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Generational accounts in Hungary

Abstract

In this study we present the results of a generational accounting for Hungary. The analysis extends to the entire government including the central budget, social security funds, local governments and separate government funds.

We used three sources of data for constructing the tax profiles. The first one consists of two samples of personal income tax returns provided by the National Tax Office (APEH). One of them is a 0.45% random sample of tax returns declared by the employer, the other one is a 1% random sample of self-declarations. The second source is the Household Budget Survey of the Central Statistical Office (KSH). This contains data about consumption and income of 7,531 households. The third source is the government's 1996 Budget Report, which contains the macro-data on taxes. Besides these, we used several further studies and statistical data in order to make micro- and macro-level data consistent.

According to the base assumptions of the model (1.5% productivity growth per annum, 5% discount rate), those born in 1996 can expect a total of $ 8,400 net taxes through their entire lifetime at the 1996 present value. If modifications of the tax system were implemented in such a way that any tax increase or any reduction of expenses would only affect future generations, they could expect $ 43,900 of net life-time tax (also at the 1996 present value), which means a 5.25-fold (425%) increase. In international comparison, this is one of the highest values. If the productivity growth rate were only 1%, the degree of the imbalance would increase further, 5.93-fold (493%), and even with 2% annual productivity growth, it would only go down to a factor of 4.77 (377%).

The main reason for the imbalance is the expected demographic deficit. If the age composition remain the same as in 1996, the 5.25-factor would go down to 2.19 (119%).

1. Introduction[1]

The method of generational accounting was introduced by Alan J. Auerbach, Jagadeesh Gokhale and Laurence J. Kotlikoff. The essence of the method is breaking down net taxes by cohorts (from here on, we use both the words generation and age group as synonyms for cohort). The theoretical background is provided by the micro-foundations of dynamic macroeconomics, primarily Franco Modigliani's life cycle model.

Auerbach et al. recommend to replace budget deficit by generational accounts. They argue that the budget deficit does not give much information about the distribution of the burden among generations (see, among others, Auerbach and Kotlikoff (1987), Kotlikoff (1988), Auerbach, Gokhale and Kotlikoff (1991)). One could interpret certain items as taxes and benefits including them in the budget deficit, or as loans and payments which do not feature in the budget deficit. According to Kotlikoff (1992), the ratio of the budget deficit to GDP, a figure exposed to easy manipulation, cannot give an adequate picture about the state of prevailing fiscal policy. In his view, there is no connection between the budget deficit and other measures such as private savings, inflation, interest rates or prices.

The model is introduced in Chapter 2; the 1996 Hungarian generational accounts – in international comparison – are given in Chapter 4. In Chapter 3, we describe how we computed the net tax profiles, the raw material of the model, that is, the balance of revenues and expenditures broken down by gender and cohorts.

We note that we find generational accounting a very promising concept for quantifying imbalances of redistribution. For the time being, however, we consider the country studies of the international literature experimental. Hungarian generational accounting is no exception to this. The method is not standardized as yet, the national statistical systems do not provide the same quality of data. We discuss some critical points of generational accounting in Chapter 5.

2. The method of generational accounting

The key concept of generational accounting is *the government's intertemporal budget constraint*. This a kind of zero-sum constraint, which says that there are no free lunches: the

[1] The idea of writing this paper came from Csaba László. In writing the paper, we received help from the following people: Mrs. József Arany, István Baranyai, Ferenc Bathó, Iván Csaba, Krisztina Emődi, László Halpern, Zoltán Kertész, Laurence Kotlikoff, Mrs. István Németh, Philip Oreopoulos, Éva Orosz, James Sefton and Péter Szivós. Their contribution is greatly acknowledged. Any mistakes are of our own.

present value of future net taxes of currently living and future generations has to be equal to the present value of the current national debt and future government spending. Put formally:

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

where

k: age of a cohort;

t, s, j: time variables

D: maximum age;

u: relative discount factor, the productivity growth factor $(1+g)$ over the interest factor $(1+r)$;

M_s: present value of remaining net taxes for the current generation of age s;

M_j: present value of net taxes for future generations born in year j;

W: government's net wealth;

G_t: government purchases in year t;

The first term on the left hand side of expression (1) adds up the present value of the net taxes of all living generations through their remaining lifetime. The amount in question is a *net* amount, a difference between taxes paid and transfers received. The calculation is forward-looking, that is, it does not take previous payments and benefits into consideration. The index s runs from the youngest generation, those born in the base year (in our case 1996) to those aged D, that is, the oldest generation. The second term on the left hand side of the expression adds up the present value of the net taxes of generations to be born in the future, in year j, again discounted for the base year.

The first sum on the right hand side shows the present value of government purchases in the base year and in later, future, periods: thus G_t gives government purchases in year t. In practice, the category G is wider than the position of payments and benefits on the scale of private goods-public goods would suggest. This is because the budget has numerous components that cannot be broken down per capita due to lack of data.

The second entry of the right hand side of the equation, W, is the government's net wealth, which, if negative, is actually the net national debt.

If we set the left hand side of expression (1) to be constant, the only way to reduce the net payments of currently living generations is by increasing the contributions of future generations: there really are no free lunches, at most the bill will be paid by the descendants.

We define the expressions M_s, and M_j on the left hand side of the equation in the following way:

$$M_s = \sum_{k=s}^{D} T_k P_{k,k-s} u^{k-s}, \tag{2a}$$

and

$$M_j = \nu \sum_{k=0}^{D} T_k P_{k,k+j} u^{k+j}, \tag{2b}$$

where

T_k: net tax in the base year of an average member of the generation aged k;

$P_{k,k+j}$: number of those aged k in year j.

In the expressions (2a) and (2b), T_k is net tax paid by an average member of a given age group aged k still alive in year s or j. Net payments of an age group equal the average net individual payment times the number of people in the age group. Thus in expression (2a) $P_{k,k-s}$ shows the number of people still alive in the year $k–s$ from those aged k in the initial year. Accordingly, $P_{k,k+j}$ in expression (2b) is the number of people in the age group to be born in the future, in year j. Expression (2b) also contains the ν, a correction factor. Its introduction was necessary because M_j/ν only shows how much net tax members of the age group born in year j could expect to pay during their lifetime if the current redistribution system remained unchanged. Future generations, however, have to conform to the intertemporal budget constraint, that is, they have to cover the accumulating deficits, or, in a fortunate case, they can receive the surpluses. Thus, their net taxes have to be adjusted by the ν factor.

Generational accounts are constructed in the following way. In the first step we compute the net tax profile broken down by cohorts for the base year. In this study this year is 1996, since from the available data base this year was closest to 1995, the base year of the international comparison (Kotlikoff and Leibfritz 1999). First, we divided the population into 72 cohorts (because of their smaller number, we combined those aged 71 and older into one group). Thus the net tax profile for the year 1996 is a vector with 72 components. In the next step, we calculate the values of this vector for each additional year, taking into account the hypotheses on economic growth, the discount rate and the mortality rate of the age group. In practice (and in the equation above) the hypothesis concerning growth is built into the so-called relative discount factor together with the discount rate.

For the base year, we counted mid-year population data estimates based on population data of the 1996 and 1997 Hungarian Statistical Yearbook. For population forecast, we used the predictions of Hablicsek (1995). Since that study gives predictions till 2051, and we have a longer time-horizon, after 2051 we assumed that the structure of the population will not change any longer. (A similar solution is applied by Cardarelli, Sefton and Kotlikoff (1999), and Oreopoulos (1999).) The time horizon of the calculation is long, the number of iterations goes up to 105. We extended the prediction until 2100 because from this point the sum of the remaining powers of the relative discount factor is sufficiently small[2].

In this 72x105 matrix we trace each cohort. Because of the limited sample size, the 72 cohorts were collapsed into 16 larger groups in every calculation, in such a way that we created 14 five-year cohorts among those born between 1925 and 1995. The method treats unborn people as a single cohort.

A similar method is used for the calculations of government purchases, with the important exception that in this case we can spare the tiresome work of computing the net tax profiles.

For the calculation of present values, we have to choose an appropriate discount rate. In this study, as we have already indicated in equations (2a) and (2b), we have employed a relative discount factor, that is, one which already contains a growth element, the average annual rate of productivity growth (*g*), as well as the discount rate itself (*r*). Since future government revenues and expenditures are risky, the discount rate has to be higher than the real interest rate of government bonds. At the same time, the volatility of government revenues and expenditures is lower than that of stocks, which justifies using a value between the interest rate of government securities and the yields possible in the stock exchange (Auerbach, Gokhale and Kotlikoff, 1994). For the sake of international comparability, in the base case scenario we set the annual rate of productivity growth at 1.5 percent, and the discount rate at 5 percent. We also performed the usual sensitivity analyses. This is discussed in our paper mentioned above (Gál, Simonovits, Szabó and Tarcali 2000).

Last but not least, for writing the intertemporal budget constraint we also need the government's net wealth (or, indeed, the net national debt).

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[2] For the sake of comparison we note that in most of the country studies the calculations are also made until 2100; the Argentinean analysis covers the longest time period: its authors made calculations until 2200.

3. Net tax profiles, government purchases and national debt in 1996

If we know the future net payments of currently living generations, future government spending, and the value of the national debt, we can calculate the present value of the burden of future generations as well[3].

3.1. Net taxes by age groups

Both on the side of revenues and expenditures, net tax profiles were put together from partial profiles[4]. Of the various forms of taxes and contributions, we could compute an age-profile of personal income tax, social security contributions, unemployment insurance, VAT, excise tax, other taxes related to the maintenance of motor vehicles, and some forms of corporate taxes.

The revenue tax profiles were based on three data sources. The first one consisted of two samples of personal income tax declarations provided by the Tax and Financial Auditing Office (APEH; the Hungarian equivalent of the Internal Revenue Service). One was a 0.45 percent random sample of employer-declarations including 9,631 cases, the other is a 1 percent random sample of self-declarations with 22,867 cases. The second data source is the Household Budget Survey of the Central Statistical Office (KSH). This contains data about the consumption and income sources of 7,531 households. The household sample is representative of the population living in private households, but does not extend to those living in institutional households. Our third source of data is the 1996 Budget Report, which contains the macro-data of each payment item. Besides these, in each part we used several additional analyses and statistical data in order to be able to compare micro- and macro-level data, and to separate items that can or cannot be broken down per capita.

The computation of expenditure profiles is more difficult. The border between private and public goods (M- and G-items) is more blurred, and the central records are less complete and accessible. Moreover, because of the complexity of the benefit system, poll data, such as our most important micro-database, the Household Budget Survey, lack the necessary completeness of detail. We could compute the following partial profiles: child-care benefits, family benefits, health care expenses, sick pay, unemployment benefits, pensions, social

[3]Further details of the know-how of generational accounting can be found in Auerbach, Kotlikoff and Leibfritz (1999), and Cardarelli, Sefton and Kotlikoff (1999).

assistance, education, housing assistance, consumer price subsidy. In the course of computing the partial profiles, again we used several other sources as well. The itemized revenues and expenditures and the macro-amounts broken down per capita are shown in Table 1.

Table 1.

Revenues and expenditures, 1996 (million $)

Revenues		**Expenditures**	
Personal income tax	3,216	Child-care benefits	282
Social security contributions	5,698	Family benefit	626
Unemployment insurance	560	Health care expenses	2,414
VAT and excise tax	4,832	Sick pay	216
Other taxes related to the maintenance of cars	151	Unemployment benefits	545
Corporate taxes	1,280	Pensions	4,395
		Social assistance	289
		Education	1,738
		Housing assistance	415
		Consumer price subsidy	295
Total	15,737	Total	11,216
Non-traceable revenues	4,959	Non-traceable expenditures	10,919
Total consolidated government revenues*	20,695	Total consolidated government expenditures*	22,135

** Without privatization revenues. Source: Government Finance Statistics, Hungary 1991-1997, Ministry of Finance, 1998*

The total net tax profile is computed by combining the partial profiles of revenues and expenditures. Its 1996 development is shown in Table 2. Since the net tax profile was computed as the difference between the average payments of a given age group and the average benefits received, negative values mean that an average member of a given cohort receives more benefits than the payments she or he makes.

Table 2 shows that both genders up to the generation aged 11–15 are net beneficiaries; in this phase of life the generation aged 6–10 receives the greatest net benefits, $ 437 per capita.

[4]The details of computing the net tax profiles have already been published in an earlier paper (see Gál, Simonovits, Szabó and Tarcali, 2000).

Table 2

Net tax profiles by gender and age, 1996 ($)

Age	Men	Women	Total
0	-30	-38	-34
1–5	-267	-267	-267
6–10	-436	-439	-437
11–15	-340	-365	-352
16–20	57	73	65
21–25	1,130	820	979
26–30	1,884	756	1,343
31–35	1,767	662	1,219
36–40	2,153	1,629	1,890
41–45	2,633	2,000	2,312
46–50	2,512	2,049	2,274
51–55	2,221	878	1,511
56–60	366	-946	-364
61–65	-1,559	-1,455	-1,500
66–70	-1,747	-1,425	-1,557
71–X	-1,919	-1,520	-1,660

From here on the amount of net tax payments grows up to the cohort aged 26–30 (in the case of men, in much larger degree, which can be explained partly by the higher wages of men, partly by lost income as well as healthcare benefits of women due to childbirth), then in the generation aged 31–35 we can see a slight break, which is probably caused by concentrated family assistance. This break characteristically distinguishes the Hungarian net tax profile from the French one (see Lévy and Doré 1999).

In the cohorts of 36–40 the difference between the net tax payments of men and women decreases, probably because of growing wages of women who are again becoming active in the workforce after childbirth. Men have the highest net tax payments between 41 and 45 ($ 2,633), women reach their maximum net payments ($ 2049) only a 5-year-cohort later. From these generations on net taxes decrease continuously: for women, net taxes become negative from the age of 56–60, for men the change happens one age group later. Due to the higher old age pensions of men, the magnitude of benefits received from age 66–70 is higher for men than women. In comparison with the French profile, the difference between genders is smaller in Hungary.

Note that the difference between the genders cannot be regarded a measure of the role played by them in society. Women more frequently produce goods and provide services that are not exchanged on the market. Our findings only give information about the difference in productive activities outside the family.

3.2. Government purchases

The G-items, expenditures and revenues that cannot be broken down by individual were calculated from the consolidated balance-sheet of the government. It is shown in Table 3:

Table 3

Calculation of non-traceable government revenues and expenditures (million $)

Revenues		**Expenditures**	
Consolidated government revenues *:	20,695	Consolidated government expenditures*:	22,135
Of this, can be broken down per capita:	15,737	Of this, can be broken down per capita:	11,216
Non-traceable revenues:	4,959	Non-traceable expenditures:	10,919
Total government purchases:	10,919 – 4,959 = 5,960		

** Without privatization revenues. Source: Government Finance Statistics, Hungary 1991–1997. Ministry of Finance, 1998.*

Table 3 shows that the consolidated balance of the budget was $ –1,440 million without privatization revenues and credit operations. We used this balance in our calculations because privatization revenues – due to the limits of the public property that can be privatized – will not be available forever. We would like to take this opportunity to note that although in breaking down the revenues and expenditures of the budget we did not follow the structure of the Budget Report strictly, the above table shows that every item was considered and only once. The net government purchases in 1996 was $ 5,960 million.

The G-items of both revenues and expenditures can be divided into two parts. The first part (let us call it G_1) includes those revenues and expenditures that cannot be broken down per capita, not even in principle. These items are close to the concept of pure public goods. This group includes, for example, the operating expenses of budgetary institutions, defense and police expenses. The second group of items listed under government purchases (G_2) can in principle be traced back to age groups, but due to the current state of social statistics and the lack of the necessary budget records, this cannot be done in practice. This group includes among others local taxes on the population (except for the local corporate tax), duties and tariffs (an important part of government revenues), gambling tax, or agricultural subsidies.

On the whole, we could trace back over three quarters of government revenues to age groups. In the case of expenditures, this ratio is much lower: it is just over half. These differences, however, are not surprising, since revenues can be tied to individuals more easily, and public goods play a more dominant role on the expenditure side.

3.3. The government's wealth

In the model, the government's wealth (denoted by W in equation (1)) has three main components: net national debt, the government's wealth that can be privatized at 1996 prices, and actual privatization income in 1996. Its method of calculation is the following:

W = the part of the government's wealth that can be privatized + privatization income– net national debt.

Substituting real values:

	(million $)
Government's wealth that can be privatized[5]*	4,100
Privatization revenues in 1996**	1,708
Net national debt *	–14,258
Government's wealth (W)	–8,449

**Source: Hungarian National Bank Monthly Report, 1997/2.*

***Source: Government Finance Statistics, Hungary 1991–1997, Ministry of Finance, 1998.*

The volume of the government's wealth considered in our calculations went up to $ –8,449 in 1996. The equation for the intertemporal government budget constraint shows that we reduce the right hand side of the equation by the above amount (in our case, because of the negative sign this means an increase), which is based on the assumption that the government's wealth that can be privatized is fully sold, and the national debt does not increase. These assumptions are in accordance with the methodology of the international research on similar topics, but they require some explanation.

In the case of the government's wealth, we only consider the part that can be privatized because if wealth not meant for privatization also were sold, then later it should to

[5] Mihályi (1998) gives a different figure, $ 4,273 million, for the part of the government's wealth that can be privatized.

be rented, and the present value of the cost of rent cancels out the given property's 1996 value. In this question we again chose the method generally used in generational accounting.

We cannot take into account the value of possible concessions either, since we cannot predict what property items the government will give into concession in the future.

When we reduce the right hand side of the intertemporal budget equation by the amount of the national debt, we assume that growth factor of the national debt is lower than the reciprocal of our relative discount factor. The solution we chose again coincides with what was used in other country studies.

4. The results of generational accounting in Hungary, in international context

With generational account we can isolate the effects of the two most important mechanisms of the intergenerational redistribution process, demographic transition and national debt. We can also estimate the extent of the alternative measures needed to correct the imbalance between generations, that is, increasing tax and cutting expenditures. The next chapter takes up these points in detail.

4.1. Generational accounts

The method of generational accounting was developed in the United States, but its application became international by now. A recently published volume contains calculations for 17 countries (Auerbach, Kotlikoff and Leibfritz, 1999). The data in Table 4 are taken from the chapter summarizing the results of the country studies (Kotlikoff and Leibfritz, 1999). In the table we included countries that appeared most important in terms of comparison with Hungary. This is how we chose Argentina, Brazil and Thailand (where GDP per capita is closest to the Hungarian value), Portugal (which is most similar in terms of its size), Sweden and Germany (where the extent of the welfare state is similar to the Hungarian one), Italy and Japan (which, together with Germany, are similar to Hungary in the expected fast aging of the population) and finally the United States.

Table 4

Generational accounts in 1995 in selected countries (thousand 1995 dollars)

Age in 1995	United States	Japan	Germany	Italy	Sweden	Thailand	Portugal	Argentina	Brazil	Hungary (thousand dollars)*	Hungary (million forints)
80	–89.5	–26.7	–109.6	–72.2	-58.1	1.5	–24.8	-34.3	–14.1	–11.1	–1.7
70	–104.6	–44.8	–180.7	–117.5	-97.8	2.8	–42.7	-43.0	–32.9	–16.6	–2.5
60	–51.7	11.9	–183.6	–142.0	-66.4	4.8	–47.1	-39.9	–28.0	–18.6	–2.8
50	56.4	173.1	–4.2	–46.8	104.6	8.1	–10.6	-11.3	–6.3	0.0	0.0
40	135.6	263.8	160.1	63.4	226.5	11.8	39.7	12.6	19.7	17.5	2.7
30	168.7	297.8	271.8	155.2	278.9	14.1	75.0	28.2	31.3	24.1	3.7
20	159.3	257.4	313.6	186.6	265.1	13.2	82.7	30.8	27.0	23.7	3.6
10	71.4	135.4	179.0	112.4	162.9	8.9	50.9	20.3	17.1	13.9	2.1
0	28.5	73.0	97.1	68.4	121.8	5.9	43.5	13.9	10.2	8.4	1.3
Future	73.9	319.4	248.8	209.9	83.8	–1.5	73.2	24.3	22.1	43.9	6.7
Generational imbalance (%)	159.0	337.8	156.1	223.8	-31.2	–125.4	68.3	74.8	116.7	424.8	424.8

Source: Kotlikoff and Leibfritz (1999) Table 4.2, Hungarian figures are based on our own calculations.
** For Hungary: 1996 dollar; the 80 year-old generation mean everybody over 70.*
Note: Educational expenses are treated as benefits. Other basic assumptions: productivity growth rate 1.5 percent, discount rate 5 percent.

The comparative generational accounts presented in Table 4 are forward-looking, thus they only concern how much individuals will pay and will receive in benefits in the rest of their life. In Hungary, the account of the 70 years old is close to $ -16,600, the 20 years old is $ 23,700.

The individual distributions differ from each other on several points, but a few characteristics are more or less common. The data follow the same pattern in basically all countries. In the case of the oldest, those aged 80, the values are negative, but in absolute terms they are not very large, at least not compared to the 70 years old. This is due the lower life expectancy of the oldest cohort. The accounts of the 70 year-olds are also negative, but, because of their higher life expectancy, their accounts' absolute value is higher. The only exception is Thailand, where even the values calculated for the elderly are positive, because of this country's limited welfare system.

The accounts of the generation aged 60, immediately before (or after) retirement, are in most cases still negative, but their extent can vary, according to the demographic structure of the individual countries. In Hungary the generation enjoying the largest net gain is the 65 years old, not shown in the table, coming somewhat ahead of the groups 60 and 70. In several countries, for example in Italy, the account is still substantially negative even for those aged 50, but in Hungary the accounts of this generation are already balanced. Below 50, the accounts become positive in every country, since the tax burden is much larger. The values for the currently youngest generation (the generations between 0 and 10) go down again because of education and other factors reduce net taxes.

In other words, the accounts support the life-cycle hypothesis. At the beginning of their lives, individuals consume more than their disposable income, in their active period they start saving and their consumption is lower than their income, and then when they are old, their consumption increases again relative to their income using up their savings.

In some countries, especially in Japan, Germany and Italy, the young and the middle-aged face very high net tax payments for the rest of their lives. The situation is especially serious in Japan, where the expected very fast aging of the society is usually cited as the main cause of the problems.

Because of the forward-looking character of the calculation, national accounts can be compared, but generations within a national account cannot. The only exception of this are the accounts of those born now (aged 0 in 1995, or, in Hungary, in 1996) and the generations born in the future. The figures in the last row of Table 4 show how much more net taxes future generations will have to pay compared to those born in 1995. Hungary with its 425 percent imbalance is in the worst position of the countries in Table 4. If we consider all other national accounts as well, only the Norwegian index is less favorable. Japan also has a serious imbalance, where the value of the index is 338 percent, and in Italy, where 224 percent.

The relative generational imbalance, depending to a large extent on the basis, is not a perfect measure. It makes sense to calculate the absolute imbalance as well, that is, the difference between the tax burden of new-born and future generations. Since this measure is distorted by the difference in the purchasing power of the dollar across countries, we have to take the values of GDP adjusted for purchasing power parity. Values expressed in dollars have another drawback: a dollar does not have equal weight in a poorer than in a richer country, say Brazil and Norway, even if we use purchasing power parity. Because of this, Kotlikoff and Leibfritz (1999) re-scaled the absolute index of the imbalance. The difference between predicted taxes of new-born and future generations were calculated for every country on the basis of its per capita GDP, at purchasing power parity, adjusted to the per capita GDP of the United States. In this way, they got an index that expresses how great the generational imbalance would be in dollar terms, if we did not consider the differences in purchasing power. Table 5 presents their results for the countries listed above, supplementing them with Hungarian figures based on our own calculations.

If we filter out the differences in purchasing power across countries, the Hungarian generational imbalance is still very serious, but it does not seem quite that dramatic any more. Although the measure of imbalance in percentages remains the same by definition, the unborn have to pay less than half the tax than their Japanese contemporaries through their lifetimes. The German and Italian values are also higher by nearly one-third than the Hungarian value. However, none of the emerging economies in the table show such a serious burden at the cost of the future as Hungary.

We mention it here, and we will come back to it in Chapter 5, that at the current state of generational accounting, the results of international comparison have to be treated with caution. In addition to the assumptions on economic growth, the interest rate and the discount rate, individual calculations are very sensitive to the procedures employed in calculating the net tax-profile, the method and time-frame of demographic prediction, and in general the state of social statistics in a given country.

Table 5

Scaled generational accounts in 1995 in selected countries (thousand 1995 dollars)

Age in 1995	United States	Japan	Germany	Italy	Sweden	Thailand	Portugal	Argentina	Brazil	Hungary*
80	–89.5	-32.6	-147.3	-98.1	-84.6	5.4	-52.8	-111.4	-70.5	–43.9
70	–104.6	-54.7	-242.9	-159.6	-142.4	10.0	-90.9	-139.6	-164.5	–65.6
60	–51.7	14.5	-246.8	-192.9	-96.7	17.2	-100.2	-129.5	-140.0	–73.5
50	56.4	211.4	-5.6	-63.6	152.3	29.0	-22.6	-36.7	-31.5	0.0
40	135.6	322.1	215.2	86.1	329.7	42.3	84.5	40.9	98.5	69.1
30	168.7	363.6	365.3	210.9	406.0	50.5	159.6	91.6	156.5	24.1
20	159.3	314.3	421.5	253.5	385.9	47.3	176.0	100.0	135.0	95.2
10	71.4	165.3	240.6	152.7	237.1	31.9	108.3	65.9	85.5	54.9
0	28.5	89.1	130.5	92.9	177.3	21.1	92.6	45.1	51.0	33.2
Future	73.9	390.0	334.4	285.2	122.0	-5.4	155.7	78.9	110.5	173.4
Generational imbalance										
Absolute ($)	45.3	300.9	203.9	197.1	-55.3	-26.5	63.2	33.8	59.5	140.2
(%)	159.0	337.8	156.1	223.8	-31.2	–125.4	68.3	74.8	116.7	424.8

Source: Kotlikoff and Leibfritz (1999) Table 4.2, Hungarian figures are based on our own calculations.

** For Hungary: 1996 dollars; the 80 year-old generation mean everybody over 70. Source of the Hungarian per capita GDP at PPP: Business Central Europe December 1997, Statistics Monthly Update.*

Note: Educational expenses were treated as benefits. Other basic assumptions: productivity growth rate 1.5 percent, discount rate 5 percent. Scaling: present values multiplied by the per capita local GDP (at purchasing power parity) / per capita US GDP.

4.2 The impact of the demographic transition and the explicit national debt on generational accounts

Why is there such a large imbalance? In line with the international standards, we separated the impacts of the demographic deficit and the official national debt. We calculated how large the generational imbalance would be if the size of the population, and its composition by gender and age remained unchanged, and what would happen if the net debt of individual countries were zero. The results of the calculations are shown in Table 6.

Table 6

Sources of generational imbalance (%)

Country	Base case scenario	No demographic Changes	Zero national debt
United States	159.0	21.6	96.5
Japan	337.8	77.2	308.6
Germany	156.1	-7.6	80.6
Italy	223.8	18.0	97.6
Sweden	-31.2	-66.9	-44.6
Thailand	-125.4	-174.6	-228.8
Portugal	68.2	24.9	22.0
Argentina	74.8	1.7	41.0
Brazil	116.7	64.1	99.0
Hungary	424.8	118.9	384.0

Note: Educational expenses were treated as benefits. Other basic assumptions: productivity growth rate 1.5 percent, discount rate 5 percent.
Source: Kotlikoff and Leibfritz (1999) Table 4.8, Hungarian figures are based on our own calculations.

The table clearly reveals that demographic factors are to a large extent responsible for the imbalances. The population is aging, and the elderly are net beneficiaries of the tax-transfer systems. If there were no changes in the composition of the population, then in Hungary the generational imbalance would drop from 425 percent (that is a 5.25-times increase) to 119 percent (to a 2.19-times increase). This shows still a substantial imbalance, but significantly less than with the expected demographic deficit. The expected deterioration of the demographic situation is responsible for the significant imbalance elsewhere, too. The generational account of Germany struggling with a serious implicit imbalance for example would turn into a surplus if the current demographic composition did not change.

Reducing the national debt would also improve the situation, but to a much smaller extent. This is due primarily to the assumption of the interest-free nature of the national debt.

If the national debt bore interest in the model, the initial generational accounts would have a lot more deficit. In countries where the ratio of the national debt to the GDP is higher, writing off credits would have a greater impact on generational imbalance.

4.3 Different methods for achieving balance among generations

In accordance with the international practice, we examined four options of achieving generational balance: reducing government purchases, reducing benefits, raising all taxes and finally raising just the income tax. We determined the necessary changes in such a way that the generational accounts of the new-born and future generations should be equal to each other. The results, in international comparison, are presented in Table 7.

Table 7

Different methods for achieving balance among generations (%)

Country	Reduction of government purchases	Reduction of benefits	Increase of all taxes	Increase of Income tax
United States	27.0	20.3	10.8	24.4
Japan	29.5	25.3	15.5	53.6
Germany	25.9	14.1	9.5	29.5
Italy	87.9	40.0	61.4	188.8
Sweden	-8.7	-6.0	-3.1	-8.6
Thailand	-47.7	-114.2	-25.0	-81.8
Portugal	9.8	7.5	4.2	13.3
Argentina	29.1	11.0	8.4	75.7
Brazil	26.2	17.9	11.7	74.0
Hungary	50.5	27.3	20.6	102.0

Note: Educational expenses were treated as benefits. Other basic assumptions: rate of productivity growth 1.5 percent, discount rate 5 percent.
Source: Kotlikoff and Leibfritz (1999) Table 4.9, Hungarian figures are based on our own calculations.

Each of the economic policy options presented in the table guarantee alone the achievement of generational balance, thus a combination of them require smaller changes. Note, that in our calculations we assumed the *immediate* introduction of changes, accordingly, they would affect current and unborn generations equally.

If we try to eliminate the generational imbalance by reducing government purchase, the amount devoted to public goods should be halved in Hungary. If the country followed the other method of reducing costs, and decided to slash benefits, 27 percent of benefits should be immediately sacrificed. If we wanted to maintain both the amount spent on public goods and the current level of benefits, all taxes should be raised on average by 21 percent. If, on the other hand, we wanted to finance the imbalance entirely from a raise in the income tax, current revenues should be doubled. The increase of the income tax needed for achieving generational balance is much faster. In countries where revenues from the income tax constitute a relatively smaller portion of all government revenues, such as Italy, France or Brazil, income tax payments have to be increased by significantly more. For example, in Italy, the amount should almost be tripled.

5. Some technical problems of generational accounting

In an earlier paper (Gál, Simonovits, Szabó and Tarcali, 2000) we reviewed the critiques to the method of generational accounting in detail. Here we only put one argument, which – at the method's current level of development – weakens the international comparability of the results. Namely, it appears that the methodology of calculating the incidence of taxes is far from unified.

The burden of taxes is not necessarily shouldered by those who actually pay them[6]. The favorable effects of a cut in VAT fall to shareholders as well as employees, consumers and suppliers. Similarly, the portion of the social security contribution paid by the employer could not be taken as a payment of the employee as self-evidently as we – in full accord with the international practice – assumed above. Real tax-incidence depends on the price elasticity of the factors of production.

The following example illustrates the consequences of disregarding the problem of tax-incidence. There are different methods for breaking down taxes by age groups, including corporate taxes as well[7]. As for Hungary, we broke down national corporate tax by wages,

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[6] A classic reference on the subject is Pechman (1985).

[7] In generational accounting of Anglo-Saxon countries (for example the British or Canadian calculations, see *Cardarelli, Sefton and Kotlikoff* (1999), *Oreopoulos* (1999)) corporate tax is broken down among individuals in proportion to wages. This method – similarly to the solution that lists social security contribution paid by the employer among the contributions of the employee breaking it down in proportion to wages – also regards the corporate tax a kind of wage-tax. However, if a relatively high proportion of wage earners are employed by the government, that does not pay corporate tax, the method of breaking down taxes by wages bears an implicit assumption. Namely, the age composition of government employees is the same as the age composition of employees of the private sector. *Levy* and *Doré* (1999) broke down the corporate tax by wealth constructing the French generational accounts. This solution suggests that the corporate tax is paid by the owner, thus if eliminated, it would result in a raise in profits rather than wages.

local corporate taxes by the sales-related taxes (VAT and excise tax). We also examined, however, how generational imbalances would change if we treated corporate taxes differently.

In Table 8, we present three scenarios: first, the base case which our calculations are based on. In the second scenario, we break down national corporate tax, as before, in proportion to wages, but local corporate taxes, differing from each other region by region, are listed under the non-traceable *G*-terms. In the third scenario, duties and tariffs are also broken down in proportion to wages, assuming that companies more active in international trade pay higher wages.

Table 8

Changes in generational accounts due to different classifications of corporate taxes

	Case 1	Case 2	Case 3
Net taxes in 1996, million $	4,521	4,072	6,141
Government purchases in 1996, million $	5,960	5,512	7,581
Ratio of the budget deficit to government purchases (%)	24	26	19
Generational imbalance (%)	425	488	326

Case 1: National corporation tax broken down in proportion to wages, local corporate taxes to turnover, duties, tariffs and other corporate taxes are in government purchases.
Case 2: National corporate tax broken down in proportion to wages, duties, tariffs and other corporate taxes are in government purchases.
Case 3: National corporate tax, duties and tariffs broken down in proportion to wages, local corporate tax to turnover, other corporate taxes are in government purchases.

It is obvious that manipulating the list of items that can traced back to age groups does not affect the size of the consolidated budget deficit (which is given by the difference between rows 1 and 2 and made $ -1,440 million). It is also evident that the closer the traceable amount of revenues to the traceable amount of expenditures, the closer the non-traceable revenues to the non-traceable expenditures. If the magnitude of government revenues and expenditures that can be traced back to cohorts are the same, in other words, the government gives everything back to taxpayers as personalized benefits, and spends nothing to providing public goods, the budget deficit will constitute the only part of the non-traceable expenses. Following from the method, this budget deficit is taken into account through the entire period of the calculation, while the payment of the deficit places a greater burden on later generations.

This is illustrated by Table 8. The way we treat different corporate taxes affects the ratio of the budget deficit to the size of government purchases, which also substantially alters the extent of generational imbalance. This applies to the results of the previous section, too, where we described various policy measures, such as slashing expenditures or raising taxes. An international comparison is biased the different methods available for calculating the non-traceable government expenditures. The list of the non-traceables contains very different things, which greatly affects their ratio to the whole budget. This is essential in determining the changes necessary for achieving balance.

Note that the process of tracing government revenues and expenditures back to age groups is not only a matter of international standards. Results largely depend on the quality of social statistics and the central records of a given country, since often these are responsible for the ambiguities.

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