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**FISCAL IMPLICATIONS OF IMMIGRATION
– A NET PERESENT VALUE CALCULATION**

by

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Fiscal Implications of Immigration - a Net Present Value Calculation*

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1 Introduction

The inflow of immigrants to Western countries has surged over the last decades. This, together with rapidly ageing populations have spurred public interest in immigration issues. While some authors have argued that immigration could serve as a remedy for the fiscal pressure associated with an ageing population (Storesletten, 2000, and World Bank, 2000), the popular press often portray immigrants as a public burden. For example, in the 2001 election in Denmark, immigration policy emerged as a salient election issue and the perceived fiscal burden of immigrants was used as a major argument for curbing immigration.

Lessons from the U.S. suggest that the fiscal cost or gain on the average immigrant is small, while the picture is more dramatic if on conditions on age and education - young, high-skilled immigrants are expected to make large net contributions to government coffers, while low-skilled immigrants and retirees represent large cost (Smith and Edmonton, 1997 and Storesletten, 2000). The U.S. differs substantially from other Western countries, however. In particular, the U.S. has a small public sector (22% of GDP), low taxes, low unemployment, and a relatively limited social insurance system. Moreover non-refugee immigrants have quite restricted access to social insurance during the first years after arrival. In contrast, European welfare states feature large public sectors (on average 41% of GDP), high taxes, high unemployment, and generous social insurance.¹ In particular, immigrants are plagued with even higher unemployment rates than natives.² It is therefore important to investigate whether the conclusions from the U.S. debate hold up for European welfare states.

This paper makes two contributions. First, it quantifies the fiscal impact of immigration for a typical European welfare state - Sweden. Second, it adds to the

¹The figures on the size of public sector are taken from Persson and Tabellini (1999), and represent an average of central government expenditures as a fraction of GDP during 1990-99. "European welfare states" refers to an average across Austria, Belgium, Denmark, Finland, France, Germany, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden and the UK.

²For instance, immigrants in Sweden, had about 6% higher rate of open unemployment than natives in 1995, and their employment rate was about 20% points below natives.

tools for assessing the cost of immigration by introducing a break-even analysis in terms of expected employment rates. The choice of Sweden is motivated by two concerns. First, detailed data exist on immigrants' earnings and take-up of public benefits in Sweden. Second, Sweden has a very large public sector and also a sizeable inflow of immigration: since 1989 annual immigration has been about 0.67% of the population (57,000).

An immigrant, as well as any native (Swede), incurs benefits and costs for public coffers every year of his/her remaining life. A typical sequence of net government benefits for a new immigrant is a short period with net costs right after immigration, followed by a long period with large tax revenues. After retirement, the net flow from government is usually negative (pension benefits, health care, etc.). Following Smith and Edmonton (1997) and Storesletten (2000), I compute the *net public gain* of a new immigrant as the discounted value of future tax payments less transfers and marginal government consumption, including the costs and contributions of future children. Thus, admitting a new immigrant is implicitly viewed as a public investment.

Storesletten (2000) computes the net gain of immigrants in a dynamic equilibrium closed economy framework that explicitly accounts for demographics and fiscal policy, along the lines of Auerbach and Kotlikoff (1987). While the general equilibrium restriction can provide valuable insights, it does, however, make the model costly to solve, thus forcing the modeler to include relatively few elements of heterogeneity. For a small, relatively open economy such as Sweden, however, it seems fruitful to start by abstracting from the general equilibrium effects of immigration. That is the also the approach adopted by Smith and Edmonton (1997).

This paper explores how the net benefit of an immigrant depends on gender and age at time of immigration. The analysis is done in a simple framework that can include a large amount of heterogeneity and can easily be applied to other countries. It is imperative to stress that this is *not* a welfare analysis but a dynamic accounting exercise of government revenues and expenditures.

The central assumptions are that future immigrants resemble those already re-

siding in Sweden, that the current government expenditure policy is sustained, and that taxes are adjusted so that the government budget is balanced in the long run, given an initial government debt. The framework of analysis is an overlapping generations model allowing for a dynamic analysis of fiscal policy and the pension system. In particular, the model accounts for the costs of future children and the new (planned) Swedish pension system, and contains quite detailed descriptions of public transfers and taxes. Note that each generation bears the same tax burden in the sense that, from the outset, tax rates are constant over time and wages and government consumption and transfers per person are growing at a constant rate.³

The model is parameterized using the data from Ekberg (1995) and several years of the Swedish Survey of the Labor Force data on foreign born workers (“Arbetskrafts-undersökelsen”, abbreviated AKU). Substantial uncertainty is associated with forecasts of earnings, fertility, return migration, etc. of future immigrants, and the work is probably best understood as a tool to help determine which factors matter for the net government gain of immigrants to typical welfare states.

The analysis suggests that the potential gains from immigration are large, especially for immigrants who are 20-30 years old at the time of immigration to Sweden: on average more than 200,000 SEK per immigrant. In 1995 this represented more than 30,000 USD (\$), and all subsequent USD figures refer to the 1995 USD-SEK exchange rate. For immigrants older than 50 and younger than 10 the net cost seems substantial; in some cases over 1.5 million SEK. An *average* new immigrant represents a net government loss of 175,000 SEK, (\$26,500) given the baseline parameterization. The annualized value of this is 7,250 SEK (given that immigrants on average live 54 years after immigrating and the discount rate is 3.5\%).

³This approach differs from a “Generational Accounting” exercise in that taxes paid and benefits received *prior* to the start of the model are not taken into account (see Auerbach, Gokhale and Kotlikoff (1991)). Thus, taxes are constant across agents and time, as opposed to the Generational Accounting approach where tax rates at each point in time may differ across age cohorts.

The results depend crucially on how immigrants fare on the labor market and, in particular, on the expected labor participation rate for new immigrants. My findings could therefore also be expressed in terms of “break-even participation rates”, i.e. the participation rate for which the net present value is zero so the immigration “investment” breaks even. For male immigrants of age 27 the break-even participation rate is as low as 50%, while the average for all 27 years old immigrants is 60%. In comparison, the average participation rate for foreign born individuals in Sweden is 67% and 83% for natives (1995 figures).

The results for Sweden are qualitatively similar to those for the U.S. in terms of the shape of the age profile of NPV contributions to government, measured at the age of arrival. However, the magnitudes are dramatically different – Smith and Edmonton (1997) and Storesletten (2000) report discounted gain of on average \$80,000 and \$7,400, respectively, per immigrant to the U.S. Put succinctly, the net fiscal impact *per immigrant* is up to \$106,500 larger gain for the U.S. than for Sweden!

Note that the approach of computing the net public gain of immigrants as the present value of future revenues and expenditures, which I have pursued here, differs quite significantly from an alternative and more standard method, namely that of computing the annual cost of immigrants as the cash flow in a particular year by simply adding the revenues and deducting the expenditures incurred in one particular calendar year for all immigrants living in the host country. This “cash flow” approach has been pursued for Sweden (e.g. Ekberg and Andersson (1995) and Gustafsson and Larsson (1997)) and several other countries (e.g. Huddle (1994) and Passel (1994) for the U.S. and ECON (1996) for Norway). The cash flow approach has its virtues - it does not hinge on uncertain projections of future tax rates and immigrant earnings, but its shortcomings are also well understood: as 2/3 of government expenditures are age dependent, the age structure of a particular group largely determines the net cost in a particular year. Hence, the aggregate surplus/deficit for a group in a given year says little about the net public benefit over the whole lifetime for a member of this group. Moreover, large costs in distant future, such as pension benefits and health care for retirees, should be discounted, while costs

and revenues in the near future should get more weight. Finally, since most Western countries pursue fiscal policies which arguably imply a future fiscal imbalance when the dependency ratios rise, it seems reasonable to expect future fiscal reforms required to balance the budget. Ignoring this would most likely imply a negative bias in the assessment of the future cost of immigrants.⁴

The paper is organized as follows: Section 2 describes the sources of data, the model framework is outlined in Section 3, and the parameter choices are accounted for in Section 4. The results are reported in Section 5 and Section 6 concludes.

2 Data

In addition to standard public data sources, National Social Insurance Board (1995) and Statistics Sweden (1995), I use the AKU data on labor force participation, unemployment and leave of absence (due to sickness, child care, etc.). The sample consists of 52,000 natives and 6,000 immigrants of age 16-64 for every year after 1990. Gender and age are identified, but national origin or age at the time of immigration are not.

The key data source to impute earnings and welfare payments for immigrants is the tables underlying Ekberg (1995). All immigrants residing in Sweden in 1991 are included. This source identifies annual earnings and welfare payments. Earnings are split on age, gender, national origin and time of immigration. The immigration periods are identified as 1980-91, 1970-79 and before 1969. The areas of origin are Finland, other Nordic countries, other West-European countries, Greece, other South-European countries, Poland, Czechoslovakia, Yugoslavia, other Eastern European countries, Middle East, Asia, Africa and Latin America.

⁴It is straightforward to apply the cash flow approach for computing the fiscal impact of immigrants in the current model, and it implies an annual cost of about 20,000 per immigrant in 1995. This is in line with estimates in Ekberg and Andersson (1995) and Gustafsson and Larsson (1997).

3 Model

3.1 Population

The economy is populated by agents who live up to 100 years. Agents of age i differ in gender, labor force status, national origin and age at the time of immigration. For notational convenience, let m denote the agent's "type" (gender, national origin and age at the time of immigration). An immigrant is defined as a person born abroad and currently residing in Sweden. Natives (born in Sweden) "Immigrated" at age 0. Children of immigrants are assumed to be identical to natives. A fixed immigration policy determines the annual inflow of future immigrants and their age, gender and national origin.

Agents face longevity uncertainty. Fertility and mortality rates for each age, gender and immigration group are assumed to be fixed over time. Once in Sweden, immigrants are assumed to never return to their home countries. The sensitivity of this assumption is explored below.

The evolution of population is now straightforward: immigration is pinned down, the number of births is given by the size of each female cohort in a given year, and mortality (i.e. how much of the cohort is chipped off in a period) depends on age and gender.

3.2 Labor market and labor force status

Children and retirees do not work. Labor status for working age individuals is one of the following:

- Not participating
- Participating
 1. Unemployed
 2. Employed

- (a) Working
- (b) Taking work leave (leave for sickness, rehabilitation or child care).

When leaving childhood (or upon immigration at working age) each agent draws a random variable that determines his/her labor market status for all future: either permanently out of the labor force or permanently in. For agents participating in the labor force, unemployment and work leave are not chosen, but exogenously imposed. All agents in the labor force with the same age, gender, country of origin and age at the time of immigration are unemployed a fraction u of the year, take work leave p of the year and work $(1 - u - p)$ of the year. Group-specific unemployment and participation rates u and p do not change over time.⁵

Output (or wages) for a type m agent of age i is linear in labor input and given by $W_t e_{i,m} (1 - u_{i,m} - p_{i,m})$. W_t should be interpreted as an economy-wide wage per “efficiency unit” at time t , and $e_{i,m}$ as the number of efficiency units for type m of age i . Note that e may differ across immigrant groups, gender and age. The e ’s are fixed over time, while W_t is assumed to grow at a constant rate z , due to technological progress. Thus, there is no crowding out of jobs or general equilibrium changes in wages due to immigration.⁶ When new immigrants enter the economy, new jobs are created in a deterministic way (since the probabilities of being in the labor force do not change), and wages for agents in the labor force are determined by age, gender, country of origin, etc.

⁵Quantitatively, the results are equivalent if agents face the participation lottery each period.

⁶A long string of papers have investigated the adverse effects on the labor market empirically, i.e. the extent to which immigration leads to higher native unemployment and lower wages for natives. The overall conclusion of the literature is that immigration has little or no effect on native labor markets, see e.g. Borjas (1994) for a review. For instance, Card (1990) documents that employment and wages for natives in Miami hardly moved in response to the Mariel Boatlift which in 5 months brought about 125,000 Cubans to Miami.

However, if one still wanted to include adverse labor market effects without writing down a full scale general equilibrium model, one could use estimates of elasticities of native employment and wages to a rise in labor supply as an upper bound on the effects of an inflow of immigrants.

3.3 Taxes and transfers

The role of the government is to formulate immigration and fiscal policy, given that the government budget must eventually be balanced, i.e. public debt cannot grow faster than output in the long run. Immigration policy is defined as the number and type of new immigrants. Fiscal policy consists of a government consumption rule, a tax system, and a transfer system (including the pension system).

The public consumption rule determines government purchases of goods and services as a function of output per capita and population:

$$G_t = (1 + z)^t \sum_{i,m} g_{i,m} \mu_{i,m,t} \quad (1)$$

where $\mu_{i,m,t}$ is the number of group i, m agents in period t and $g_{i,m}$ is agent-specific government cost in the initial year. Note that $g_{i,m}$ includes both “variable” costs that can easily be allocated to specific groups (e.g. schools and health care) and “fixed” costs like defense spending and infrastructure. Government costs per group i, m individual are growing at the same rate z as wages.

The tax system specifies a constant tax rate on consumption, τ_c , a constant tax rate on return on capital, τ_k , a payroll tax τ_w , a pension contributions tax rate τ_p on non-capital earnings, and a tax rate $\tau_e(x)$ on taxable non-capital earnings x (net of τ_p). $\tau_e(x)$ is given by

$$\tau_e(x) = \begin{cases} \underline{\tau_e} & \text{for part of } x \leq \text{SEK } 180,000 \\ \underline{\tau_e} + 0.20 & \text{for part of } x \text{ in excess of SEK } 180,000 \end{cases}$$

This description closely resembles the current Swedish tax code, see Agell, Englund and Södersten (1996) for a more detailed account.

Transfers from government to individuals are composed of welfare payments, general transfers, work-related transfers and pension benefits.

Welfare payments $b_{i,m}$ are not taxable and are paid on a lump sum basis to non-participating agents in each group. General payments are taxable and paid in lump sum to all agents in each group (albeit the amounts differ across groups). Work-related transfers are composed of compensation for parental leave, rehabilitation, sick leave, and unemployment benefits. The work-related compensation is paid only to participants in the labor force and is proportional to wages. Again, transfers are assumed to grow at rate z , so that transfers to agents of type (i, m) in period t are given by $(1 + z)^t b_{i,m}$ and $(1 + z)^t h_{i,m}$. More details are provided in section 4.

The pension system is a version of the new Swedish pension system.⁷ Old age pension benefits are a function of the “pension stock”, a weighted sum of taxable non-capital earnings times the pension contributions tax rate τ_p . The stock is indexed by the rate of growth in average earnings, so the law of motion for the pension stock E_t when working is

$$E_{t+1} = (1 + z)E_t + \tau_p w_t$$

where w_t is the individual’s earnings in year t .⁸ In the planned system $\tau_p = 18.5\%$, and $\frac{2}{18.5}$ of the pension stock is forced saving and can be paid out over the first 5 years after retirement at the earliest. I assume that everyone chooses this option. The regular old-age pension benefit for an age i retiree is E_t/D_i , where D_i is expected remaining lifetime for age i individuals (fixed by assumption). Thus, after retirement, the pension stock is consumed over time and the law of

⁷For simplicity, I assume that the new system is implemented immediately. This will make pension benefits for people born before 1953 less expensive for the government, which could bias the net government benefit of new immigrants downwards, since a higher tax rate τ_e will be needed to make the fiscal policy feasible. However, the Swedish pension reform set aside a large fund earmarked for financing this part of the transition, which I have excluded when measuring the Swedish government debt.

⁸The planned Swedish system will also give “accumulated wage” for child rearing, care for sick relatives etc. I have abstracted from this here because even average native women participating in the labor force fall under the guaranteed minimum pension benefits after the first five years of retirement, so the marginal effect on wages for e.g. child rearing would be very small for most individuals.

motion is⁹

$$E_{t+1} = (1 + z)E_t \frac{D_i - 1}{D_i}.$$

The old Swedish pension system contains a set of benefits not directly dependent on previous earnings: sickness pension, early retirement pension, widow/widower benefits, child pensions, handicap-pension, and pension housing support. I assume that these payments will remain unchanged in the new system, only indexed by the rate of growth in wages. In the model, pension benefits that are independent of earnings are modelled as age dependent lump sum transfers to non-participants in each group.

The proposed pension system guarantees a minimum pension benefit to be indexed with average wages. The minimum level in 1992 was 67400 SEK. I assume that all other public pension payments are deducted from the guaranteed level, but that social security payments are independent of private pension plans and savings.

3.4 Consumption and agents' budget constraint

In order to calculate the amount collected in consumption tax and capital tax each period, it is necessary to project consumption and wealth for each agent. To simplify the analysis, I assume that agents have no bequest motives and can hedge mortality risk on perfect annuities markets (Blanchard and Fischer, 1989). In this case there are no bequests, and agents consume all of their lifetime income before death. Newly arrived immigrants and newborn agents are assumed to have zero wealth, and to simplify the consumption side, I assume that the current (average cross-sectional Swedish) consumption profile remain constant, i.e. that age-dependent propensities $\{\xi_{i,m}\}_{i=1}^{100}$ to consume out of lifetime after-tax income are fixed. In this case, the consumption of an agent of age i (and

⁹For convenience, the pension stock is assumed to be indexed by z annually also after retirement. The proposed law, however, indexes the pension stock once and for all at retirement. The two methods do not differ very much in expectation terms.

type m) who immigrated at time $t = I$, is given by

$$c_{i,m} = \frac{\xi_{i,m}}{(1 + \tau_c)} \sum_{i=I}^1 \left\{ (1 - \tau_e)(1 - \tau_p)(W_0(1 + z)^i e_{i,m} + (1 + z)^i h_{i,m}) + (1 + z)^i b_{i,m} \right\}$$

where I is age at time of immigration, $we_{i,m}$ is labor compensation (including work leave and unemployment compensation) for group m , $h_{i,m}$ is taxable non-wage compensation, and $b_{i,m}$ is non-taxable, non-wage compensation. Note that the rate of return on assets has been modified by the mortality probability s_i to implement the annuities markets. Obviously, $e_{i,m} = 0$ for types who are not participating in the labor market.

Asset holdings $a_{i,m}$ are then determined as a residual of net wealth minus consumption:

$$\begin{aligned} a_{i+1,m} = & (1 + (1 - \tau_k)R/s_i)a_{i,m} - (1 + \tau_c)c_{i,m} + \\ & (1 - \tau_e)(1 - \tau_p)(W_0(1 + z)^i w(e_{i,m}) + (1 + z)^i h_{i,m}) + (1 + z)^i b_{i,m}. \end{aligned} \quad (2)$$

It is useful to study how consumption, assets and pension benefits, change over time. Recall that the interest rate, the tax rates, and the mortality are constant over time, and that the general wage level government transfers that are not earnings related by assumption are growing at rate z . Therefore, work-related transfers must also be growing at the same rate. Moreover, for agents born after time $t = 0$, labor income and pension stock is growing at rate z , and since the lump sum part of pension benefits, $h_{i,m}$, are also growing at rate z , the lifetime income of agents born at time $t + 1$ must be $1 + z$ times larger than for those born at time t . Hence, consumption and asset holdings must also be growing at rate z , i.e. $c_{i,m,t} = (1 + z)c_{i,m,t+1}$ and $a_{i,m,t} = (1 + z)a_{i,m,t+1}$. This is defined as the “steady state” distribution of asset holdings and pension stocks.

For agents alive at time $t = 0$, however, the previous work history would matter. To simplify matters, I assume that the initial (time $t = 0$) distribution of asset holdings and pension stocks coincide with the steady state distributions

(associated with the feasible fiscal policy). Thus, even the agents alive at $t = 0$ will have steady state distribution of wealth, pension benefits and consumption.

3.5 Government budget

The government faces a binding constraint: given the tax and transfer system the government's budget must be balanced in the long run. Note that large budget deficits are acceptable in the short run but must be offset by corresponding surpluses later. The government's intertemporal budget constraint is

$$B_0 = \sum_{t=0}^{\infty} R^{-t}(T_t - G_t - P_t) \quad (3)$$

where R is interest rate, B_0 is initial government debt, G_t is government consumption in period t , T_t is total tax revenues, and P_t is transfer payments (pension benefits, welfare benefits and general transfers).

The current Swedish fiscal policy does not satisfy the solvency requirement (3) and is therefore not feasible. The problem can be resolved by either increasing taxes or lowering spending. I have chosen to keep the current expenditure policy constant (or, rather, increase the spending policies with the rate of growth in wages) and increase taxes until the long run budget is balanced. In the experiments, I keep all tax rates constant except the tax on non-capital earnings, τ_e . Changing only τ_e is an arbitrary choice, but the government gain of admitting new immigrants is not very sensitive to which of the taxes that are subject to change. Since immigrants to Sweden generally have lower employment rates than natives, it represents a slight bias towards lower net government benefit of immigrants.

3.6 Net present value calculations

Let $s_{i,m,t}^p$ denote tax payments less transfers and marginal government expenditures for a labor force participating individual of type m and age i in period

t . Let $s_{i,m,t}^n$ be the corresponding figure for non-participants, and define $s_{i,m,t}$ as the weighted average of $s_{i,m,t}^p$ and $s_{i,m,t}^n$ where the participation rate is used as weight.

For a given parameterization of the model economy and a tax rule τ_e such that the government's budget is balanced in the long run, i.e. such that (3) holds, one could compute $s_{i,m,t}$ in any year for any group i, m in the economy. The expected net present value of future tax payments less government expenditures (averaged over participants and non-participants) for a type m of age I at time t is then

$$\sum_{i=I}^{100} \frac{\pi_{i,m}}{\pi_{I,m}} R^{I-i} s_{i,m,t+I-I} \quad (4)$$

where π_i is the unconditional probability of surviving until age i .

Note that the figure in (4) does *not* include the cost of children. Agents may give birth at some point in the future, and newborn children represent a net gain or loss to the government. To compute the *net gain* to government of getting one extra agent of type m and age i at time $t = 0$, one must incorporate the net government gain of the children the agent gives birth to in period t , $\text{NPV}(0, M, t)$.¹⁰ Recall also that earnings and government expenditures for each type i, m individual is growing at rate z , so the annual surplus for agent M, i must also be growing at rate z .

Since the interest rate R is constant over time, the government gain of getting one extra native newborn must be growing at rate z . Thus, $\text{NPV}(0, M, t) \equiv (1+z)^t \text{NPV}(0, M)$, where $\text{NPV}(0, M)$ is net government gain of a native newborn in the initial period. Note that $\text{NPV}(0, M)$ must incorporate the contributions of the agent's children, grandchildren and so on. Therefore, $\text{NPV}(0, M)$

¹⁰ $\text{NPV}(0, M, t)$ is defined as the discounted gain (to period $t = 0$) of a native born in period t , where M denotes natives. Recall that children of immigrants are assumed to be identical to natives.

must satisfy

$$\text{NPV}(0, M) = \sum_{i=0}^{100} \pi_{i,M} R^{-i} \left(s_{i,M,i} + \phi_{i,M} (1+z)^i \text{NPV}(0, M) \right) \quad (5)$$

where $\phi_{i,m}$ denotes the annual fertility for a type m individual of age i . Equation (5) yields $\text{NPV}(0, M) = \sum_{i=0}^{100} \pi_{i,M} R^{-i} s_{i,M,i} / (1 - \sum_{i=0}^{100} \pi_{i,M} \phi_{i,M} R^{-i} (1+z)^i)$.¹¹

The discounted (expected) net government gain of getting one extra agent of type m of age I is then given by

$$\text{NPV}(I, m) = \sum_{i=I}^{100} \frac{\pi_{i,m}}{\pi_{I,m}} R^{I-i} \left(s_{i,m,t+i-I} + \phi_{i,m} (1+z)^{i-I} \text{NPV}(0, M) \right) \quad (6)$$

4 Parameterization

The following section describes how the model is parameterized.

4.1 Population

Fertility and mortality for Swedish natives are fixed at 1992 levels. A key assumption is that immigrants and natives have the same fertility and mortality rates. Data on immigrant fertility and mortality are scarce and poor. I explore the sensitivity of this assumption by letting immigrant women have 50% higher fertility than native women.

The current paper computes the net government gain of letting in one additional immigrant. This marginal change has no aggregate effect and the experiment is independent of the regular immigration policy. The current immigration policy is assumed to be sustained, which implies a long run population growth rate

¹¹The condition $R > 1 + z + n$, where n is the steady state population growth rate, rules out rational Ponzi schemes and is sufficient to guarantee that $\sum_{i=0}^{100} \pi_{i,M} \phi_{i,M} R^{-i} (1+z)^i < 1$.

of 0.91%. I use the Swedish population in 1992 as a starting point for the population process.

4.2 Earnings, unemployment and participation

Labor force age is 17-64, so all agents in the labor force are assumed to retire at age 65.

Earnings, participation, unemployment etc. for future immigrants are imputed by assuming that they will be exactly equal to those of current immigrants, conditional on country of origin, gender, age and number of years since immigration. This approach abstracts from cohort effects. The cross-sectional data underlying Ekberg (1995) are used to estimate annual earnings for natives and every immigrant group described in Section 2, conditional on age and gender. The earnings profile during the first 11 years for a new immigrant is estimated from the group that came to Sweden during 1980-1991. The profile for his/her next 10 years is estimated using data from the group that came during 1970-79, etc. Earnings include compensation for paid leave of absence. Annual growth rate in wages is set to 1.5%.

Participation rates and unemployment rates are taken from the AKU survey from January to June 1995. The estimated rates for open unemployment are 6.8% and 4.7% for native men and women, and 12.5% and 8.3% for immigrant men and women, respectively. Unemployment replacement rate is set to 75%. Participation rates are 83.7% and 79.5% for native men and women, and 70.1% and 61.5% for immigrant men and women, respectively. Note that participation and unemployment rates are implicitly assumed to be similar for every immigrant group, since this data set does not identify national origin.

4.3 Government transfers

According to the National Social Insurance Board (1995), parents get on average 500 days of paid parental leave for every newborn kid, and 89% of the parental

leave is used by the mother. The compensation is set to 90% of labor earnings for the first 410 days and 60 SEK per day for the last 90. The government pays the bill and I record it as a transfer to parents. I assume that fathers are on average 2 years older than mothers.

Expected sick leave (conditional on age and gender) for natives is estimated as expected length of sick leave times expected number of leaves. This allows splitting the sick leave payments between employer and government. A key assumption is that immigrants and natives have the same age and gender-dependent sick leave. Compensation rates are as of 1995. A similar approach is followed for rehabilitation compensation.

Income dependent welfare payments are assumed to be paid to agents in the age group 16-64 who are not in the labor force. The data underlying Ekberg (1995) identify welfare payments for natives and every immigrant group in 1991. Age distribution of welfare payments is assumed to be the same as in May 1994. The size of the transfers is computed as aggregate transfers to a group divided by the number of non-participating individuals in the group in 1991.

General transfers are paid lump sum to children and age 18-24 individuals. I assume that immigrants and natives receive the same general transfers. The part of pension benefits which is not directly income dependent (labeled lump sum part of pension benefits) is estimated using aggregate payments in 1992. I assume that immigrants and natives receive the same lump sum pension benefits. This is probably an over-estimate of immigrant pension transfers since immigrants on average earn less and have lower participation rates.

4.4 Government

Employer tax is 38% of the annual labor compensation paid by the employer. Labor compensation is equal to estimated annual earnings minus parental leave compensation and the part of sickness compensation paid by the government. Consumption tax τ_c is set to 27%. Following Lundvik (1995), I set the tax rate on capital to zero since net revenues from capital taxation are about zero in

Sweden (i.e. capital subsidies roughly net out capital taxes).

The tax rate on labor income that balances the government budget is 37% on income up to 180,000 SEK (1992) and 57% on income exceeding 180,000.

Government consumption $g_{i,m}$ conditional on age and gender are taken from Ekberg (1995). Some government costs cannot be allocated to a particular age group (defense spending, infrastructure, etc.) and it is not obvious how new immigrants influence this class of government expenditures. Here I have assumed these government expenditures to increase proportionally when an additional immigrant enter the country. The same assumption is made by for instance Borjas (1994) and Gustafsson and Larsson (1997). Another extreme view would be to treat these expenditures as financing pure public goods, in which case these expenditures should be excluded when computing the net public gain of new immigrants.¹² Following Ekberg, I assume that the marginal increase in government consumption is identical for natives and immigrants. Initial government debt is 95% of GNP.¹³ The real interest rate is set to 3.5%, the same level as Lundvik (1995)

5 Results

5.1 Baseline case

Given the parameterization in Section 4, including initial conditions for population and government debt, tax payments less government expenditures for all natives and immigrants ($s_{i,m,1995}$ in section 3.6) can be calculated. Figure 1 shows the annual flow of government gain for 1-100 years old natives and for

¹²The results are quite sensitive to this assumption. The average net gain on immigrants, for instance, increases by about \$75,000, or 500,000 SEK, when the part of government expenditures that cannot be attributed to a particular age group is excluded.

¹³This excludes pension reserves equal to about 30-40% of annual GNP, which I assume is needed to finance the transition to the new pension system. An alternative approach would be to include the old pension system in the model and include pension reserves as part of government assets.

1-100 years old average immigrants who immigrate at age 1. During their working years (21-64) both natives and immigrants contribute to government coffers, albeit immigrants less than natives, due to lower wages, lower labor force participation, and higher welfare payments. Not surprisingly, both immigrants and natives are net burdens when young (1-20) and when old (65+). Natives represent a slightly bigger burden than immigrants during retirement since natives earn more during their working life and therefore get higher pension payments than immigrants.

I proceed to compute discounted net government gain of Swedish newborn and new immigrants. The expected net gain of a Swedish newborn baby is -46,000 SEK.¹⁴

Figure 2 (middle graph) reports the expected net government gain of letting in an i years old average immigrant to Sweden. Age at the time of immigration, i , is on the horizontal axis, running from 1 to 100. Each point in Figure 2 is the discounted sum of a payment stream like the one in Figure 1. The weighted average is taken over $NPV(i, m, 1995)$ for gender and country of origin. The country and gender mix is the same as for the time period 1980-91. The net cost of a Swedish newborn is plotted as an asterisk * on the vertical axis. The upper and lower graph in Figure 2 represent the NPV of male and female immigrants, respectively.¹⁵

According to these measurements, the discounted net government gain of letting in a 20-30 years old immigrant is roughly 200,000 SEK. A back of the envelope calculation suggests that 6.2 million immigrants (age 20-30 at arrival) would represent a net government gain of the same size as the current debt. At the same time, the net cost of old or very young immigrants is high (e.g. more than

¹⁴Note that aggregate net gain (adding up the net gains associated with all individuals in Sweden) must equal initial government debt, since the interest rate is greater than the growth rate in real wages plus the population growth rate. This is a no Ponzi game condition. Thus, the net gain for newborns may very well be negative as long as the net present value of payments for older natives is sufficiently large.

¹⁵Note that 89% of parental leave benefits are attributed to the mother, so Figure 2 exaggerates the cost for women, since child rearing and parental leave are usually joint household decisions.

1.5 million SEK for a 66 years old immigrant). These findings should not be surprising. The pension system, health care, child care and schooling are very expensive programs. Young immigrants enter with education from abroad, and even though they fare worse on average than natives in the labor market, the net effect is positive and large.

One could weigh the graph in Figure 2 with the age distribution of new immigrants to Sweden to measure the expected net cost of an “average” immigrant (note that most of the current immigrants to Sweden are young). The resulting figure is 175,000 SEK, or \$26,500.

In a comparable study for the U.S., and using a discount rate of 4%, Smith and Edmonton (1997) find the average net government gain of new immigrants to be about \$80,000, or more than \$100,000 higher than the figures for Sweden reported here.¹⁶ The intuition is that Sweden is a country with much bigger government transfers and public sector, and that immigrants to the U.S. fare quite well on the labor market relative to their counterparts in Sweden.¹⁷

One possible explanation for why the gains are so small in Sweden could be that the process of immigrating and obtaining a work permit in Sweden is rather complicated, at least for immigrants from countries outside the European Economic Space. A large amount of the prospective immigrant’s productive time is wasted waiting for a work permit, getting a police interview etc. Speeding up the process would incur very small costs for the immigration authority, while other parts of government would gain: higher tax revenues and lower welfare payments. Given the annual flow of net government gain, one could compute the net gain to government of making the prospective immigrant available to the labor market one year earlier. I compute the net public gain of shortening

¹⁶With discount rate of 8%, they find the average gain to fall to \$6,000, which is similar to the \$7,400 in Storesletten (2000). However, once general equilibrium effects are taken into account, the net effect of an immigrant is negative (Storesletten, 2000).

¹⁷Immigrants to the U.S. fare better on the labor market than immigrants to Sweden in the sense that the wage gap between immigrants and natives is lower in the U.S. (less than 20% using estimates from Borjas (1990)) than in Sweden (about 37% according to AKU data for 1995). Moreover, the employment rate of immigrants in the U.S. is comparable to natives, while the difference between natives and immigrants in Sweden is large (see the introduction).

the waiting period with one year to 51,000 SEK per immigrant.

5.2 Net present value versus cash flow approach

The net present value approach pursued in this paper for computing net gain on immigrants differs substantially from more conventional methods for computing the annual cost of immigrants. The standard “cash flow” approach has been to compute the “annual cost” of immigrants by simply adding the revenues and deducting the expenditures incurred in one particular calendar year for all immigrants who lived in the host country at that time, see e.g. Borjas (1994), ECON (1996), Ekberg and Andersson (1995), Gustafsson and Larsson (1997), Huddle (1994) and Passel (1994).

To investigate how misleading the cash flow approach is, I do a similar exercise with my model and compare the result with that of the net present value approach. The only change is that the tax rate on labor is lowered from 37% to 30%, in line with Swedish tax code. Note that the government budget will not be balanced in the long run under this fiscal policy. Under the cash flow measure the *annual* cost is about 20,000 SEK per immigrant in 1995. Multiplying this figure with the number of immigrants gives 17 billion SEK, or 1.1% of GNP. For comparison, the corresponding figures in Gustafsson and Larsson (1997) is 1.0% (for 1992) and 2.6% in Ekberg and Andersson (1995).

One way to compare the net present value measure with the cash flow measure is to compute the annuity value of the net present value and interpret this as the average loss per year per immigrant. If immigrants stay in Sweden for the rest of their lives and have the same mortality rate as Swedes, the average time until death is 54 years. With a discount rate of 3.5% the 54 year annuity value of 175,000 SEK is 7,250 SEK, or \$1,100. Thus, the cash flow measure overestimates the annualized cost of immigrants by a factor of 2.8! The discrepancy is probably due to

- Immigrants come when they are young. Considering cross-sectional cash flows puts too much weight on old age costs and too little on near future

tax revenues.

- The cash flow method assumes a too low tax rate since the current fiscal policy in Sweden and most other OECD countries is not feasible in the long run. If the tax rate on labor was set to 37%, which would balance the budget in the long run, the average annual cash flow is reduced to 14,000 SEK, which still is two times the (annualized) net present value measure.
- Moreover, the current Swedish immigrant population is on average 3 years older than the future steady state population of immigrants, presuming the current age distribution of new immigrants is sustained. This is due to substantial labor immigration in the 60ies.

5.3 Break-even participation rate

An alternative way of presenting my findings is to compute the break-even rate of employment for new immigrants. The break-even rate $k_{i,m}$ is defined as the participation rate, such that expected net present value for a new immigrant is zero:

$$k_{i,m}s_{i,m,1995}^p + (1 - k_{i,m})s_{i,m,1995}^n = 0$$

The results are displayed in Figure 3. The middle graph shows that the break-even rate for 20-30 years old new immigrants is as low as 61%. In comparison, the average participation rates for 21-65 years old persons were, in 1995, 66.4% for immigrants and 82.3% for natives.

5.4 Sensitivity analysis

Labor market conditions for new immigrants to Sweden have been difficult during the last 5 years, especially for refugees. In 1993 refugees and their dependents (spouse, children, etc.) of age 20-64 who had been in Sweden 2-4 years

had average employment rates of 25.2% and 22.2% for men and women respectively. In the absolutely worst case, I include a scenario where the employment rate of new immigrants is as low as for recent refugees in Sweden. Also, the employment rate for immigrants is assumed not to improve with spending more time in the country. In this case, the average NPV of each new immigrant is -694,000 SEK. Note, however, that my results are very sensitive to the participation rate of immigrants: a 1% point increase in participation rate raises the average NPV by more than 26,500 SEK.

The previous analysis assumes zero return migration. This is a convenient assumption, since little is known about what persons actually return to their native countries. A large fraction of prospective immigrants will probably leave Sweden before the end of their lives. To check how sensitive the results are to the baseline assumption, I compute the NPV graph when 25% of the new immigrants leave Sweden at age 65. I assume that those who leave do not collect any pension benefits after departure. It is in fact possible to receive some pension benefits despite having left Sweden, but for the sake of the argument I abstract from this. Under this scenario, the NPV graph shifts up the net gain by about 200,000 SEK for all ages until retirement. The weighted average NPV of new immigrants is +69,000 SEK in this case.

Storesletten (2000) suggests that the net government benefit of immigration to the U.S. is closely linked to the fertility of immigrants. To check how sensitive the predictions are for Sweden, I run an experiment where immigrant women have 50% higher fertility than natives (as opposed to the same fertility in the baseline case). The average NPV increases to -134,000 SEK (the necessary income tax rises by 1.4% since the new fertility rate is assumed to hold even for immigrant women currently residing in Sweden). Hence, the results are not sensitive to the assumption on immigrant female fertility.

Lowering the growth rate to 0% annually decreases the net benefit of an average immigrant to -191,000 SEK. A real interest rate of 3.5% may be too low. If the interest rate is increased to 5% (the current return on Swedish real bonds), the NPV of an average immigrant falls by 14,000 SEK to -189,000 SEK.

6 Conclusion

This paper computes the forward looking government “gain” on immigrants by the use of a simple net present value calculation, taking into account the Swedish tax system and detailed government expenditures. The baseline model predicts large possible gains from immigration, over 0.2 million SEK per immigrant if the immigrant is between 20 and 30. For immigrants older than 50, the net cost is substantial, about 1.1 million SEK per immigrant on average. Using the 1990 age distribution of new immigrants, I find that the average net government loss per new immigrant is 175,000 SEK, or \$26,500.

The calculations are obviously sensitive to underlying assumptions. The net gain is particularly sensitive to conditions in the labor market, return migration, rate of growth in wages, and the choice of discount rate. Immigrant fertility turns out to matter very little.

These results suggest that immigrants to a typical welfare state such as Sweden represent, on average, a substantial fiscal burden, and is an order of magnitude less beneficial for public coffers than immigrants to the U.S. While these results tend to mitigate the scope for resolving the fiscal strains associated with the ageing of the baby boom in European welfare states, it is important to stress that *young* immigrants still represent a large net gain. Thus, if immigration policy is to be exploited so as to solve fiscal problems, the policy must be targeted at selecting 20-30 years old immigrants.

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Figure 1

Annual net government contribution for various age groups

Annual tax payments less government expenditures for a Swedish born (-) and an immigrant who came at age 1 (- -).

Figure 2

Net government gain - benchmark case

Middle graph (-) shows the government gain, in net present value terms, of admitting immigrants who come when $1, 2, \dots, 100$ years old under the baseline parameterization. The upper (dashed) and lower (dotted) graphs represent government gain (in NPV terms) for immigrant men and immigrant females, respectively (see footnote 13).

Figure 3

Break even participation rates

The middle graph (- -) represents the break-even rate of participation for immigrants who come when $1, 2, \dots, 100$ years old. A break-even rate equal to one means that the net present value cannot be zero for any participation rate. The upper and lower graphs are break-even rates for female and male immigrants, respectively.

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