_{i,s,t}((1+\Gamma)^t \hat{\xi}_i + h(d_{i,s,t}))\Big) \Bigg\}, \tag{4}$$

where $d_{i,s,t}$ is the AIME of an agent (i,s) in period t and the condition $s \in \mathcal{L}$ ensures that illegal immigrants are excluded from T_t. The total tax revenues are given by

$$Revenues_t \equiv (1-(1-\tau_p/2)(1-\tau-\tau_p/2))W_t\hat{N}_t + \tau R_t \hat{A}_t, \tag{5}$$

where $\hat{N}_t$ and $\hat{A}_t$ are aggregate labor input and private financial wealth of natives and legal immigrants. Note that the employer part of Social Security contributions is tax deductible. Budget deficits are financed by increases in government debt, held as bonds B_t by private agents.

The only individual portfolio constraint is that agents of age I, who will die for sure, cannot leave negative bequests. There are no annuity markets in the economy, so the agents face the risk of dying with positive wealth. Each period, accidental bequests are donated to newborn natives in a lump sum x_t. Immigrants are assumed to bring no wealth when they arrive, while return-migrants bring their savings out of the country when they leave. RM_t denotes the aggregate amount of capital brought out of the economy in period t.

This model specification abstracts from nonrival public goods and congestion effects (scarce public capital diluted by new immigrants). I will, however, consider the sensitivity of the results to the inclusion of a nonrival public good. One feature of the model which does capture a public good element of immigration is that the per capita government debt falls as immigration increases. As the model abstracts from government-owned physical capital, parts of government consumption, g_i, can be interpreted as a stand-in for replenishing government capital per agent of age i. Thus, a potentially increased pressure for public investments due to immigration is captured in the model, as government consumption is increasing in the number of new immigrants.

2.3 Equilibrium

Given initial conditions for government debt B_0, the error term of the fertility process y_0, and the distributions of assets a_0, past average earnings d_0 and population μ_0 and $\hat{\mu}_0$, an equilibrium is defined as a sequence
$\left\{W_t, R_t, N_t, K_t, B_t, RM_t, x_t, \{n_{i,s,t}, c_{i,s,t}, a_{i,s,t}, d_{i,s,t}, \mu_{i,s,t}, \hat{\mu}_{i,s,t}\}_{s,i=s(1)}^{I}\right\}_{t=0}^{\infty}$,
a tax rate τ, and an immigration policy rule ψ, such that the following holds

a) The wage rate and rate of return on savings, W_t and R_t, equal net marginal productivities of labor and capital.

b) The aggregate resource constraint holds every period.

c) Each sequence $\{c_{i,s,t+i}, n_{i,s,t+i}\}_{i=s(1)}^{I}$ solves the utility maximization problem (2) of agents of type s who were born in period $t - s(1)$, subject to their budget constraints, the pension system, and the price sequence $\{R_t, W_t\}_{t=1}^{\infty}$. Moreover, the sequences of individual wealth and average indexed earnings, $\{a_{i,s,t+i}, d_{i,s,t+i}\}_{i=s(1)}^{I}$, are consistent with the agents' consumption and leisure choices.

d) Aggregate accidental bequests per newborn native in period t, x_t, are consistent with the distribution of assets and population.

e) The government policy (ψ, τ) is feasible, in the sense that current government debt equals the net present value of future budget deficits and surpluses.

f) The sequence of government debt evolves according to $B_{t+1} = (1 + R_t)B_t + T_t + G_t - Revenues_t$, and the aggregate figures N_t and RM_t are computed by aggregating individual labor effort and return migrants' wealth holdings.

g) Aggregate capital K_t equals aggregate private wealth minus government debt B_t in period t.

h) The population sequences $\{\{\mu_{i,s,t}, \hat{\mu}_{i,s,t}\}_{i=s(1)}^{I}\}_{t=1}^{\infty}$ are generated by μ_0, $\hat{\mu}_0$, y_0, ψ, and the mortality, fertility, and return migration processes.

3 Parameterization of the model economy

3.1 Population parameters

The length of a period in the model is taken to be five years. Each agent retires after period 13 and might live until period 18 (i.e. agents retire at 65 and die before 90). The mortality rates of natives and immigrants are assumed to be identical, fixed at the 1988 US levels. Since many immigrants originate from countries where tropical diseases are common, a case could be made for immigrants having higher mortality than natives. Shorter longevity would increase net government benefit from immigration so the equal mortality assumption is a conservative benchmark.

The age-specific average fertility rates in (1) for natives are estimated by averaging over the 1960–89 time period.[4] Storesletten (1995) estimates immigrant women's fertility by constructing synthetic cohorts from the 1990 and 1980 Census, and computing changes between 1980 and 1990 in the average number of children for various groups. This approach implies that the average total fertility rate (TFR) of high-skilled immigrants is 16% lower than that of natives, while the TFR for medium- and low-skilled immigrants are 7% and 50% higher than that of natives, respectively. The $\phi_{i,s}$ parameters are set accordingly. The error term y_t in (1) follows a deterministic AR(2) process with coefficients $\rho_1 = 1.28$ and $\rho_2 = -0.65$, estimated using US data from 1960 to 1990. The 1990 values of the estimated process are used as the starting point y_0.

Return migration appears to be quite high in the first years after immigration, but declines sharply over time. As an approximation of the return migration process, I assume that the return migration rate, η_j, is constant after the first period. Warren and Peck (1980) find that by April 1970, 18% of the 1960-70 cohort of new immigrants and 5.2% of the immigrants present in 1960 had emigrated from the US. Using these measurements, I set $\eta_1 = 17.06\%$ and $\eta_j = 2.63\%$ for all $j >= 2$.

All alternative immigration policies considered in this paper constitute increased inflow, relative to the status quo immigration policy, of one or several groups of legal immigrants. I measure the status quo immigration policy, unconditional on legal status, as the distribution of age and skills of immigrants enumerated in the 1990 Census, who immigrated during the period 1988-1990. The status quo annual inflow of immigrants is 0.44% of the population. The annual inflow of illegal immigrants currently constitutes about 300,000, or 0.12% of the population, (Fix and Passel (1994)), and I assume this fraction to be constant over time. All illegal immigrants are assumed to be low-skilled.

Note that the status quo population process implies a lower future dependency ratio (retirees per worker), after 2010, than the standard alternative projections. For instance, the status quo case projects a maximum dependency ratio of 0.315 in 2035 (and 0.276 eventually), compared to 0.369 in 2035 (and 0.421 eventually) for the Social Security Administration (SSA) projections (Bell (1997)). This discrepancy is due to higher mortality rates, more immigration, and higher fertility rates (after the year 2000), in the status quo population process than what is assumed in the SSA projections. Higher fertility rates will worsen the future fiscal burden, while higher mortality rates will alleviate the problems. In Section 4.7, I explore the sensitivity of the results to increased life expectancy.

3.2 Efficiency unit profiles, preferences and technology

Estimates of the efficiency unit profiles for each type s are taken from Storesletten (1995).[5] This implies that immigrants who came when they were, say, 27 years old, earn, on average, 2% less than natives over their remaining lifetime and those who immigrated when 37 years old earn 13% less than natives. These estimates are in line with e.g. LaLonde and Topel (1992) and somewhat below those of Chiswick (1978). Since the public finance implications of immigration are sensitive to the labor income of natives, I also try an alternative earnings profile where immigrants earn 10% less than my estimates. The skills of immigrants are measured as completed education and divided into three groups: (1) "low-skilled" - high school or less, (2) "medium-skilled" - more than high school but less than a bachelor's degree, and (3) "high-skilled" - a bachelor's degree or more. This distributes the recent immigrants in the 1990 Census into three roughly equally sized skill groups.

The functional form of the utility function (2) implies a unit elasticity of substitution between consumption and leisure, which is motivated by fairly constant annual hours worked per household in the postwar period. The parameter α is set to 0.33, see Ríos-Rull (1996), and the inverse of the intertemporal elasticity of substitution, γ, is set at 4, since a period in the model is fairly long. The time preference parameter β is set to 1.011 (annualized), based on estimates from Hurd (1989).

The technology is standard. I assume a standard Cobb-Douglas production function taking labor and capital as inputs, $Y_t = z_t K_t^{\theta} N_t^{1-\theta}$. Following Cooley and Prescott (1995), the capital's share of income, θ, and the (annualized) depreciation rate, δ, are set to 0.4 and 4.8%, respectively. The steady state growth rate in consumption per capita, Γ, is 1.5% (annualized), which equals the average annual US growth rate in GNP per capita over the last two decades.

3.3 Government

The income tax rate of the "status quo" fiscal policy is calibrated to $\tau = 28.2\%$, which would make total tax revenues amount to 32.5% of output in the first period of the "fiscal reform" economy, the same as total federal, state and local tax revenues in 1993.[6] The payroll tax, τ_p, is set to 15.3% of labor income.

The age-specific government consumption levels, g_i in (3), are taken from Auerbach, Kotlikoff, Hagemann and Nicoletti (1989), and scaled so that overall government consumption is 16.1% of GNP in the first period of the fiscal reform economy, the same as in 1993.

I assume all workers, except illegal immigrants, to be enrolled in Social Security. The Old Age Insurance formula is a function $h(.)$ of average indexed earnings, indexed at rate Γ.[7] The age-specific lump sum transfers from the remaining components of Social Security, including Medicare, are estimated from unpublished data from the Social Security Administration. All agents who have contributed to the Social Security system for more than ten years qualify for benefits according to US law. Using historical immigration figures and the calibrated return migration process, I find that 930,000 return migrants did qualify for Social Security benefits in 1970. Warren and Peck (1980) report that only 230,000 return migrants actually did collect benefits in 1970 (many countries have bilateral treaties with the US limiting the scope of collecting benefits from more than one country). Hence, I assume that κ =25% of the return migrants claim the benefits to which they are entitled. Moreover, age-specific lump sum transfers to return migrated agents, $\hat{\xi}_i$, contain only Survivor's Insurance and Disability Insurance.

All other transfers on federal, state and local level, which added up to 7% of GNP in 1993, are distributed evenly on all natives and legal immigrants as part of ξ_i. Aggregate government transfers in the first period, T_1, are then 14.4% of GNP in the fiscal reform economy, the same as the total federal, state and local transfers and subsidies in 1993.

3.4 Initial conditions

I use the 1992 distribution of natives as the initial condition for the population. The initial distribution of immigrants across age and skills is taken from the 1990 Census. 3.2 out of the initial 8 million low-skilled immigrants are assumed to be illegal residents (Fix and Passel (1994)).

The initial government debt, which consists of financial assets of the federal, state and local governments, is set to 50% of GNP (in the fiscal reform economy). The initial distribution of assets equals the steady state distribution of assets scaled so that the initial capital to output ratio is 3.3. The steady state capital to output ratio in this economy is 2.4, and agents must hold 126% more wealth than in steady state to reach 3.3.[8] In Storesletten (1999), I document that the results are quite robust to the choice of initial capital stock.

4 Findings

The model is solved by using a method related to the Auerbach and Kotlikoff (1987) approach, see Storesletten (1999) for details.[9]

4.1 Fiscal reform

Before turning to the immigration policy reform experiments, I will briefly describe the fiscal reform economy, where the current immigration policy is pursued and the budget is balanced through a once-and-for-all tax increase in the first period.

The equilibrium income tax rate τ in this economy is 32.6%, 4.4% points higher than the "status quo" tax rate of 28.2%. Thus, a once and for all immediate tax hike of 4.4% points would preempt the need for any future fiscal reform associated with the demographic transition.

The aggregate capital stock falls sharply during the first periods. This is due to a relatively high initial wealth to output ratio (3.8 in the first period, compared to 2.0 in steady state). Consequently, the rate of return on capital (before tax) rises from 6.8% in the first period to 10.0% in steady state, and the initial growth rates in GNP per capita are lower than Γ. All the immigration reform economies below, exhibit a similar pattern. Note that the steady state age profiles of consumption and work effort in the theoretical economies fit reasonably well with the data (Ríos-Rull (1996) and Storesletten (1999)).

4.2 Immigration policy reform

This paper investigates if immigration policy reform alone can be used as an instrument for satisfying the government's long-run budget constraint, given that current tax and spending policies remain unchanged, i.e. when τ equals its "status quo" level of 28.2%. To this end, I explore a particular type of selective policies: let future immigration of each age and skill group of legal immigrants be some fixed fraction of the population. For each single age-skill group of new legal immigrants, I compute the smallest annual inflow of such immigrants, over and above the status quo flows of immigrants, that would balance the budget in the long run.

The first four rows in Table 1 summarize the key results for the benchmark calibration. Within this class of policies, I find that the budget can be balanced with a sufficient inflow of any age group of high-skilled immigrants between 20 and 54. If the attention is restricted to immigrants below 20 or above 54, however, the budget cannot be balanced without increasing taxes or reducing government spending. For medium-skilled immigrants, the feasible age range is 25-49, while no positive inflow of legal low-skilled immigrants can balance the government budget.

40–44 year old high-skilled immigrants is the group with the lowest fraction of new immigrants required to balance the budget: 0.617% annually, or about 1.6 million, compared to 0.44% today. This policy will be referred to as the "immigration reform" policy and if pursued, the steady state population growth would be 0.9% annually.

Thus, to the extent that an immigration reform which involves the admission of 1.6 million 40–44 year old high-skilled immigrants annually is feasible, the government can choose between this reform and an income tax hike of 4.4% points. While admitting 1-2 million high-skilled immigrants might be feasible from a domestic political point of view, attracting such a large number of high-skilled middle aged immigrants might, in practice, be a bigger obstacle to feasibility. In comparison, the number of high-skilled 25–49 year old immigrants required to balance the budget is 1.8 million, or 0.70% of the population annually (simple average across age groups 25–49 in Table 1). Currently, only 15.0% of the new immigrants, about 160,000 annually, are 25–49 years old and high-skilled (according to the 1990 Census 5% sample). But even though the prospects of achieving, say, an eleven-fold increase of this figure might be slim, tripling or quadrupling the size of this group would still go a long way in alleviating the need for fiscal reform.

The strong fiscal impact of immigration can be further demonstrated by considering the evolution of the debt to output ratio in the immigration reform economy, which declines from 50% of GNP in 1995 to -21% of GNP in year 2040. The government budget, excluding interest payments, is running a surplus from 1995 to 2035, while the government runs a deficit until 2000 if interest payments are included, five years more than in the fiscal reform economy.

These calculations incorporate the general equilibrium effects of immigration, which can be expected to suppress the net benefits of immigrants. If immigration is not associated with a capital inflow (as I have assumed here), an increase in immigration increases the interest rates and reduces the wages. Consequently, the cost of servicing the public debt increases, and the tax revenues fall, as most tax revenues are collected from labor under the US tax system. These effects are quantitatively large. Consider, for example, the impact of abstracting from general equilibrium effects when re-calculating on the number of 40-44 year old immigrants required to balance the budget. If the prices are held fixed and equal to those of the fiscal reform economy – where the status quo immigration policy is being pursued –, the required number of immigrants decreases by one fifth, to 0.48% of the population per year.

4.3 Net present value calculations

To understand these findings, it is illuminating to consider the net discounted gain to government of admitting one extra immigrant. Since the aim is to compute the fiscal impact under the *status quo* fiscal policy, the immigration reform economy is used as a starting point for the net present value calculations. These are partial equilibrium exercises in that potential changes in prices and bequests due to increased immigration are ignored.

Let $J(i,s,t)$ denote tax revenues minus government consumption and transfers directly incurred by an agent (i,s) in period t. Simply computing the net present value of $\{J(i,s,\cdot)\}_{i=s(1)}^{I}$ is not sufficient for determining the net contribution of an immigrant, however. One must also include the cost or gain associated with potential future children, grandchildren, etc. The net discounted gain, $\mathrm{NPV}(s,t)$, including the cost of future children, of receiving one new immigrant (or native newborn) of type s in period t, must then satisfy

$$\begin{aligned}\mathrm{NPV}(s,t) &= \sum_{i=s(1)}^{I} \Big(J(i,s,t+i-s(1)) + \\ &+ \frac{\phi_{i,s}}{1+R_{t+i-s(1)+1}}\mathrm{NPV}(0,t+i-s(1)+1)\Big)(1+R_t)/\Pi_{j=0}^{i-s(1)}(1+R_{t+j}), \qquad (6)\end{aligned}$$

where $\mathrm{NPV}(0,t)$ denotes the NPV of a native newborn in period t. This figure is computed by applying (6) recursively and found to be -\$88,000. Note that a negative NPV of newborn natives can be consistent with long-run government budget balance, because there is a sufficient number of working-age agents alive, whose NPV of remaining tax revenues minus expenditures are large and positive.

4.3.1 Impact of skills

NPV profiles across age and skills for new immigrants are displayed in Figure 1. All NPV figures are reported in 1993 dollars and use the prices and fiscal policy of the immigration reform economy. The "skill" of an adolescent immigrant is defined as the education she will acquire in the future. Thus, the NPV of, say, a "low-skilled" adolescent immigrant is the NPV conditional on her being low-skilled her entire life.

The results reveal dramatic differences in fiscal impact across these groups: net government gain of new immigrants ranges from -\$94,000 for an infant immigrant, conditional on being low-skilled during her entire life, to \$177,000, or 7.0 times annual GNP per capita, for a 40–44 year old high-skilled immigrant. Thus, denying a prospective 40–44 year old high-skilled immigrant a visa is expected to cost the government \$177,000. These results are quantitatively similar to those of Lee and Miller (1997).

<Figure 1 about here>

Conditional on age, the NPV of high-skilled immigrants exceed the NPV of medium-skilled immigrants which, in turn, dominate the NPV of low-skilled immigrants, except for immigrants past the retirement age. In fact, the NPV of low-skilled immigrants is negative for all age groups, which explains why no positive inflow of low-skilled immigrants would suffice to balance the budget. In contrast, all high-skilled working-age immigrants yield a positive NPV.

All age profiles exhibit a strong hump-shape which peaks between 35 and 44, reflecting a trade-off between a longer remaining working life on the one hand, and a smaller number of new children on the other. The local maximum for 60–64 year old immigrants is due to the minimum requirement of ten years of Social Security contributions for receiving full benefits. Thus, 55–59 year old immigrants is the oldest group which can enjoy full Social Security benefits during retirement. After 65, all groups coincide (since skills by assumption distinguish immigrants on productivity only). The NPV of retired immigrants increases monotonically with age as the remaining lifetime becomes shorter.

The global maximum occurs later for high-skilled immigrants (40–44) than for medium- and low-skilled immigrants (35–39). Social Security benefits relative to tax contributions are lower for the high-skilled than for the other skill groups, so getting to the peak earnings years (40–60) more quickly becomes relatively more important than avoiding the costs associated with retirement. If the cost of children is excluded (which is equivalent to a zero fertility assumption), the peak NPV comes 5–10 years earlier for the low- and medium-skilled. Including the cost of children is of most importance for immigrants who arrive before 35. If the cost of children was excluded, the NPV of this group would be \$29,000 higher. The timing of the peak is also influenced by the discount rate. If the sequence of individual net contributions, $\{J(i, s, \cdot)\}_{i=s(1)}^{I}$, is discounted at, say, 4% (annualized) instead of the equilibrium return on capital, the NPV profiles would peak at 30–34 for all skill groups. With a lower discount rate, the peaks shift to the left, since the costly retirement years are discounted to a smaller extent.

Given the empirical age structure of new immigrants currently admitted to the US, I can compute the government gain, in net present value terms, of admitting one additional "representative" legal immigrant, by weighting the age structure of current new immigrants with the net present value profiles in Figure 1. This yields a net discounted gain of a mere \$7,400. When conditioning on skills, I find the NPVs of representative high-, medium-, and low-skilled immigrants, to be \$96,000, -\$2,000, and -\$36,000, respectively. In contrast, the NPV of a representative *illegal* immigrant is -\$54,000, given the rather extreme assumptions that they incur the same government consumption as natives, pay no taxes, receive no transfers, and have the same return migration process as legal immigrants.

4.4 The role of return migration

Return migration is an important part of the demographic process, and, to the extent that public policy can influence return migration, one would like to understand its impact on public coffers. To this end, I contrast the benchmark return migration process to a polar case of no return migration. The NPV profiles for high-skilled immigrants, displayed in Figure 2, reveal that reducing return migration to zero would increase the NPV of 5–49 year old immigrants and reduce the NPV for others. The calibrated return migration process implies substantial emigration after the first (five-year) period, so groups facing a long sequence of positive (negative) contributions to government in the near future, will see their NPV increase (decrease), if return migration is decreased.

<Figure 2 about here>

This picture is mirrored for the calculations regarding the flows of immigrants required to balance the budget, see row 7 of Table 1. A smaller number of new immigrants are required for all age groups between 20–49, while a slightly larger number are needed for the 50–54 year old high-skilled immigrants.

4.5 The role of family migration

Admitting adult immigrants but excluding their (already existing) children may not be politically feasible. To understand the impact of family migration, I contrast the benchmark single immigrants case with a case where immigrants bring children who are 15 years old or younger and leave their older children behind. The children are assumed to be medium-skilled, and the distribution of an immigrant's children is computed, conditional on her age, by assuming pre-migration fertility rates to be a fixed fraction of native fertility, where this fraction is set so that the inflow of immigrants under 15 matches the data.

The dashed line in Figure 2 illustrate the effect of family unit migration on the NPV profile of high-skilled immigrants. The numbers denote NPV per head of household, including her children brought from the emigration country. The effects are considerable; the NPV of 20–50 year old immigrants decreases by $37,000 relative to the single immigrant case. The impact is largest for 30–39 year old immigrants, whose NPV is reduced by $56,000, on average. This is due to the fact that these families have the largest number of children under 15, on average 1.53 per adult family member, according to my calculations.

This picture is largely confirmed when considering the number of immigrants (including children) required for balancing the budget; the minimum annual number increases to 1.08% of the population. The head of the household is then assumed to be high-skilled and 45–49 years old (see row 5 of Table 1), five years older than those for whom the NPV profile peaks. The discrepancy is due to the fact that, even though each 40–44 year old immigrant has a higher NPV, including children, the size of their households are larger than those headed by 45–49 year old agents.

4.6 Static accounting exercises

Borjas (1994), Huddle (1993) and Passel (1994) quantify the gain on immigration in a static accounting framework by computing the government surplus or cash flow in one particular year of all immigrants currently residing in the US, and find this figure to be -$16 billion, -$40 billion, and $27 billion, respectively (1993 figures). To contrast my findings to these previous studies, I perform a similar exercise with my model. I consider the current fiscal policy and the current immigration policy, disregarding that this combination is infeasible, and using the prices of the immigration policy reform experiment. I then compute the net government surplus in the first period, resembling the 1993-1997 period, to be about 0.32% of GNP, or $21 billion in 1993, which is within the range of the previous studies. Note that the current age distribution of immigrants is favorable, since the surge in immigration is a recent phenomenon. If a similar static accounting exercise is performed for future periods, it will produce negative numbers after six periods (30 years), provided the status quo immigration policy is continued.

4.7 Sensitivity analysis

To check the sensitivity of the absence of public goods assumption, I assume, alternatively, that part of government consumption provides a nonrival public good and that future public goods expenditures, in levels, is a fixed fraction of government consumption in the fiscal reform economy. Thus, additional immigrants do not increase the public goods provision, and the immigrants' net contributions, $J(i, s, t)$, are increased accordingly. I set the fraction of public goods in government consumption to 31%, which equals the 1990–94 share of national defense, foreign affairs, and general science, space and technology in government purchases of goods and services. Moreover, agents' preferences are assumed to be additively separable over the public good on the one hand, and the standard private consumption–leisure composite on the other, so that the provision of public goods does not affect the agents' decisions. In this case, the NPV of new immigrants increase by a substantial $19,000 on average; the younger the immigrants, the larger the increase ($21,000 for the 0-4 year old).

The benchmark calibration implies a life expectancy of 77 years. The SSA population projections, for instance, assume life expectancy to increase gradually and reach 82 years by 2075. To explore how sensitive the results are to the mortality assumptions, I study an extreme case where life expectancy is 82 years from period one. Under this demographic scenario, the implied dependency ratios exceed the SSA projections until 2050 and reaches a maximum of 0.399 in 2035. The income tax hike and inflow of high skilled immigrants aged 40–44 required to balance the budget are, in this case, 5.6% and 0.80%, respectively, compared to 4.4% and 0.62% under the benchmark mortality assumptions.

All results are sensitive to the wage income of immigrants. To illustrate this, I explore the case where immigrants earn 10% less than in the benchmark case, which reduces the net benefits of immigration significantly. For example, the NPV of 40–44 year old high-skilled immigrants falls by about one sixth, or $31,000, and the NPV of a representative immigrant falls to -$6,000. The minimum number of new high-skilled immigrants required to balance the budget increases to 0.80% of the population (see row 6 in Table 1).

5 Conclusion

This paper demonstrates that immigration can have strong quantitative implications for US fiscal policy. In particular, the paper investigates if an immigration policy reform alone could resolve the future fiscal problems associated with the ageing of the baby boom generation.

Using a calibrated general equilibrium overlapping generations model, which explicitly accounts for key differences between immigrants and natives, Social Security and the demographic transition, I find that immigration policies sustaining the current fiscal policy do exist and are characterized by increased inflow of middle aged high- and medium-skilled immigrants. Admittedly, the American public seems opposed to such large increases in immigration. However, when faced with the trade-off between higher taxes on the one hand and a larger number of high-skilled immigrants on the other, it seems reasonable that a majority would, on the margin, opt for increasing the number of immigrants.

These findings are illustrated by computing the net government gain, in present value terms, of admitting one additional immigrant to the US, conditional on age and skills at the time of immigration. This discounted gain varies considerably across the age and skills of new immigrants, with large and positive figures for high- and medium-skilled working-age immigrants.

Thus, rather than viewing immigration as a problem, the perspective should be one of considering high- and medium-skilled working-age migrants as an attractive resource, for which various countries compete. Moreover, to the extent one is willing to use immigration for generating revenues, the immigration policy should involve attempts to actively attract such immigrants. This analysis has described how some of the migration rents go to natives via the government. A larger share of these rents could be seized, however, by deviating from the principle of taxing natives and legal immigrants at the same rates, although such reforms would have to be traded off against the reduced attractiveness of the US as a host country.

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[1]For instance, Gustman and Steinmeier (1998) show, using data from the Health and Retirement Survey, that immigrants have, on average, provided a postive net contribution to social security.

[2]Although the economic effects of immigration have received substantial attention, the main focus of the literature has been on the impact on employment and wages for natives (see e.g. Friedberg and Hunt (1995) for a survey).

[3]This specification abstracts from possible differences between immigrants and natives in the utilization of government transfer programs. Borjas and Hilton (1996) document that immigrants have a higher participation rate in welfare programs than natives. Fix, Passel and Zimmermann (1996) argue that these differences are explained by the higher welfare program participation rate among refugees and retired immigrants (who, presumably, do not qualify for Social Security benefits). My focus, however, is on labor migrants; that is, working-age legal immigrants who will most likely qualify for Social Security when old. Moreover, my measure of ξ_i encompasses *all* government transfers (net of OAI), including programs where natives may well have a higher participation rate, like unemployment insurance or survivors' insurance. In the case of Canada, where labor immigrants are explicitly targeted, the welfare participation rate among immigrants is lower than among natives (Baker and Benjamin (1995)).

[4]This implies a final total fertility rate of 2.23, compared with 2.25 in the middle projections of the U.S. Bureau of the Census (1992).

[5]The estimation technique involves accounting for changes in national origin, gender, and the age of new immigrants over the 1950–90 period. This requires aggregation over sex, national origin, etc. The approach in is to divide the 5% 1990 Census sample into $15 \times 3 \times 12 \times 6 \times 2$ boxes (age, education, age at the time of immigration, region of origin, and sex), and to compute the average wage for each box. The efficiency unit profiles for new immigrants are then computed as weighted averages over these boxes, where the relative weights of each box is based on the 1988-1990 cohorts of immigrants. "Cohort effects" should not be a problem, as observables are controlled for (LaLonde and Topel (1992)). Since legal status is not identified in the 1990 Census, I assume that no differences in wages between legal and illegal immigrants are left after controlling for education, region of origin, age, age at the time of immigration, and sex.

[6]For calibrating several model parameters, I use, as a benchmark, a "fiscal reform" economy where the current immigration policy is pursued and the budget is balanced through increasing taxes. Note that the equilibrium tax rate in the fiscal reform economy exceeds the status quo tax rate.

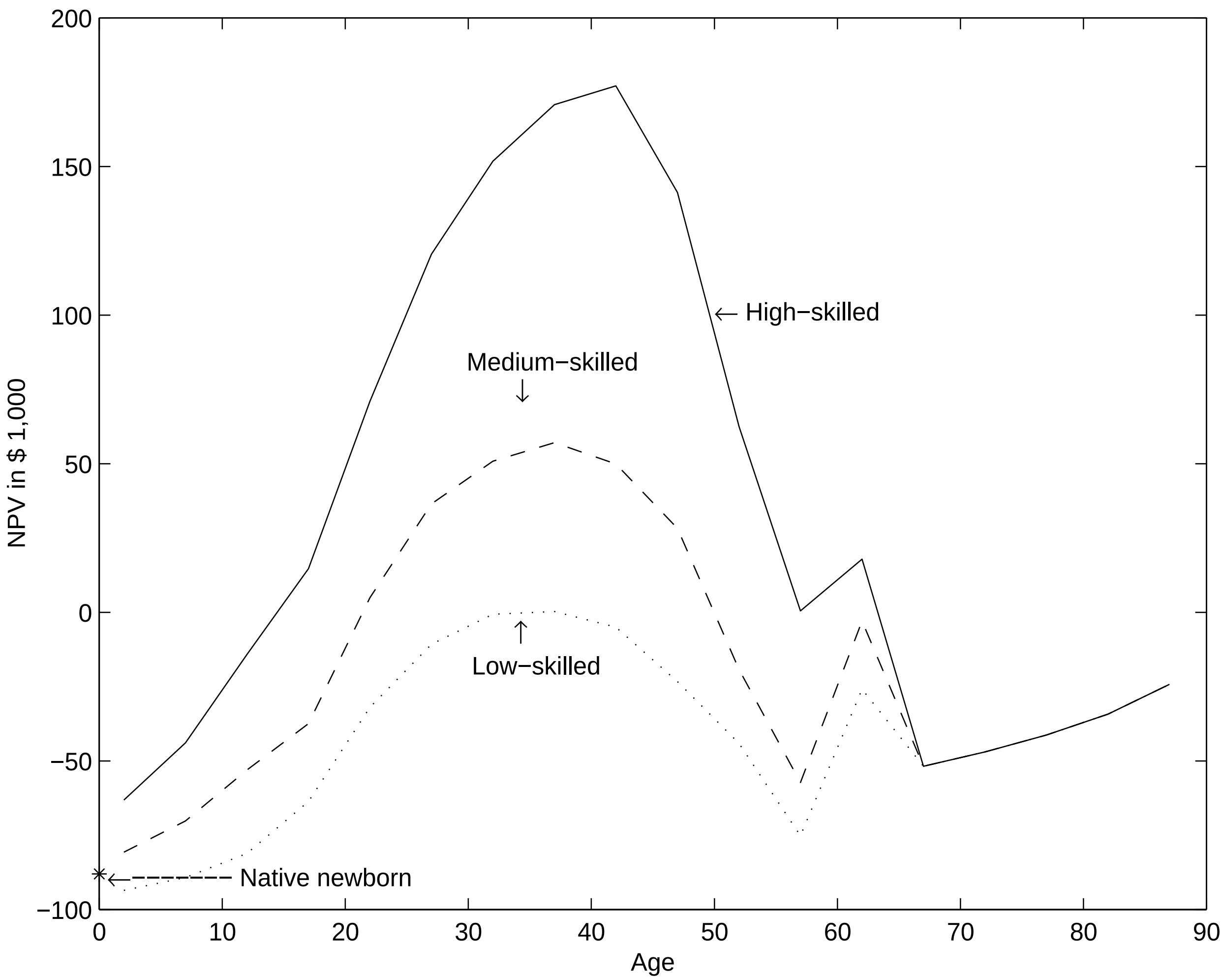
[7]The formula is standard; h is piecewise linear with two "bend points," which are set to 20% and 122% of GNP per capita. The replacement rates (i.e. slopes of h) within brackets 1, 2,

and 3 are 90%, 32%, and 15%, respectively.

[8]Note that there is, at most, one stable steady state for a given pair of immigration policy and fiscal policy. As attention has been restricted to policies that are constant over time, the initial conditions and immigration policy will determine the lowest constant income tax rate, τ, satisfying equilibrium condition (e). Equally, the equilibrium condition (e), the initial conditions, τ, and a particular distribution of new immigrants, pin down the required number of new immigrants and the future path of government debt. If the tax rates or the immigration policy were allowed to vary over time, however, the need for higher taxes or increased immigration during the demographic transition could be alleviated by aiming at a higher long-run debt to output ratio, for example.

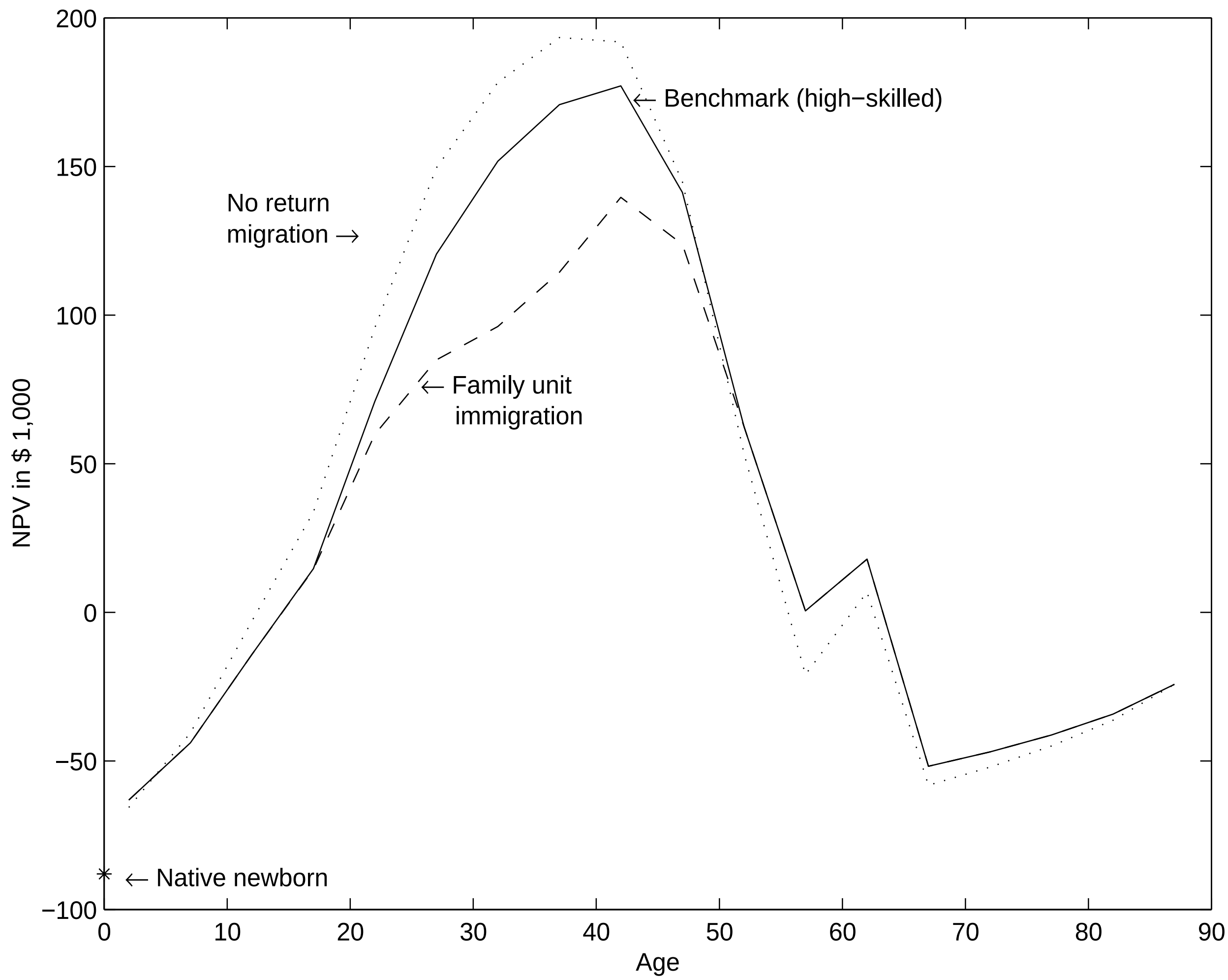
[9]In a nutshell, the idea is to iterate on the tax rate or immigration policy and, for every iteration, solve for a finite equilibrium price sequence, given initial conditions and the assumption that the economy is in steady state after 50 periods. The approximations are quite accurate, as the economies converge well before they are supposed to be in steady state. For instance, after 30 periods – or 150 years – the annualized rate of return on capital has typically been less than 10 basispoints away from its steady state value in the economies I have considered.

Figure 1



Discounted net public gain of admitting additional immigrants, conditional on age and skills.

Figure 2



Discounted net public gain of admitting additional immigrants – return migration and family units.

Experiment	Age of new immigrants:						
	20-24	25-29	30-34	35-39	40-44	45-49	50-54
Baseline (high skilled)	1.89	0.84	0.66	0.62	0.62	0.77	2.01
Medium skilled	-	3.13	2.01	1.79	2.13	3.86	-
Low skilled	-	-	-	-	-	-	-
Averaged over skills	-	2.23	1.50	1.40	1.67	3.61	-
Family unit	4.20	2.06	2.02	1.57	1.10	1.08	2.06
Low earnings	-	1.20	0.90	0.80	0.80	1.10	3.52
No return migration	1.17	0.65	0.54	0.50	0.53	0.74	2.43

Table 1: Annual immigration (in percent of population) required to balance the government budget if the fiscal policy is kept unchanged. A dash - means that no positive number of immigrants was large enough to balance the budget in the long run.