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GENERATIONAL ACCOUNTS IN HUNGARY 1992-2001

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Summary

Using the method of generational accounting, this study describes the long-term imbalance that arises from the existing structure of revenues and expenditures in Hungary's budget.

In the first step, we break the population down into generations (cohorts, age groups), and calculate the tax and contribution payments of average individuals across the various age groups, netting out the share they claim of public benefits and services. The balance of taxes and transfers (including in-kind services) is the net age-profile. In the next step, we calculate the net contributions of the representative agent of each generation over their remaining lifetimes: these are the generational accounts.

If the balance of generational accounts shows a deficit, it must be charged against future generations. The indicator of generational imbalance measures the difference between the net contributions made by the new-born over their entire lives (their generational accounts) and the net contributions of future generations. If there is a significant difference between the net lifetime contributions of the new-born now and those of future generations, then the existing system of redistribution is not be sustainable in the long run.

The figures for the generational imbalance between 1992 and 2001 show a strong correlation with government cycles. Since in election years the budget deficit soars and the age structure of the additional expenditure is particularly unhealthy, the value of the sustainability indicator shows up especially unfavourable in these years.

The pension reform of 1998 significantly improved the long-term sustainability of the tax and transfer system. This improvement is mainly attributable to the reform of the pay-as-you-go system, and especially to the increase of the retirement age, and the application of the Swiss, half-wage, half-price index rule. It must be added, though, that the calculations for the future are based on the increases of the official retirement age, and do not take into consideration the opportunity for early retirement.

After 1995, and especially since 1998, the indicator of generational imbalance has improved. This is due not only to a fall in the budget deficit, but also to a change in the age structure of public spending that encouraged long-term sustainability.

The indicator of generational imbalance is quite sensitive to assumptions made in the construction of age-profiles, so an international comparison is only sensible if the calculations were based on the same assumptions. Such data are available for 1995. By this comparison, the long-term sustainability of the Hungarian tax and transfer systems is especially unfavourable. However, it must be noted that since then significant reforms have been introduced in many countries. If we were to use the data from 2001 in the international comparison for 1995, Hungary would have an average result.

1. Introduction[1]

Generational accounting measures the long-term sustainability of the tax-transfer system. Its basic principle is to break net tax burdens down by generation, and project this distribution of burden across future years. Using some additional assumptions (including the rate of productivity growth and the discount rate) and a forecast on demography, we can determine the extent to which the current net tax burdens projected for the future will increase (or decrease) the tax burden on future generations so that the so-called intertemporal budget constraint is met. The intertemporal budget constraint is a zero-sum constraint; it states that any excess expenditure in the present must be paid for by someone; if no one else, then by generations to come. To put it more accurately: the present value of the future net taxes levied on generations both present and future must equal the present value of the current national debt and future government spending.

The outcome of generational accounting is a vector of amounts of money. The individual entries of the vector show the present value of the difference between the tax payments expected from the representative agent of a particular generation over her remaining lifetime and the cash or in-kind services she will receive, assuming that no changes occur in the current redistribution system.

The balances of the various generations are different: the balance of those over the retirement age is negative, because after the active age contributions decrease, while the amounts required to cover social security and health services are relatively high. The balance is only forward-looking and does not take account of past contributions from those who are currently retired. In contrast, the balance of active age groups is positive, i.e. their contributions exceed expected benefits.

An important feature of generational accounting is the account of those born in the base year. Since they have no redistribution history, their balance

[1] This paper is the English equivalent of the Hungarian original revised for the foreign reader. The research was conducted by TÁRKI on behalf of, and with the participation of, the Hungarian Ministry of Finance. We are also grateful for financial support from the National Research and Development Fund (NKFP 5/62/2002) and the National Science Fund (OTKA T 046967). The authors of the background papers are Róbert Iván Gál (tax incidence, generational accounting), Márton Medgyesi (equivalence scales and breaking down household consumption into individual consumption, elementary age-profiles produced from the Household Budget Survey of the Central Statistical Office), Miklós Szabó (tax incidence), Árpád Törzsök (elementary age-profiles, generational accounts) and Tamás Révész (changes in government wealth). We acknowledge the contribution of Dóra Benedek, Gizella Csonka, Orsolya Lelkes and Ágota Scharle. In presenting the model of generational accounting, we deviate to some extent from the original version of Auerbach, Gokhale and Kotlikoff (1991). We thank András Simonovits for his help in performing this simplification.

consists of an entire lifetime's balance under the current tax-transfer system. On the other hand, the accounts of future generations represent a representative lifetime balance that covers accumulating deficits too, since the method assumes that taxes and benefits will change with future generations only, and existing generations will pay net taxes by the current net tax age-profile. Thus, by comparing these two entire lifetimes we can determine whether the existing system of redistribution can be sustained in the long term.

Generational accounting was first published in a study by Auerbach, Gokhale and Kotlikoff (1991). Theoretical, methodological and comparative studies that were prepared on the basis of this first study are compiled in a publication by Auerbach, Kotlikoff and Leibfritz (1999). The study by Kotlikoff and Raffelhüschen (1999) includes international comparisons, too. Special methodology summary and country reports were prepared for 12 EU member states on behalf of the Commission in Brussels (European Commission 1999).

Generational accounts are constructed in the following way. As a first step, we determine the net tax profile as the difference between taxes and benefits[2] that affect the particular generations in the base year, which we will refer to as $t = 0$. As each year is represented by a single number, the profile of tax balances for the base year is a vector of s components, where s denotes the number of individual cohorts, including newborns, i.e. 0 year-olds. In the theoretical model, s extends from 0 to D, the highest age. In practice, however, as there are fewer people in the higher age groups, cohorts for the older brackets are usually combined. As a next step, we calculate the values of this vector for each subsequent year – for 100 years according to the explanation below – by taking into consideration the assumptions on discount rates and productivity growth, the particular generation's death profile, and future changes of the welfare system expected that have already been legislated.[3] Finally, in the s x 101 matrix (or projection matrix) we have just created, we track the individual year groups by moving diagonally (i.e. taking into account the aging of people), and make a sum of the present values of their net taxes across their entire remaining lifetime.

We provide the results of our calculations below. In these, for the decade between 1992 and 2001, we prepared *separate* generational accounts, with each year considered as a base year. Therefore our results for 2001 are based on calculations in which 2001 is $t = 0$ (just as for 1992 in the calculations relevant for 1992), as opposed to $t = 10$.

[2] In order to facilitate an easy flow of the text, we will refer to all types of fees, levies, customs, contributions and taxes collectively as tax, and all benefits and allowances as benefits.

[3] In practice, these changes are limited to the pension system, for instance the gradual elimination of degressiveness of the pension formula, the phased increase in the retirement age, and the expected modification of the formula in 2013.

2. The model

The basic criterion for generational accounting is that the combined net tax balances of future and already living age groups conform to the intertemporal constraint described below:

$$\sum_{s=0}^{D} M_s + \sum_{j=1}^{\infty} M_j = \sum_{t=0}^{\infty} G_t u^t - W \qquad (1)$$

where
M_s: is the present value of remaining net taxes for already living generations in $t = 0$;
M_j: is the present value of net taxes of the future generation to be born in year j;
s: is the generation variable: the age of a generation in $t = 0$;
t: is the year variable; $t = 0$ is the base year;
D: is the maximum age;
G_t: is the government consumption in $t = 0$;
u: is the relative discount factor, calculated as the rate of the productivity growth factor $(1+g)$ and the interest factor $(1+r)$;
W: is net government wealth.

The left side of the equation includes the net taxes of already living (M_s) and future (M_j) cohorts, i.e. the balance between their taxes and benefits or, more accurately, their present value calculated for t. As the welfare system extends 'from the cradle to the grave', s increases from zero to D, the latter denoting the oldest generation. In theory, we do not limit the year of birth of future generations, or j, and therefore all future years are considered. In practice, however, the time horizon of the calculation is 100 years, because – due to discounting – the impact of additional years is negligible.

The first item on the right-hand side of the intertemporal constraint, $G_t u^t$, is the present value of government consumption arising in the base year and in subsequent years, and W represents the net government wealth, which – if negative – equals the net national debt. Net taxes (the M-items), i.e. the balance between public revenue and expenditure broken down for individuals, are, of course, part of the budget, much the same way as government consumption (the G-item). G_t represents public-spending items that, on the 'private goods'–'public goods' scale, are closer to the latter, and as such may not be broken down to individuals. In practice, the G-category is wider than it would be justified by the position of taxes and benefits on the private goods–public goods scale, because micro-data necessary for the breakdown are sometimes unavailable.

On the left-hand side of (1) we separately summed up the net taxes of already living generations and future generations. The net tax balance of a generation for the entire remaining lifetime is calculated as:

$$M_s = \sum_{k=s}^{D} T_{k,k-s} P_{k,k-s} \left(\frac{1}{1+r} \right)^{k-s} \qquad (s = 0,1, \ldots, D) \qquad (2)$$

for already living generations, and

$$M_j = \nu \sum_{k=0}^{D} T_{k,k+j} P_{k,k+j} \left(\frac{1}{1+r} \right)^{k+j} \qquad (j = 1, 2, \ldots) \quad (3)$$

for future generations, where
$T_{k,k-s}$: is the net per capita tax of the cohort of age s in $t = 0$, when the generation is k years old;
$T_{k,k+j}$: is the net per capita tax of a generation to be born j years after $t = 0$, when the generation is k years old;
$P_{k,k-s}$: is the number of people of the cohort of age s in $t = 0$, still alive at the age of k;
$P_{k,k+j}$: is the number of people of the cohort to be born j years after $t = 0$, still alive at the age of k;
r: is the discount rate;
k: is the age variable: the age of a generation;
j: is the year variable; for each value where $t > 0$, $t = j$;
ν: is the adjustment factor.

Both (M_s) and (M_j) are vectors: they are vectors of net taxes of the various generations. The discounted net lifetime tax for a given generation's remaining life is calculated from the actual per capita net taxes and the number of those alive in the generation in the given year. It is important to note that it is not redundant to calculate the per capita average for generation of age k, and subsequently multiply it by the number of individuals of the generation who survived until the age of k. The net per capita taxes of the k year-old are not determined by dividing and then re-multiplying the macro-values of the relevant year – as this indeed would not make sense – but rather they are computed from the balance of the previous year of the k+1 year-old, by applying the relative discount factor. This way we use the vector of net per capita taxes of the base year across the entire calculation.

In formula (3) we use the ν adjustment factor as well. We had to introduce this because M_j / ν only shows how much net taxes should be paid by the representative agent of the generation born in j during her entire lifetime if demographic trends followed the forecasts. However, future generations must adjust to the intertemporal budget constraint, i.e. they must pay the accumulated deficits, or, in a favourable scenario, they can receive the surplus. Therefore, their net lifetime tax must be corrected by the ν adjustment factor.

In formulae (2) and (3) we used $T_{k,t}$ to indicate, in general, the net tax relevant in a given year (for already living generations the expression is $T_{k,k-s}$, while for future cohorts the expression $T_{k,k+j}$ applies). Net tax is made up of contributions (C) and benefits (B). The definitions of $T_{k,t}$,$C_{k,t}$ and $B_{k,t}$ are:

$$T_{k,t} = C_{k,t} - B_{k,t} \quad (4a)$$

$$C_{k,t} = C_{k,t-1}(1+g) \quad (4b)$$

$$B_{k,t} = B_{k,t-1}(1+g) \quad (4c)$$

where
$T_{k,t}$: is net tax per capita of the k year-old in year t;
$C_{k,t}$: is total tax per capita of the k year-old in year t;
$B_{k,t}$: is total benefits per capita of the k year-old in year t.

Taxes per capita in year t were computed of only two inputs: the contributions of the preceding cohort in the previous year and productivity growth. This implies the tacit assumption that the average tax of those who die between year t-1 and t equals the average tax for the entire generation. This is probably not the case: life expectancy actually correlates with income and thus with taxes paid. However, in the absence of reliable external estimates for Hungary, we cannot take that relationship into account.

As a last step, following the projection of the balance in the base year and the accumulation of the balances for the various generations, we determine the generations' net per capita taxes for the remaining lifetime of each cohort. For already living generations, this balance is calculated as:

$$N_s = \frac{M_s}{P_{s,0}} \qquad (s = 0,1,\ldots D) \quad (5)$$

While in the case of future generations the formula is:

$$N = \frac{\sum_{j=1}^{\infty} M_j}{\sum_{j=1}^{\infty} P_{0,j} u^j} \quad (6)$$

where:
N_s: is the generational account of generations already alive;
N: is the average generational account of future generations.

The first step in determining the per capita values is to calculate the size of the generation. For generations already alive, the actual size of the generation in the base year will be used. In other words, the generational account shows what the net position will be of a representative member of a particular generation vis-à-vis the general government budget across the remaining lifetime. The generational account is positive if the given generation is a net

contributor and negative if the contributions of the cohort fall short of the benefits they receive.

The generational accounts for future generations can be constructed in two steps. In the first step, we define the size of a generation – of every generation – as the size of the generation at zero years of age. We use these figures to project net lifetime taxes. From the aggregated net contributions calculated in this way and adjusted by ν, we select an average generational account, which is the same for all future generations.

3. Constructing generational accounts

3.1 Net tax profiles

In the equation of the intertemporal budget constraint, the present value of remaining net taxes of already living and future generations is determined by the net tax profile of the base year. In the background papers of this study we provide a detailed description of constructing net tax profiles. Here, we limit ourselves to give a list of the elementary tax age-profiles we have constructed, to describe briefly the tax incidence assumptions applied, and to summarise the total net tax profile for 2001.

3.1.1 Elementary tax age-profiles

As mentioned before, the revenue side includes several items that were disregarded in the construction of the generational tax profiles. Items where the contributor can be identified, in principle at least, are among taxes. Taxes make up 80 to 90 percent of consolidated revenue in the years under review, and their weight is slowly increasing. As for the number of balance sheet entries, this group includes a wide variety of revenue categories, but the better part of taxes is made up of only a handful of them. In Table 1 we present the level of detail we used for revenues, and also give the data sources we had to break down the various entries to individual contributors. In Table 2 we present the expenditure side in a similar structure, showing data sources applied in constructing the elementary age-profiles.

Table 1: Revenue items of the general government and data sources for constructing of elementary age-profiles

Code	Description	Data source
I.1.1.1.1	Personal income tax (PIT)	From PIT sample
I.1.1.1.2	Corporate taxes	From PIT sample
I.1.1.1.3.1	Tax from separately taxed income	Allocated to *G*-items due to lack of input
I.1.1.1.3.2	Contributions due to special events	Allocated to *G*-items due to lack of input
I.1.1.1.3.3	Other income taxes (not classified)	Allocated to *G*-items due to lack of input
I.1.1.2.1.1	Employee contribution	From PIT sample
I.1.1.2.1.2	Employee pension and health insurance contribution	From PIT sample
I.1.1.2.2.1	Social security contribution	From PIT sample
I.1.1.2.2.2	Employer contribution	From PIT sample
I.1.1.2.2.3	Health contribution	From PIT sample
I.1.1.2.2.4	Sick-leave contribution	Allocated to *G*-items due to lack of input
I.1.1.2.3.1.1	Contributions paid by private entrepreneurs	From PIT sample
I.1.1.2.3.1.2	Contributions from those paying by special agreement	Allocated to *G*-items due to lack of input
I.1.1.2.3.1.3	Health contribution paid by private entity	Allocated to *G*-items due to lack of input
I.1.1.2.3.1.4	Accident contribution	Allocated to *G*-items due to lack of input
I.1.1.2.3.2	Other contributions from state budget	From PIT sample
I.1.1.2.3.3	Other contributions (not split)	Allocated to *G*-items due to lack of input
I.1.1.3.1	Vocational training contribution	Allocated evenly for those with income from employment
I.1.1.3.2	Rehabilitation contribution	Allocated to *G*-items due to lack of input
I.1.1.3.3	Communal tax related to employees	Allocated to *G*-items due to lack of input
I.1.1.4.1	Construction tax	Allocated as local business tax
I.1.1.4.2	Tourism tax for buildings	Allocated as local business tax
I.1.1.4.3	Communal tax for private entities	Allocated as local business tax
I.1.1.4.4	Land tax	Allocated as local business tax
I.1.1.4.5	Inheritance tax	Allocated to *G*-items due to lack of input
I.1.1.4.6	Gift tax	Allocated to *G*-items due to lack of input
I.1.1.4.7	Duty on transfer or acquisition of property	Allocated to *G*-items due to lack of input
I.1.1.4.8	Duty on transfer of real estate	Allocated to *G*-items due to lack of input
I.1.1.4.9	Duty on transfer of vehicles	Allocated to *G*-items due to lack of input

I.1.1.5.1	VAT	From HBS
I.1.1.5.2.1	Consumption tax on goods and services	From HBS
I.1.1.5.2.2	Excise tax	From HBS
I.1.1.5.3	Profit from financial monopolies	Allocated to *G*-items due to lack of input
I.1.1.5.4.1	Taxes on other services	Allocated to *G*-items due to lack of input
I.1.1.5.4.2	Taxes on use of goods and services, local business tax	Allocated as corporate taxes
I.1.1.5.4.3.1	Tax on domestic vehicles	From HBS
I.1.1.5.4.3.2	Tax on foreign vehicles	*G*-item
I.1.1.5.4.3.3	Levies on excess weight of vehicles	From HBS
I.1.1.5.4.4.1	Road fund contribution	From HBS
I.1.1.5.4.4.2	Environmental protection product fees	Partly broken down from HBS
I.1.1.5.4.4.3	Cultural contribution	Allocated to *G*-items due to lack of input
I.1.1.5.4.4.4	Tourism tax (based on nights spent)	Allocated to *G*-items due to lack of input
I.1.1.5.4.4.5	Tourism contribution	Allocated to *G*-items due to lack of input
I.1.1.5.4.4.6	Revenues from brandy making monopoly	From HBS
I.1.1.5.4.4.8	Other taxes on goods and services	Allocated to *G*-items due to lack of input
I.1.1.6.1	Customs levies	Allocated to *G*-items due to lack of input
I.1.1.6.2	Other import fees	Allocated to *G*-items due to lack of input
I.1.1.7.1	Other taxes	Allocated to *G*-items due to lack of input
I.1.1.7.2.1	Fees due to use of environment	Broken down as the environmental protection product fees
I.1.1.7.2.2	Nuclear contribution	*G*-item
I.1.1.7.2.3	Other tax-type revenues	Allocated to *G*-items due to lack of input
I.1.1.8	Tax and contributions penalties, late payment penalty, self-revision penalty	Allocated to *G*-items due to lack of input

Notes:
The codes in the first column are taken from the Ministry of Finance guideline *Economic Revenue Categories* (*Bevételek közgazdasági besorolása*).
G-item: an item where a breakdown to individual tax payers is not feasible, not only due to lack of input, but also for conceptual reasons.
PIT: personal income tax; HBS: Household Budget Survey of the Central Statistical Office.

Table 2: Expenditure items of the general government and data sources for constructing of elementary age-profiles

Function	Description	Data source
F01	General public services	*G*-item
F02	Defence	*G*-item
F03	Police and public security	*G*-item
F04	Training activities and services	Allocated uniformly for all participants
F05	Health care	From the sample of records
F06.a	Sick leave pay, maternity and temporary disability benefits	From HBS
F06.b	Pensions	From the sample of records
F06.c	Other social security and social benefits	Allocated to *G*-items due to lack of input
F06.d	Unemployment benefit	From HBS
F06.e	Family allowances and child care benefits	From HBS
F06.f	Other social benefits	Allocated to *G*-items due to lack of input
F06.g	Social and welfare services	Allocated to *G*-items due to lack of input
F07.1	Other housing and communal services (not split)	Allocated uniformly for all participants
F07.2	Individual housing benefits	Allocated to *G*-items due to lack of input
F07.3	Other housing services	Allocated to *G*-items due to lack of input
F07.4	Public housing services	Allocated to *G*-items due to lack of input
F07.5	Communal development	Allocated to *G*-items due to lack of input
F07.6	Administration of housing affairs and services	Allocated to *G*-items due to lack of input
F07.7	Local water networks and protection of water quality	Allocated to *G*-items due to lack of input
F07.8	City and village management services	Allocated to *G*-items due to lack of input
F08.a	Sports and leisure activities and services	Allocated to *G*-items due to lack of input
F08.b	Cultural activities and services	*G*-item
F08.c	Broadcasting and publishing activities and services	Allocated to *G*-items due to lack of input
F08.d	Religious activities	*G*-item
F08.e	Political parties	*G*-item
F08.f	Other community and cultural activities	Allocated to *G*-items due to lack of input
F09	Fuel and energy provision	*G*-item
F10	Land, forest, fishery and game management	*G*-item
F11	Mining and industry	Allocated to *G*-items due to lack of input
F12	Transport and telecommunications services	Allocated to *G*-items due to lack of input
F13.a	Multi-purpose development activities and services	Allocated to *G*-items due to lack of input

F13.b	Other management activities and services	*G*-item
F14	Environmental protection	*G*-item
F15	Management of national debt	*G*-item
F16	Items not allocated to main categories	*G*-item

Notes:

The function codes shown in the first cell of each line are taken from the methodology manual of the Ministry of Finance *The Functional Classification of the General Government Budget* (*Az államháztartás funkcionális rendje* MS-4/1998).

G-item: an item where a breakdown to individual beneficiaries is not feasible, not only due to lack of input, but also for conceptual reasons.

HBS: Household Budget Survey of the Central Statistical Office.

3.1.2 Tax incidence considerations

The shape of the net tax age-profile, and consequently the final result of generational accounting, is significantly influenced by the incidence assumptions we use about the various tax categories. A basic finding in the theory of tax incidence is that those who are required to pay tax by law (*legal incidence*) are not necessarily the same people who will eventually pay the tax, i.e. whose well-being will decrease as a result of paying taxes (*economic incidence*). This is because, taxation changes the behaviour of actors and prices will reach new equilibriums. For instance, when a new tax is introduced, actors cut back their consumption or adjust their savings decisions. In other words, they try to devolve the tax burden to others. The extent to which they can do that depends on the market structure and their market position. The same can also occur on the expenditure side, especially in the case of cash payments. This latter could be termed 'skimming'.

Table 3: Tax incidence conventions of major research centres

	JCT	**OTA**	**CBO**	**EUGA**
Personal income tax	Those required to pay	Those required to pay	Those required to pay	Those required to pay
Capital gains tax	Capital owners			
Corporate income tax	Corporate capital owners	By capital gains income	All capital owners (not only corporate capital owners)	All capital owners (not only corporate capital owners)
Social security contribution (employee's and employer's)	Employees	Employees	Employees	Employees
Sales taxes for consumers	Sales tax in its broad sense is defined as the tax on equivalent wage and the tax on capital	In proportion to consumption and by income from employment and capital gains	Among consumers in proportion to the consumption of taxed commodity	Among consumers in proportion to the consumption of taxed commodity
Sales tax for corporations	-	In proportion to income from capital and work	Among consumers in proportion to their total consumption	Among consumers in proportion to their total consumption

Source: JCT (1993), OTA (1999), CBO (2001) and European Commission (1999).

In Table 3 we present the tax incidence conventions developed by four major professional bodies. These bodies are: the Joint Committee on Taxation

(JCT) which comprises representatives delegated by the two houses of the US Legislature; the Congressional Budget Office (CBO), which works under the supervision of the US Congress; and the Office of Tax Analysis (OTA) at the US Treasury Department. We found no corresponding bodies in Europe. However, in 1999, a benchmark study on generational accounting was prepared on behalf of the European Commission (European Commission 1999), and as part of this project a convention was established (below we will refer to that as EUGA).

In our study, we usually use the EUGA convention as a guideline, unless stated otherwise. One reason for this choice is that the generational accounts that will be the output of our exercise are intended for use in European benchmarking. The other reason is that, from a professional perspective too, the EUGA convention is close to the methodology used in this project. The tax incidence conventions used in the US focus primarily on the distribution of tax burden by income brackets, while in constructing generational accounts incidence is examined by age. These two approaches are somewhat different in terms of methodology. For instance, a tax incidence study performed by income does not require the separation of household consumption into individual consumptions, while this breakdown is necessary in a study by age. Members of a household typically have the same income level, but their ages are different.

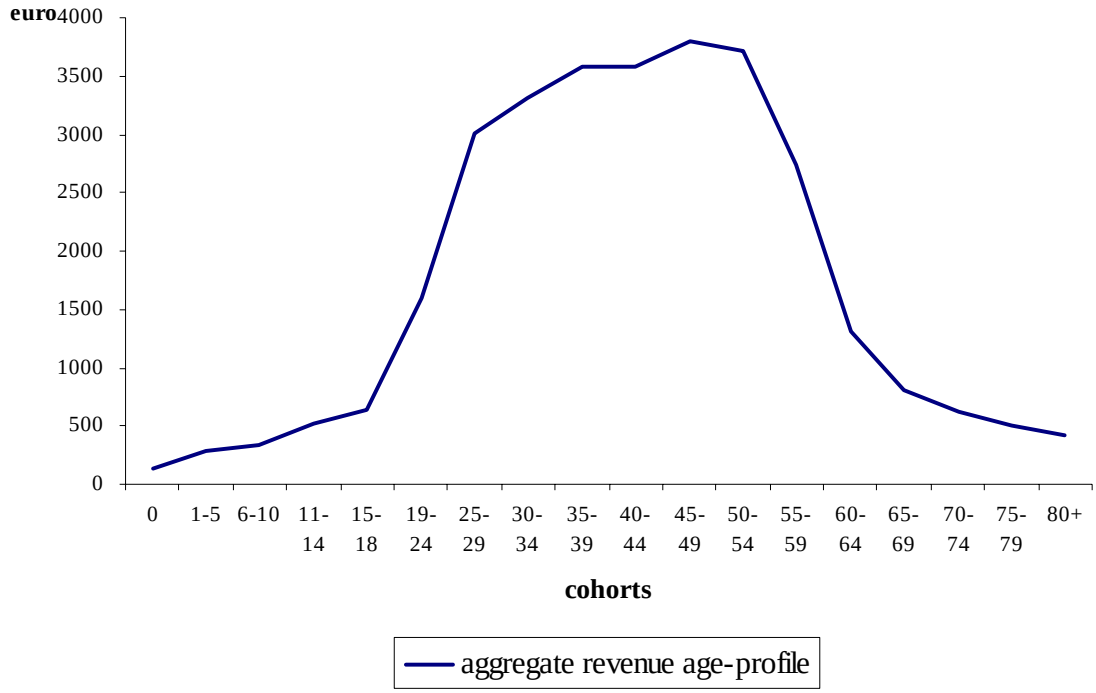
However, tax incidence by age poses several problems too, such as taxes on and transfers for raising children. Whose consumption is in fact burdened by taxes on commodities consumed by children: that of the child or the parent? Who is the beneficiary of cash family benefits or housing subsidies subject to the number of children of the family: the child, as the actual basis for eligibility, or the parent, as the recipient of the subsidy? If the beneficiary is the child, i.e. the source of the eligibility, then by the same token, whose account should be credited for a survivor's pension: that of the person who has acquired the right to the benefit (who is no longer aging together with the beneficiary, therefore making it impossible to tell the age of the eligible person, for instance in the case of a widow's pension that has been paid for a number of years) or that of the recipient, i.e. the survivor? Based on these examples, we may conclude that the existing convention may not be the ultimate solution.

3.1.3 The net tax age-profile in 2001

The curve of the age-profile of revenues does not start exactly in the origin, because we have credited tax on the consumption of newborns, too (VAT and excise tax). In 2001, the tax burden charged against newborns was more than 140 euros. Growth is steady at the beginning of the curve due to increasing consumption as children grow older. Members of the generation between 15 and 18 bear more than 630 euros of tax burden on average, with VAT

representing as much as two-thirds of the amount. This generation is already partially burdened by excise duty on tobacco and alcohol.

Figure 1: The aggregate revenue age-profile, 2001



The next age group, from 19 to 24, already includes significant amounts of income from employment, and thus the tax burden is higher, too: people of this generation had a tax burden of more than 1,580 euros per capita in 2001. Here, the curve is steep, because the older a generation, the higher its employment rate. Then the curve plateaus somewhat, since the 25 to 29 year-old have almost the same employment rate as people between 30 and 35, except they earn a little less. In terms of consumption tax, there is no significant difference between these two groups.

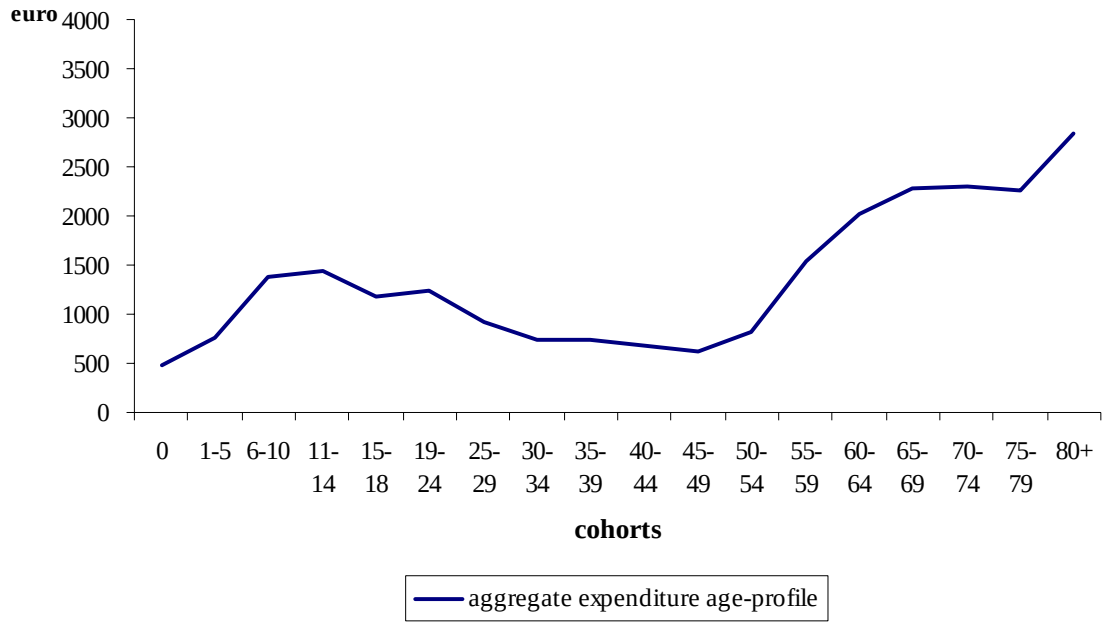
The next section worth of attention on the curve is its sloping part. The turning point in the curve is at the cohorts of 45 to 49. This cohort pays the highest amount, 3,800 euros on average. The 50 to 54 year-old pay somewhat less, and the generation of 55 to 59 only pays 2,740 euros per capita. The main reason is declining participation in the labour market in this age group, despite the retirement age rising for women to 58 years in 2000.

While the greater part of revenue is related to income from employment, the purpose and categories – and thus the profiles – of public spending vary greatly.

Newborns are recipients of substantial public spending: their account is credited by nearly 490 euros for health services. Some in the generation of 1 to 5 already use the education system, because they go to kindergarten, and almost 100 percent of primary school age children are recipients of expenditure on the public education system. The generation of 19 to 24 use the rather expensive higher education, and some of them already receive family benefits. Public benefits received by the working-age population decrease as people get older, and they surge again just before retirement. Among the older generations, those over 80 receive 2,840 euros per capita in social security and health care.

Benefits to primary school-age children and those of age 19 to 24 represent the same order of magnitude in the budget: 1,370 euros and 1,240 euros per capita, respectively. Of course, this congruence vanishes if, instead of the parents' accounts, we credit the children's accounts with family benefits and housing assistance, in line with the alternative incidence concept mentioned before. The amounts spent on these younger cohorts are less than half what the state spends on people over 80 – the pension is often a pensioner's sole source of income, and health expenses on the oldest age group is also significant. Another comparison: public spending on newborns is lower than that on the 'cheapest' adult generation, i.e. those of age 45 to 49 (about 490 euros and about 630 euros, respectively).

Figure 2: The aggregate expenditure age-profile, 2001



The total of aggregate balances calculated cohorts is the net tax profile. For each generation, we deducted the expenditure relevant to the cohort from

the revenue from that generation. In the 2001 account of newborns, credits for spending exceeded debits for tax revenue by 345 euro. Almost the entire difference stems from the gap between the VAT and duty levied on the consumption of newborns and the health spending they account for. At the same time, we charged the newborn-related part of family benefits against parents (and charged survivor benefits against surviving relatives).

The youngest net contributor is the 19 to 24 year old cohort. Their contributions exceed the benefits they receive by 346 euros. We need to note again that expenditures on pure public goods (government consumption) are not included in this balance. The highest net contribution comes from the generation between 45 and 49. Not only are they the largest contributors, but they receive the lowest spending from the budget, too. If we also consider that this was the largest age group in 2001, we may find that the retirement of this generation will place a significant burden on the tax-transfer system.

The other intersection point reveals the oldest generation whose contributions still exceed benefits. According to the figure, the generation of 60 to 64 is already below this intersection point; that is to say, they are net recipients under the redistribution regime of 2001. The moderate downward slope of the curve shows that people become inactive at different ages. If everybody worked until they reached retirement age, the fall in the curve would be steeper.

Finally, the lowest point in the curve belongs to those over 80, whose net contribution per capita is 2,420 euros.

Figure 3: The aggregate net tax profile, 2001

3.2 Net tax profiles and the balance of the general government budget

3.2.1 Balance entries and net tax profiles

The net tax age-profiles are made up of elementary age-profiles such as the profiles of the personal income tax, taxes on consumption and social security. In the construction of elementary age-profiles, we examined the various revenue and expenditure entries of the budget balance separately. The elementary age-profile is an entry in the budget balance broken down by age and averaged for the representative member of a cohort. Accordingly, the contribution and benefit profiles produced by the combination of elementary age-profiles correspond to the totals of the revenue and expenditure side of the budget balance, and thus the elements of these two age-profiles multiplied by the number of members in the respective age group will equal the totals of revenue and expenditure in the budget balance, or more precisely, the part that remains of these totals after the deduction of *G*-items, or government consumption. Thus, conceptually, the net tax age-profile is related to the budget deficit. The net tax age-profile is a part of the deficit, cleared of *G*-items both on the revenue and expenditure sides, broken down and averaged for cohorts.

3.2.2 Consolidation

During the consolidation of the budget balance, items that represent transfers among various branches of the general government are offset against each other. Consolidation is practically the netting of fund transfers occurring between sub-systems of the general government. As a result, the amount of the deficit remains unchanged, because all eliminated items are simultaneously revenue and expenditure; yet the totals will decrease due to netting, and that, in turn, will increase the proportion of the deficit. Consolidation, therefore, prevents double counting of the same item and eliminates an opportunity for manipulating the deficit. Double counting can cause problems, especially in interpreting the functional balance, because some public services are financed directly by the government budget, while other functions receive funding through sub-systems of the general government. For instance, primary education is financed by the government through local municipalities. In an unconsolidated balance, this item is registered more than once. Higher education, however, is funded directly making this item registered only once in an unconsolidated balance. Consequently, an unconsolidated balance does not

provide appropriate ratios of functional expenditure, and offers a distorted picture when projected across the various generations. These considerations clearly justify the use of a consolidated balance.

However, the difference between *M*-items, traceable back to the level of individuals, and *G*-items, embodying government consumption (or, less frequently, revenue) in equation (1) does not correspond to the variation that arises on consolidation. There are several entries in the balance that can be matched with payers, despite the fact they represent transfers between sectors of the general government, and as such are eliminated on consolidation. For instance, social security contributions paid by employers are considered by every known convention of tax incidence analysis to be a tax borne by the employee. That is to say, in equation (1) they are treated as *M*-items ready for breakdown to individuals, regardless of whether the contributions are paid by the government or municipalities in their capacity as employers. Social security contributions paid by employers are recognised as household income in the system of national accounts, too, regardless of whether the employer in question is public or private.

Accordingly, the balance suitable for the purpose of generational accounting is a partially consolidated one, where both sides of the consolidated balance are completed by five types of contributions paid to social security from within the general government.[4] This partial consolidation means on the revenue side that all contributions count irrespective of those who paid worked for a private business or the government. On the expenditure side, it means that the price of public services has to include social security contributions paid by those who provided these services. Should these services be outsourced, contributions would be naturally recognised among the costs.

Partial consolidation enables us to use more accurate net tax profiles, because full consolidation, neglecting much of the contributions paid to social security, considerably re-weights the net tax age-profiles estimated from the micro-samples. Also, the so-called breakdown ratio improves, too, i.e. the ratio between items that can be allocated to contributors or recipients in practice, and items where such allocation exists in principle; we will return to this later. Partial consolidation leaves the budget deficit unchanged, yet the proportion of the deficit will shrink, and thus the method will make public spending appear larger compared to GDP than a fully consolidated balance. In generational accounting, however, what counts is the amount of the deficit, rather than its proportion to the totals. The resulting generational imbalance indicator is

[4] These items are: revenue from social security contributions from within the general government, revenue from employer contributions from within the general government, health contributions from within the general government, sick-pay contributions from within the general government, and other contributions from within the general government. In this list of budget entries "social security contribution" is used in a narrower sense than in the main text, where all of them would fall under the name of social security contributions.

compared to household categories, such as net income, rather than to categories of the general government budget.

On the ground of this, for the purposes of the research we chose to use a partially consolidated balance in which social security contributions paid by and on behalf of civil servants are not consolidated. We will describe this partially consolidated balance for 2001 in detail in Table 4.

3.3 Net taxes and government consumption

3.3.1 The borderline between M *and* G*-items of the intertemporal budget constraint*

M-items of the intertemporal budget constraint of generational accounting are derived from the net tax profile of the base year, i.e. they are made up of revenue and expenditure items where the payer or beneficiary can be identified. In contrast, *G*-items are revenue that may not, for conceptual reasons, be linked to a single person, and expenditure that finances pure public goods.

On the revenue side, taxes are made up of *M*-items (with a few exceptions, such as tax on foreign vehicles). Important *G*-items include non-tax type revenues, and transfers received for operational purposes. Non-tax type revenues include non-refundable service fees; these typically arise when someone uses a public service that carries a charge, e.g. payment for a road toll or for a certified copy at a land registry office. The payers of such fees can be identified in theory, but in such instances the state is not performing its function of redistribution; rather it is providing a service of a commercial nature. These revenues finance private goods rather than public goods, and the transactions are carried out in such a way that the payer receives the goods forthwith upon payment. The group titled 'transfers received for operational purposes' includes non-refundable revenues such as transfers received from other governments or international organisations, and primary and secondary current transfers within the budget. Again, these do not qualify as redistribution among citizens. Similarly, government revenues from capital transactions cannot be tied to individuals, and neither can be loans refunded and received.

There are public dues where a breakdown to individuals is feasible in theory, yet we classify them among items of government consumption, because we are unable to determine a relevant age distribution. Such 'obligated *G*-items include, for instance, government revenue from customs and customs-type payments, and stamp-duty fees.

On the expenditure side, the difference between *G* and *M* items is more tangible: *G*-items include expenditure on pure public goods, while *M*-items are closer to private goods. Pure public goods include government operational functions, public administration, defence, public security, public health (i.e. a small part of health-related public spending such as epidemiology), much of

road and rail transport, telecommunications and environmental protection. We also classify as public goods, albeit somewhat less obviously, cultural, religious and political activities, along with expenditure on fuel and energy, and spending on land, forest, fishery and game management. Amounts in the latter group are mainly spent on the protection of forests and the natural environment, i.e. on projects where the specific beneficiaries cannot be identified.

Table 4: Revenues and expenditures of the general government for generational accounting, in 2001, '000,000 euros

REVENUE		**EXPENDITURE**	
Current revenues and current transfers	25,337	General public services	2,940
Total dues	22,588	Defence	754
Income taxes	5,721	Police and public security	1,446
Social security, employee and employer contributions	7,393	Education	3,364
Taxes on wages and employment	76	Health care	2,637
Property taxes	414	Social security, social services	8,266
Taxes on products and services	8,236	Housing and communal services	835
Customs and customs-type charges	487	Leisure, cultural and religious activities and services	879
Other taxes	260	Environmental protection	560
Other current revenues and current transfers	2,749	Fuel and energy provision	12
Revenue from capital transactions and capital grants	775	Land, forest, fishery and game management	1,041
Loans refunded and received	215	Mining and industry	157
Items not classified in other categories	28	Transport and telecommunications	1,134
		Other economic activities and services	848
		National debt management	2,802
		Items not classified in other categories	590
TOTAL REVENUE	26,355	**TOTAL EXPENDITURE**	28,041
Of which: items that can be broken down to individuals (*M*-item) government consumption (*G*-item)	 22,222 4,132	Of which: items that can be broken down to individuals (*M*-item) government consumption (*G*-item)	 16,533 11,507

Source: ÁHIR databases.

Note: Totals exclude financing expenditure and revenue. The entries of the balance-sheet are derived from the entries of the consolidated balance by adding to both sides the social security contributions transferred within the general government (social security contribution revenue from within the general government, revenue from employer contributions from within the general government, revenue from health contributions from within the general government, sick-pay contributions from within the general government, and other contributions from within the general government). This operation affects one entry on the revenue side and multiple entries on the expenditure side.

M-items: entries not carrying pure public goods, *G*-items: entries carrying pure public goods.

We also consider expenditure on the management of the national debt to be a *G*-item, along with other items not broken down and allocated to any major category, as no individual beneficiary may be linked to such expenditures.

Since it does not finance public goods, expenditure on education and health, along with social security and welfare services (including family benefits and housing subsidies) may be linked to beneficiaries. We considered amounts spent on mining and industry to be items that finance private goods, because the better part of these is spent on job retention. Most expenditure on multiple-purpose development activities and services, and other economic activities and services, supports primarily private businesses, and thus we do not classify it as a *G*-item. However, we found no suitable method to break this down into age categories. In many cases, the detailed classification of the main expenditure groups makes the link between expenditure entries and categories fairly clear, yet the budget data actually necessary for the breakdown are not available, which makes the split between *G* and *M* items more indistinct.

On the expenditure side, there are quite a few items that should be allocated to beneficiaries in theory, as they do not finance public goods, yet we do not have a firm starting point to perform the allocation. Within social security benefits, such items include sick pay or other social support and benefits. Among expenditures on entertainment, cultural and religious activities and services, we considered sports, broadcasting and publishing to be *M*-items in principle, but again no data sources were available to link them to beneficiaries.

Equations (1) to (4) show that, during the projection, *G*-items increase exponentially of the power to u. In contrast, apart from u, *M*-items are impacted by the age distribution, too. In an aging population, future *M*-balances decrease compared to *G*-balances, because aging increases expenditure and reduces revenue. The generational imbalance is largely attributable to this phenomenon. Therefore, the obligated reclassification of some *M*-items into the group of *G*-items will artificially alter the future imbalance.

In theory, *M*-items of unknown distribution could also be classified not as *G*-items, but as *M*-items evenly distributed. If items reclassified from *G* into *M* in this way, include more expenditure than revenue, i.e. if, due to the reclassification, both the *G*-balance and the *M*-balance are reduced in the base year, in an aging population this reclassification will reduce the long-term imbalance. This must be taken into account when interpreting the results or when performing international comparisons. Due to the varying statistical capacities of different countries, the proportion of budget items involuntarily classified as *G*-items is not necessarily the same. Thus the reliability of the various calculations is significantly affected by the breakdown ratio, i.e. by the ratio between items that can be allocated to contributors or recipients in practice, and items that should be allocated to individuals in principle. The

higher the breakdown ratio, the fewer entries must be involuntarily handled as *G*-items.

3.3.2 Breakdown ratios

A good way to measure the reliability of net tax profiles is by breakdown ratios. From the totals of revenue and expenditure we deduct the *G*-items that for conceptual reasons should not be broken down to individuals. Such items, for instance, include, on the revenue side, income from capital transactions and capital grants, or loans refunded and received; and, on the expenditure side, general public spending or expenditure on defence. In the next step, we compare the remaining revenue and expenditure with the sum of items where we managed to create age-profiles in one way or the other.

As Table 5 shows, the breakdown ratios are high and show an improving trend. On the contribution side, this improvement is partly attributable to a steady decline in the weight of non-allocated taxes, such as customs or penalties for delay. Another driver is that separately taxed income is by now included in the personal income tax declaration form, and thus can be broken down for individuals. Between 85 and 95 percent of the amount that in principle should be allocated were in fact broken down to individual taxpayers. Naturally, on the expenditure side, such a high rate of allocation cannot be expected. Between 70 and 78 percent of public expenditure that do not finance public goods was allocated, which covers 43 to 47 percent of total expenditure.

Table 5: Breakdown ratios (1992-2001)

	Revenues			**Expenditures**		
	***M*-items total**	***M*-items allocated**	**Breakdown ratio** (%)	***M*-items total**	***M*-items allocated**	**Breakdown ratio** (%)
	Billion euros			Million euros		
1992	13.0	11.4	88	11.9	8.3	70
1993	14.9	13.0	87	13.5	9.8	73
1994	15.1	13.2	88	13.9	10.4	75
1995	14.3	12.2	85	11.5	8.6	75
1996	14.2	12.5	88	11.0	8.4	77
1997	15.8	14.2	90	11.9	9.3	78
1998	16.0	14.8	92	12.6	9.8	78
1999	17.4	16.3	94	13.4	10.3	77
2000	19.6	18.3	93	14.6	11.1	76
2001	22.2	21.0	95	16.5	12.7	77

Note: *M*-items total: revenues or expenditures the sources or beneficiaries of which can, in principle, be identified. *M*-items allocated: revenues or expenditures the sources or beneficiaries of which could have been identified in practice.

3.4 Government wealth

Government wealth is on the right side of the first equation of generational accounting, the intertemporal budget constraint. It is denoted by *W*, in line with the conventions. Table 6 shows the size of and the changes in, this wealth.

3.5. Predictions

Generational accounting is not used for predictive purposes. Generational accounts are usually not analysed on their own. Typically, the accounts of newborns are compared with those of future generations; or – less often – the age-profiles of generational accounts in different countries are analysed; or, as a third alternative, the age-profiles under review are examined under various institutional alternatives, e.g. different reform scenarios. Because of this, users of the method prefer to limit the role of forecasts to a minimum, since the objective is not to tell what is going to happen in the future, but rather to describe the current situation under the existing conditions including the long-term impacts.

We only use demographic forecasts, assumptions on the rate of long-term economic growth, and apply an appropriate discount rate. Population figures are taken from a model prepared by the Institute of Demography of the Central Statistical Office (CSO) in 2003, which provides data up to 2050. We complemented this forecast with data covering the 1990s, using the CSO's retrospective population adjustments made after the census of 2001. Since we had to cover a longer time period, for the years after 2050 we assumed that the structure of the population would not change from that of 2050. Similar solutions are used in generational accounting in the UK and in Canada. For the purposes of generational accounting, future generations are handled as a single age group.

In equation (1) we used a relative discount factor (u), which already includes an expansion element, the average annual productivity growth rate (g), and the discount rate itself (r). Since the amount of future welfare benefits is less certain than yields of long-term government securities, in determining the discount rate we must use an interest rate that is higher than the real interest rate of government securities. At the same time, the benefits in question are less volatile than the real yield on capital, which justifies using a value between the interest rate of government securities and the capital gain achievable in the private sector. In order to facilitate international comparisons, we set the economic growth rate at 1.5 percent and the discount rate at 5 percent. The same values were used in the research on the generational accounting of 17

countries (Auerbach, Leibfritz and Kotlikoff 1999), and in the country reports of the 12 EU member states (European Commission 1999).

Table 6: The financial wealth of the general government (S.13) (stocks), billion euros

Description	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Government (S.1311)											
Financial assets	**33.2**	**33.9**	**26.7**	**19.1**	**14.7**	**13.4**	**11.3**	**12.4**	**12.1**	**11.9**	**11.3**
1 Cash and deposits	2.6	3.5	2.8	3.5	2.1	1.6	0.8	1.5	1.1	1.8	0.5
2 Non-share securities	0.1	0.5	0.2	0.1	0.0	0.1	0.2	1.1	1.1	1.2	0.6
3 Credits and loans	3.9	3.9	2.5	2.2	1.9	2.2	2.0	1.7	1.6	1.3	1.7
3a Loans to enterprises	2.5	2.6	1.1	0.7	0.5	0.6	0.5	0.5	0.3	0.2	0.2
4 Property	24.7	23.9	19.3	11.5	9.1	7.5	6.5	6.0	6.1	5.1	5.8
5 Other receivables	1.9	2.1	1.9	1.8	1.6	2.0	1.8	2.1	2.2	2.4	2.8
Liabilities	**23.4**	**31.1**	**32.4**	**30.8**	**28.0**	**27.9**	**27.8**	**30.5**	**30.9**	**34.9**	**41.9**
6 Deposits	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7 Non-share securities	4.8	10.1	11.7	10.9	14.1	14.1	14.7	19.1	20.9	25.3	32.3
8 Credits and loans	18.2	20.5	19.9	19.3	13.3	13.1	12.4	10.6	9.1	7.5	8.1
9 Other payables	0.5	0.6	0.8	0.5	0.6	0.7	0.7	0.8	0.8	2.1	1.5
Net financial wealth	**9.8**	**2.8**	**-5.7**	**-11.6**	**-13.3**	**-14.5**	**-16.5**	**-18.1**	**-18.8**	**-23.0**	**-30.5**
Social Security funds (S.1314)											
Financial assets	**0.8**	**0.8**	**0.9**	**0.8**	**0.9**	**1.2**	**1.0**	**0.6**	**0.7**	**0.8**	**0.9**
1 Cash and deposits	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2 Non-share securities	0.2	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
3 Credit and loans	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4 Property	0.0	0.0	0.0	0.1	0.2	0.5	0.3	0.0	0.0	0.0	0.0
5 Other receivables	0.5	0.7	0.7	0.6	0.6	0.6	0.7	0.6	0.7	0.7	0.9
Liabilities	**0.2**	**0.3**	**0.5**	**0.7**	**0.4**	**0.4**	**0.5**	**0.4**	**0.5**	**0.3**	**0.6**
6 Credits and loans	0.2	0.3	0.5	0.7	0.4	0.4	0.5	0.3	0.5	0.2	0.5
7 Other payables	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1
Net financial wealth	**0.5**	**0.5**	**0.4**	**0.1**	**0.5**	**0.8**	**0.5**	**0.2**	**0.2**	**0.4**	**0.3**
Local government (S.1313)											
Financial assets	**3.6**	**4.5**	**4.8**	**3.9**	**4.6**	**4.7**	**4.0**	**3.9**	**3.9**	**4.3**	**4.5**
1 Cash and deposits	0.6	0.5	0.4	0.3	0.5	0.6	0.5	0.5	0.5	0.8	0.9
2 Non-share securities	0.1	0.1	0.1	0.2	0.2	0.5	0.4	0.5	0.4	0.5	0.3
3 Credits and loans	0.0	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.2	0.2	0.3
4 Property	2.8	3.6	3.9	3.0	3.7	3.4	2.7	2.6	2.6	2.7	2.9
5 Other receivables	0.0	0.2	0.2	0.2	0.1	0.1	0.2	0.2	0.2	0.2	0.2
Liabilities	**0.4**	**0.6**	**0.8**	**0.7**	**0.6**	**0.6**	**0.8**	**0.8**	**0.9**	**1.1**	**1.6**
6 Non-share securities	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1
7 Credits and loans	0.1	0.2	0.4	0.4	0.3	0.4	0.4	0.4	0.5	0.6	1.0
8 Other payables	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.6
Net financial wealth	**3.2**	**3.9**	**4.0**	**3.2**	**4.1**	**4.1**	**3.2**	**3.1**	**3.0**	**3.3**	**2.9**
Consolidated general government											
Financial assets	**36.7**	**37.8**	**30.9**	**22.3**	**19.0**	**17.6**	**14.4**	**15.2**	**14.9**	**15.5**	**14.8**
Liabilities	**23.2**	**30.7**	**32.3**	**30.7**	**27.7**	**27.3**	**27.2**	**29.9**	**30.5**	**34.8**	**42.1**
Net financial wealth	**13.5**	**7.1**	**-1.4**	**-8.5**	**-8.7**	**-9.7**	**-12.8**	**-14.7**	**-15.6**	**-19.3**	**-27.4**

Source: National Bank of Hungary (MNB) (2004); HUF amounts translated into euro terms on annual average exchange rates.
Note: Government includes extra-budgetary funds, such as the Hungarian Privatisation and State Holding Company (ÁPV Rt), Government Debt Management Agency (ÁKK Rt), the Hungarian State Treasury (MÁK Rt), the National Motorway Company (NA Rt), other smaller companies in charge of utilising government property and some non-profit organisations.
Consolidated data of the general government do not include receivables and payables the sub-sectors have vis-à-vis each other.

4. Generational accounts in Hungary 1992-2001

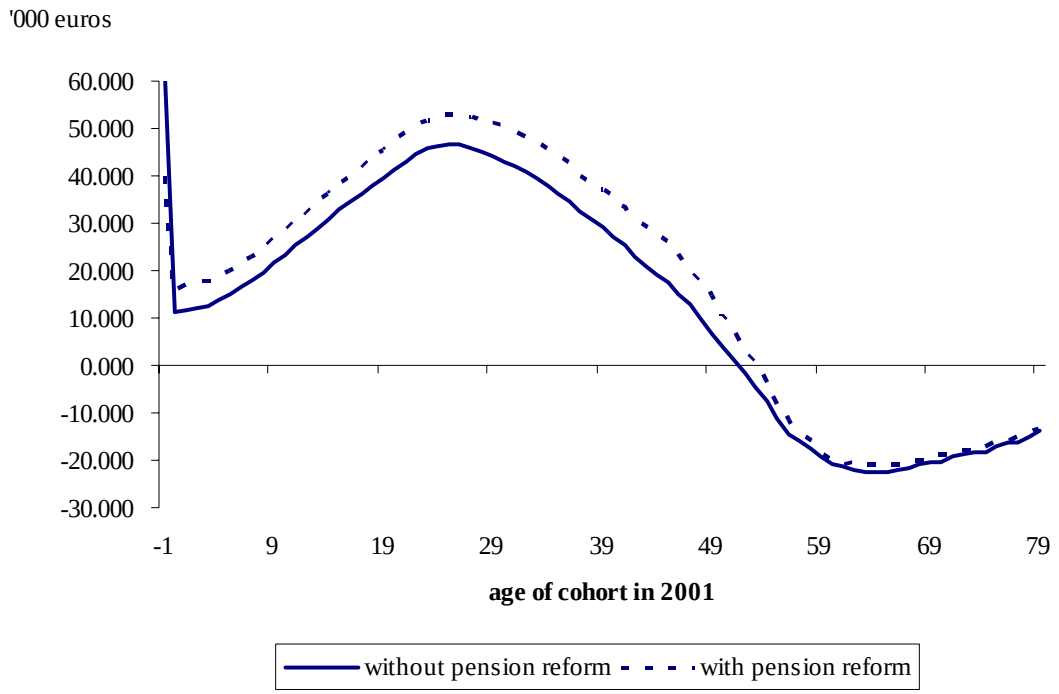
In the following section we present the generational accounts for 2001. We will show our calculations under alternative tax incidence assumptions. We will examine the extent by which the problems related to the long-term sustainability of the existing tax-transfer system are attributable to the demographic deficit shown in the forecast, i.e. the decrease in the size of the population and its aging. We will also examine how generational accounts react to different sets of parameters, and we review Hungarian generational accounts in an international comparison. We will present the so-called generational imbalance – the main indicator of generational accounting – which arises as the difference between the generational accounts of newborns and future generations, for the period between 1992 and 2001. Additionally, using the example of the pension reform of 1998, we will examine how generational accounts (in 2001) and the generational imbalance (between 1992 and 2001) reacted to some changes in the welfare system.

4.1 Generational accounts for 2001

In Figure 4, we present the generational accounts of 2001 in two versions. The continuous line displays the accounts that are derived from the net tax age-profile of the all-time base year – i.e. exclusive of pension reform components not that far implemented, which, will only be introduced some time in the future in line with the operative laws. In contrast, the dotted line shows the accounts including the effects of future institutional changes incorporated in the pension reform package (increased retirement age, new pension formula from 2013, Swiss indexation, and eliminated degressiveness bands). Let us first examine the former – base case – scenario.

As seen from Figure 4, the first section of the curve falls steeply. This is because the curve starts with the position of the representative agent of future generations (called -1 years old in the figure), and they are significant net contributors of over 61,200 euros per capita. The account of the 0 year-olds is also positive; that is to say, newborns are also net contributors to the system: on average they will pay almost 11,200 euros more each, calculated at 2001 values, than they will receive in benefits. Obviously, it would be a mistake to jump to the conclusion that people born now are losing out on the system of redistribution, since government consumption – financing pure public goods – is expensive, yet potentially profitable. Neither can we say that the system favours the older generations, because we have not taken into account the amounts older generations have already paid in taxes.

Figure 4: Generational accounts – base case and scenario with adjustment for pension reform, 2001 ('000 euros)



The maximum of the curve for generations already alive is at the 25 year-olds, who, during their remaining lifetime, are expected to pay 46,700 euros more than they will receive in benefits. This is no surprise either: typically, 25 year-olds have already completed their schools (expensive in terms of public finances), are no longer eligible for orphan's benefits, claim relatively little in the way of health benefits, yet have the better part of their active life ahead of them, during which they will pay most of their taxes. This, again, does not mean that 25 year-olds are so much worse off than newborns, as the past balances of 25 year-olds have obviously not been considered. The two groups could be compared only if we knew their total lifetime balances.

The curve intersects the horizontal axis at the account of 52 year-olds. Accordingly, they will be net beneficiaries of the redistribution system in their remaining lifetime. The account of 64 year-olds is the most favourable: over their remaining lifetime, average members of this group will receive 22,500 euros more than they will have paid. It is important to note that the negative value does not mean that 64 year-olds are dependants of society. It simply means that older generations have already paid most of their taxes in the earlier part of their lifetime, and in old age the benefits are substantially higher than taxes. Generational accounts are forward looking and focus on the amount people will pay in taxes and will claim in benefits over their remaining lifetime.

We also mention the values of two important indicators referred to earlier: those of the absolute and relative generational imbalances. Absolute imbalance is the difference between the accounts of newborns and future generations, which amounts to 50,100 euros in 2001 in the "no-pension-reform" scenario. This is the extra amount that future generations, expected to finance the deficits accumulated over the long term in the current system, have to pay for public services compared to the net contributions of those born now, assuming that the deficit can only be covered by extra taxes from future generations. The relative imbalance is the quotient of the two accounts minus 1, and gives the multiplier between the outstanding accounts of future generations compared to those of the newborn. This ratio is 4.5 for 2001.

4.2 The impact of an institutional reform: the 1997 pension reform and the generational accounts for 2001

With the method of generational accounting, we can measure the impact of changes to the institutional system on the long-term sustainability of the tax-transfer system. One such series of changes include those components of the 1997 pension reform that have been legislated but had not been implemented by 2001 in that the reform package introduced long phase-in periods for some components.

One of the key components of the pension reform was to increase the retirement age to 62 years by 2001 for men and by 2009 for women, by one-year increments every two years. In simulating the change in retirement age, we removed employment-related contributions and pensions from the existing net tax profile,[5] appropriately expanded the part of these profiles that corresponded to the period over the age of 50, and then added back the expanded profiles to the part of the net tax profile we had initially left intact. In practice, we assumed that the payment of employment-related contributions will start to decrease later, and that pension payments, too, will be pushed forward in time, while the age-profile of other contributions and benefits will remain unchanged.

In determining the degree of the expansion, we had to take into account that we had handled the two genders together. Net tax profiles and pension profiles were not broken down by gender, so we had to calculate here with the average change in the retirement age. In 1998, the retirement age increased by one year for both genders making the combined change also one year. We increased all profiles accordingly by one year. In 2001, the retirement age for

[5] In the Hungarian version of the paper we used a slightly different list of these labour-related taxes. The consequent changes are minor and show the effect of the pension reform slightly sharper.

men had reached its final target of 62 years, and after 2001 it is only the female retirement age that keeps increasing by one year in every two years.[6]

Another important element of the pension reform was the introduction of the so-called Swiss indexation. Since 1992, annual pension increases had been tied to the nominal wage index. The new indexation rule, introduced after a brief phasing-in period takes inflation into account again, and increases the pensions by half of the real-wage index. This also means that the contributions related to employment and pensions must be handled separately, not only during the pension reform's interim period, but through the entire projection. As with the other factors, we increased contributions from employment by the productivity growth rate (g), and used half of this rate to increase pensions.

In order to bring contributions and pensions more closely tied at the individual level, the degressiveness bands of the pension formula – according to which the first HUF 10,000 of average net lifetime income has a greater weight in the formula than successive HUF 10,000 bands – will have to be phased out after a transition period of a few years. Another change is that after 2013 gross lifetime earnings will be taken into account, rather than the previously applied net earnings, but the pensions calculated this way will be subject to income taxation. Also, the scale used to recognise the individual service years will be flattened out. Finally, since 1998, part of the compulsory pension contribution has been paid in to newly established mandatory private pension funds, which are not part of the general government. Accordingly, a part of fund members' pensions will not be paid by the social security fund making expenditures of the general government decrease on the long run. We performed our calculations using a 6 percent contribution rate, because – contrary to the original concept – the increase in pension fund contributions to 8 percent of the gross wage did not occur by 2001. If we use the 8 percent contribution rate in our calculations, the dotted line in Figure 4 is pushed somewhat lower. The impact of partial privatisation on the generational accounts is not as large as that of the increase in the retirement age or the introduction of the Swiss indexation. However, it is unique in that – by enhancing efficiency across the entire system – it improves the accounts of all age groups. Other elements of the reform foster long-term sustainability at the cost of currently living generations (Gál and Tarcali 2003).

Figure 4 clearly reveals that the pension reform significantly reduces the generational imbalance (the difference between the accounts of the newborn and future generations), at the expense of already living generations. The starting point on the dotted line shows that an average member of a future

[6] Gál and Tarcali (2003) calculated generational accounts separately for the pension system, which allowed the separate treatment of the two genders. Here, however, we cannot produce age-profiles for the entire tax-transfer system by gender, and this has forced us to make simplifications. The calculations of Gál and Tarcali cover the entire pension system, but they focus on the pension system only. In this study we examine the entire general government budget, but disregard components falling outside its scope, such as mandatory contributions paid to private pension funds or pension to be paid from such funds in the future.

generation would be a net contributor up to a 'mere' 39,900 euros, compared to the 61,200 euros if no reform is carried out. The relative imbalance falls from 4.5 to 1.5. We can also see that the newborn generation is worse off, as their account surges from 11,200 euros to 16,000 euros.

Other points on the curve basically follow the original curve, but with a gap that, although it varies, averages a significant 4,700 euros. The pension reform, thus, contributed significantly to a reduction in the generational imbalance, yet it places a severe additional burden on already living generations. We should point out some additional factors. Firstly, we are aware that the increased retirement age, a key component of the pension reform, has not materially changed the age at which people actually retire, due to the simultaneous introduction of early retirement. This is a factor we could not take into account when programming the reform, and therefore it is possible that we overestimate its positive effect on future generations' accounts.

4.3 Alternative tax incidence assumptions

In Section 3.1.2 we showed that, in contrast with the incidence of personal income tax and social security contributions, there is no consensus about the incidence of corporate tax in the tax incidence literature. According to the first opinion, owners of corporate capital can partially shift corporate income tax to owners of non-corporate capital. According to another theory, no such shift may be performed. A third theory states that corporate tax is not shifted to other capital owners but to employees; we applied this presumption. In the following step we will demonstrate how generational accounts would differ if alternative incidence assumptions were applied.

Corporate income tax amounts to about one quarter of personal income tax, and 16 percent of social security contributions. Thus it is significant enough to have a tangible impact on the generational accounts if it is broken down into payers by alternative age-profiles. The alternative age-profiles are shown in Figure 5. For the sake of clarity we have smoothed them out somewhat. As the age-profile of recipients of capital gains[7] starts to decrease at a higher age and at a slower pace than that of employees, due to the discounting effect we expect that the alternative scenario of burdening the recipients of capital gains income with the corporate tax would decrease the generational imbalance. So the assumption applied as the base case showed the imbalance higher. Indeed, this expectation is confirmed (see Figure 6). The balance of current younger generations is also worse in the base case, since we charge them more in the present. Although, the net taxes of older generations would increase in the alternative scenario, and younger people, too, would pay higher taxes in the future, discounting reduces the impact of this.

[7] Through this subsection we combine corporate income tax and local business tax.

We cannot show the difference in generational accounts in the way we did for pension reform, because the difference is too small compared to the totals of the accounts. However, it may be of worth to identify the age groups where alternative profiles cause the greatest variance in the balances.

Figure 5: The age-profile of corporate income tax under alternative tax incidence assumptions, 2001, euro

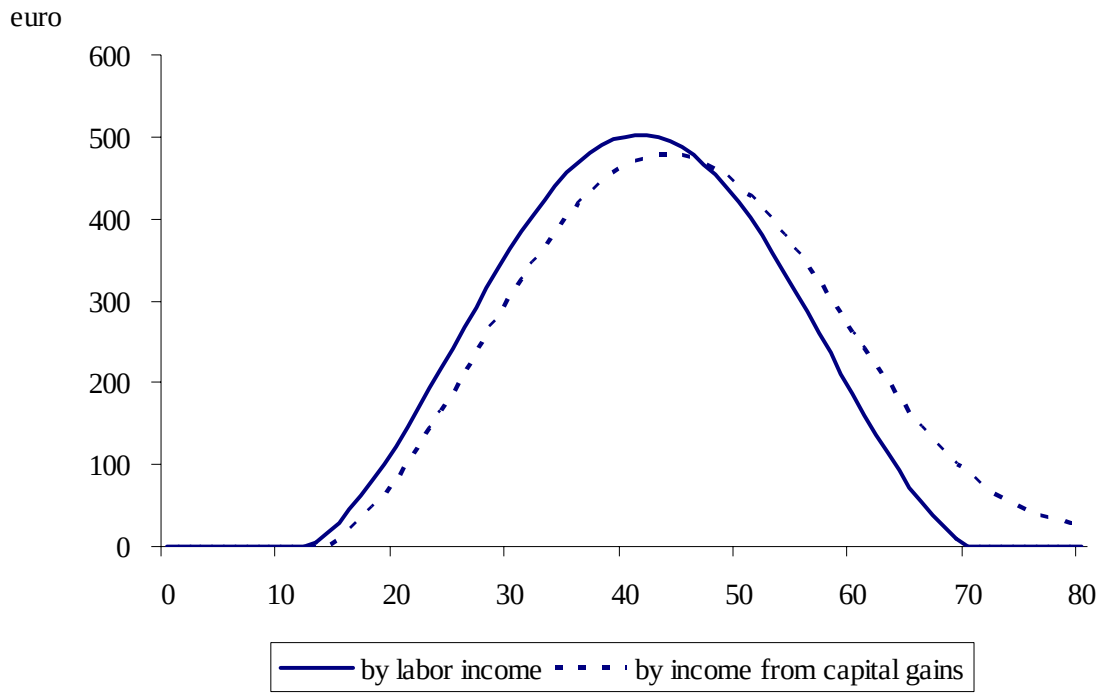
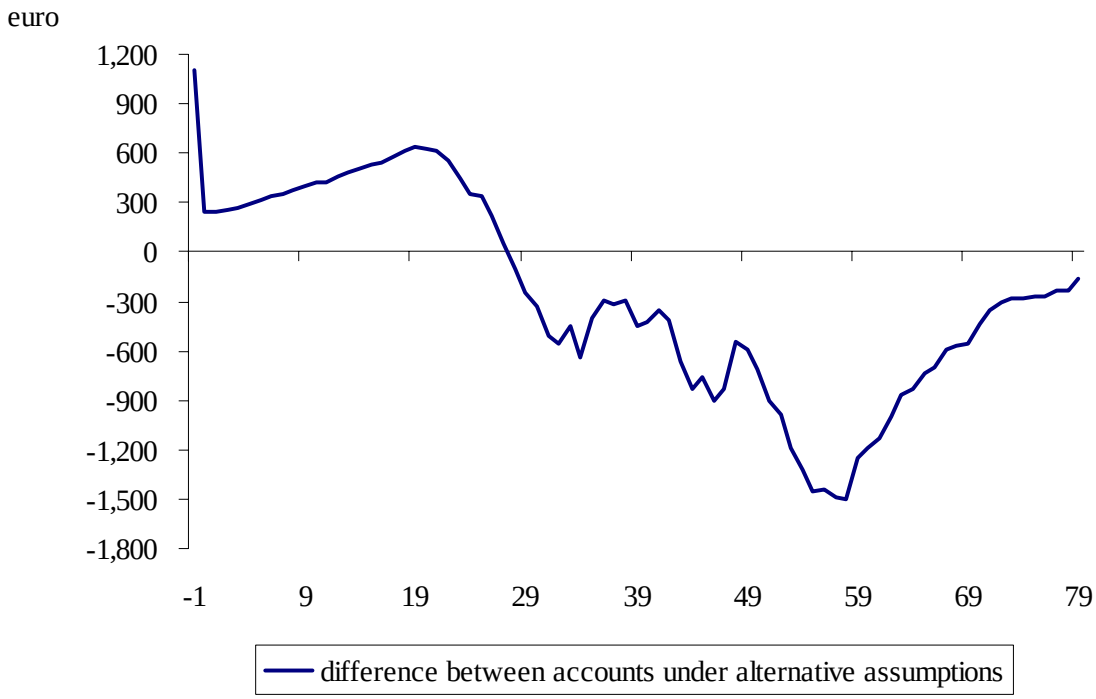


Figure 6 shows how much worse the account of younger generations is under the base case assumption on incidence than it would be under the alternative assumption. Correspondingly the account of older people is better, as the elderly bear a lower net tax burden than under the alternative scenario. The amount of the difference is not significant in comparison with the amounts in the balances, although the account of 55 year-olds is smaller by almost one sixth in the base case. The point is, though, that even profiles with such small differences have an impact on the calculation of the generational imbalance.

In another alternative calculation, we modified the incidence of duties. No breakdowns have been previously made for duties due to lack of input data. We have good reasons to assume, though, that duties payable on the transfer of real estate show an age-profile similar to taxes on capital gains. Although duties make a much smaller item than corporate tax, the profiles applied vary greatly: if we do not produce a breakdown, then, under the terms of equation (1), we

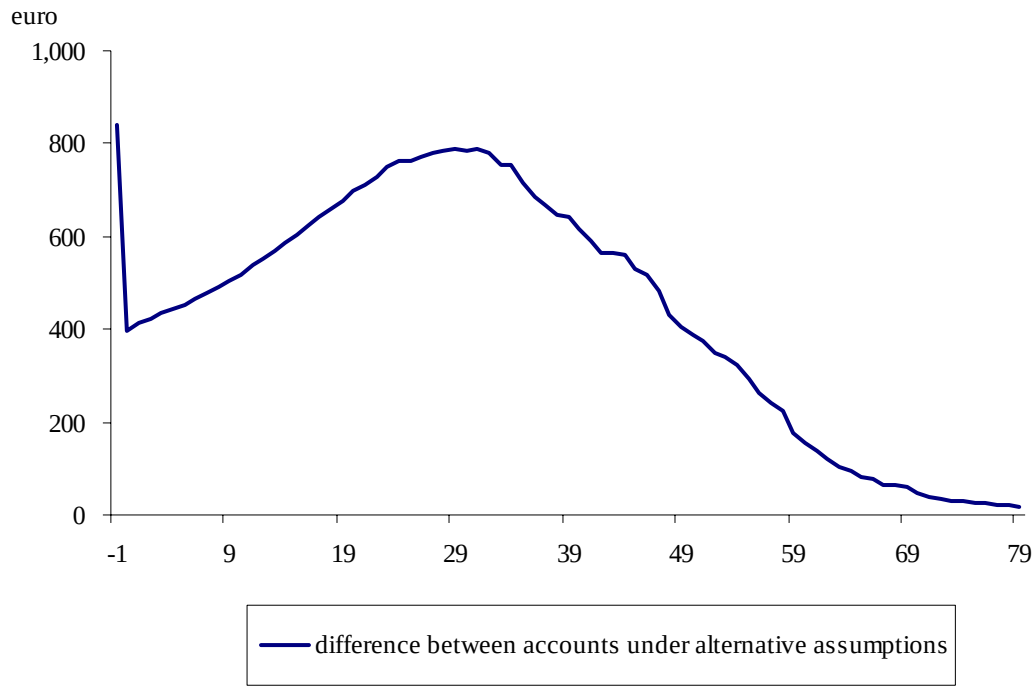
consider them to be *G*-items. We are likely to be closer to reality if we apply any of the profiles used for breakdowns for other items.

Figure 6: How much larger generational accounts got that corporate tax is borne by employees (base case) and not recipients of capital gains income (alternative), 2001, euro



The amount of the change is not sizeable in this case either, but indicates that the result of the model will change if a profile is applied even to a relatively small item, and that the newly allocated items will not only improve the validity of the model, but will actually have an impact on the outcome. The amount of the change is smaller than in the previous case, but not by much, despite the fact that the amount of duties is smaller than that of the corporate tax. The changes are shown in Figure 7. The difference between the two scenarios can be seen on the vertical axis.

Figure 7: How much larger generational accounts would get if duties were borne by recipients of capital gains income (alternative) and not put among G-items (base case), 2001, euro

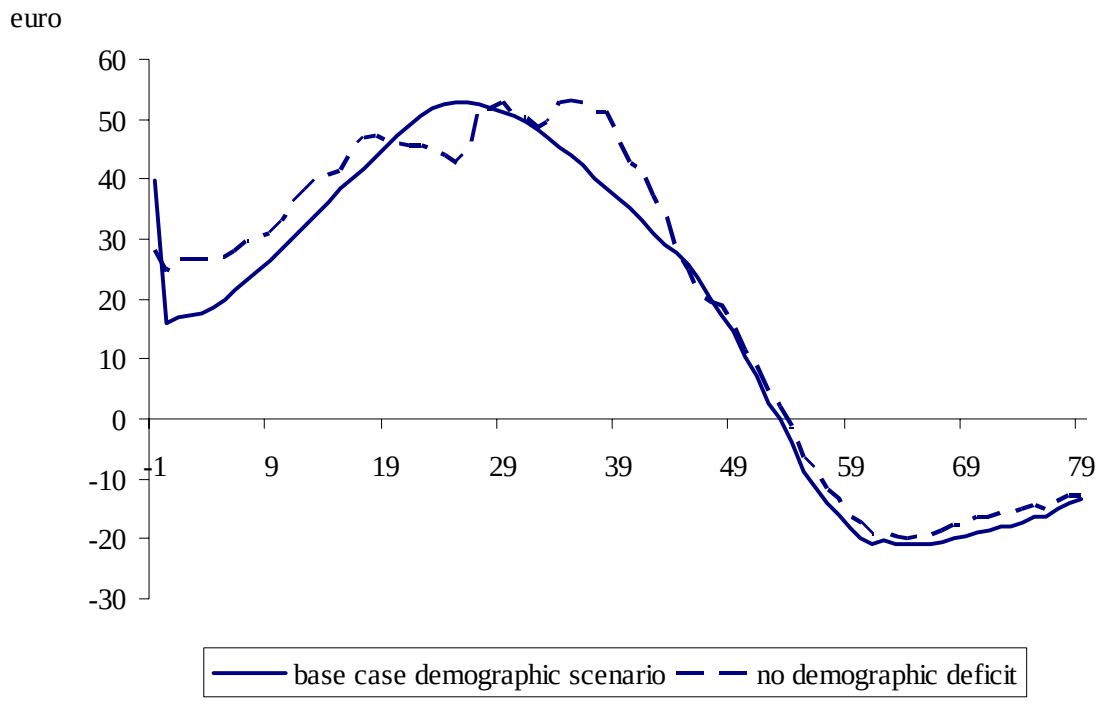


4.4 The impact of demographic deficit

Before moving on to an international comparison, we will show another alternative calculation. Generational accounting is sensitive to three factors: the budget deficit of the base year, the age structure of net tax profiles, and the demographic deficit, which, due to the net tax age-profiles of the base year, will widen the budget deficit. We show a calculation that disregards demographic deficit, and instead assumes that the existing structure of the population will continue for the next hundred years. This, of course, is not the application of some kind of optimistic scenario: we are only experimenting with this possibility. In this case the generational imbalance drops significantly for 2001; that is to say, future generations will barely pay more than newborns. It must be noted, though, that the balance of future generations is still rather high – almost 28,800 euros – while the balance of newborns will increase to 24,400 euros from the original 16,000 euros. The youngest, and smallest, generations

would come off worst if the composition and size of the population remained unchanged. On the other hand, such a scenario would be especially favourable to large generations.

Figure 8: The impact of the demographic deficit on generational accounts, 2001, euro



4.5 International comparison

The first comparative study on generational accounting (Kotlikoff and Leibfritz, 1999) includes calculations for 17 countries. In Table 7 below we repeat those accounts that appear to be most comparable to Hungary. Accordingly, the following countries are included in the table: Argentina, Brazil and Thailand (where GDP per capita is closest to Hungary's), Portugal (which is closest in size), Sweden and Germany (where the level of welfare services is similar to that in Hungary), Italy and Japan (where, along with Germany, an accelerated aging of the population, similar to the Hungarian situation, is expected) and finally the United States.

The figures in the last row of the table show how much more in net taxes future generations will have to pay compared to those born in 1995. Hungary, with its 600 percent imbalance, is in the worst position of the countries in the table. Japan also has a serious imbalance, where the value of the index is 338 percent, as does Italy, where it is 224 percent.

The relative generational imbalance is not a perfect measure as such relative indicators depend to a large extent on the base that is on the account of the newborn. If it is very low, even a relatively small increase in the life-time tax burden appears large in comparison. In the table the accounts of Hungarian newborns are the lowest, even lower than those of their contemporaries in

Table 7: Generational accounts of selected countries in 1995 (US$ '000, 1995 equivalents)

Age in 1995	US	Japan	Germany	Italy	Sweden	Thailand	Portugal	Argentina	Brazil	Hungary
70	–104,6	–44,8	–180,7	–117,5	-97,8	2,8	–42,7	-43,0	–32,9	-17,6
60	–51,7	11,9	–183,6	–142,0	-66,4	4,8	–47,1	-39,9	–28,0	-20,4
50	56,4	173,1	–4,2	–46,8	104,6	8,1	–10,6	-11,3	–6,3	-2,4
40	135,6	263,8	160,1	63,4	226,5	11,8	39,7	12,6	19,7	19,1
30	168,7	297,8	271,8	155,2	278,9	14,1	75,0	28,2	31,3	28,5
20	159,3	257,4	313,6	186,6	265,1	13,2	82,7	30,8	27,0	27,2
10	71,4	135,4	179,0	112,4	162,9	8,9	50,9	20,3	17,1	14,8
0	28,5	73,0	97,1	68,4	121,8	5,9	43,5	13,9	10,2	5,7
Future	73,9	319,4	248,8	209,9	83,8	–1,5	73,2	24,3	22,1	39,6
Imbalance (%)	159,0	337,8	156,1	223,8	-31,2	–125,4	68,3	74,8	116,7	600,5

Source: Kotlikoff and Leibfritz (1999) Table 4.2. Figures for Hungary are own calculations.

Note: Expenditure on education is treated as a transfer broken down by cohort. Other key assumptions: productivity growth rate at 1.5 percent, discount rate at 5 percent.

Table 8: Scaled generational accounts of selected countries in 1995 (US$ '000, 1995 equivalents)

Age in 1995	US	Japan	Germany	Italy	Sweden	Thailand	Portugal	Argentina	Brazil	Hungary
70	–104,6	-54,7	-242,9	-159,6	-142,4	10,0	-90,9	-139,6	-164,5	-110,1
60	–51,7	14,5	-246,8	-192,9	-96,7	17,2	-100,2	-129,5	-140,0	-127,4
50	56,4	211,4	-5,6	-63,6	152,3	29,0	-22,6	-36,7	-31,5	-15,1
40	135,6	322,1	215,2	86,1	329,7	42,3	84,5	40,9	98,5	119,5
30	168,7	363,6	365,3	210,9	406,0	50,5	159,6	91,6	156,5	178,1
20	159,3	314,3	421,5	253,5	385,9	47,3	176,0	100,0	135,0	170,0
10	71,4	165,3	240,6	152,7	237,1	31,9	108,3	65,9	85,5	92,6
0	28,5	89,1	130,5	92,9	177,3	21,1	92,6	45,1	51,0	35,3
Future	73,9	390,0	334,4	285,2	122,0	-5,4	155,7	78,9	110,5	247,0
Imbalance Absolute ($)	45,3	300,9	203,9	197,1	-55,3	-26,5	63,2	33,8	59,5	211,8
(%)	159,0	337,8	156,1	223,8	-31,2	–125,4	68,3	74,8	116,7	600,5

Source: Kotlikoff and Leibfritz (1999) Table 4.2. Figures for Hungary are own calculations.

Note: Expenditure on education is treated as a transfer broken down by cohort. Other key assumptions: productivity growth rate at 1.5 percent, discount rate at 5 percent. Scale: the individual present values multiplied by (GDP per capita in relevant country/ GDP per capita in US).

Thailand. Because of this, it is worth calculating the absolute imbalance, too, i.e. the difference between the tax burden of those born now and in the future. Since this indicator is significantly distorted by the difference in the dollar's purchasing power in the various countries, Kotlikoff and Leibfritz (1999) re-scaled the absolute index of the imbalance. The variance between the tax burdens of the 0 year-old and future generations was multiplied for each country by the difference between the GDP per capita of the US and the country in question. The resulting index expresses how great the generational imbalance would be in dollar terms, if we disregarded the differences in purchasing power. Table 8 presents the results of Kotlikoff and Leibfritz for the countries listed above, which we have supplemented with Hungarian figures of our own calculations.

If we filter out the differences in purchasing power across countries, the Hungarian generational imbalance is still serious, but it does not seem quite that dramatic any more. Although the imbalance in percentage terms remains the same by definition, future generations have to pay similar levels of additional tax as their German and Italian contemporaries, while their relative situation is substantially better than that of their contemporaries in Japan. Nevertheless, apart from Hungary, no other emerging economy assumes such an amount of burden to be met by future generations.

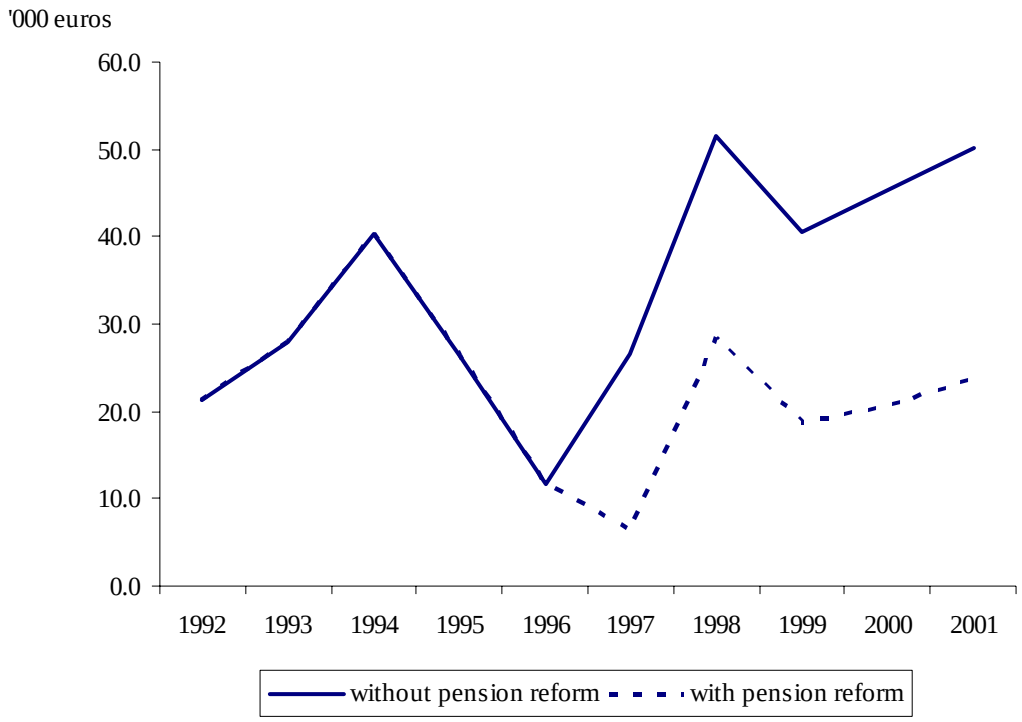
It must be noted that the data in this international comparison are outdated (the separate European comparison prepared on behalf of the European Commission also used data from 1995), and significant changes have occurred in many countries in the tax-transfer system.

4.6 A time series of generational imbalance

Generational accounts can also be examined over a period of time. Since we have prepared the net tax profiles for each year between 1992 and 2001, we can perform a separate generational accounting exercise for each year as a base year. Below, we present the generational imbalances calculated in this way. We present these calculations in ECU/euro terms to offset the impact of Hungarian forint inflation. We have run the calculation with the appropriate dollar exchange rates as well, and, apart from minor differences, have received the same result. Similarly, we calculated the number of monthly net average wages that made up the absolute generational imbalance in the particular year. The trend of this index, too, is similar to the curve of the absolute imbalance in euro terms.

Figure 9 presents generational imbalances in euro terms, calculated for the period 1992 to 2001. The figure clearly draws the political cycle. The significant jump in the generational imbalance exceeds the immediate budget deficit.

Figure 9: Absolute generational imbalance in Hungary, 1992-2001, in '000 ECU/euro



On the other hand, a similarly substantial improvement occurred following the austerity measures introduced by then finance minister, Lajos Bokros. After the introduction of the austerity measures in 1995, the imbalance already showed a significant decrease of 14,000 euros per capita, to be reduced by an additional 14,500 euros in the following year. When considering that finding, we must appreciate that generational accounting – being an accounting and not an economic method – does not calculate with behavioural reactions, and thus it disregards impacts on individual choices on savings, employment and fertility.

In Figure 9 we also present the time-series of imbalances by incorporating future steps of the pension reform. There is a major improvement in the imbalance: in each year, the index decreased by 20,000-26,000 euros compared to the no reform scenario (although in 2000-2001 this partly due to the revaluation of the forint to the euro). This is the case even though some of the positive impacts of reform were already being felt in the net tax age-profiles towards the end of the period under review.

We must note here that the pension reform is probably a rare exception, in that we incorporated the changes into the model's calculation algorithm. Typically, we examine the impacts of various institutional changes by

estimating the impact of a particular change or measure on the net tax profile, and we use this new net tax profile in the projection.

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