GENERATIONAL ACCOUNTING WITH FEEDBACK EFFECTS ON PRODUCTIVITY GROWTH

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1 Introduction

In many developed countries population ageing and its effects on government finance are now a major policy issue. Expenditures on public pensions, social security and health care will undergo significant changes when the post-war baby boom generations enter their retirement age. Usually, a government's financial situation is monitored by budget deficit and public debt. However, this gives just a picture at a moment in time, and is vulnerable to year-to-year changes in accounting procedures. In issues concerning demographic change a more long-term view is required. One of the tools to analyse the impact of demographic change on public finance that meets this requirement is generational accounting. In addition to the 'traditional' debt and deficit measures, generational accounting can be applied as a comprehensive methodology to express future cost and benefits of the government[1]. An important application of generational accounting consists of subdividing future net transfers into net transfers received by currently living generations and net transfers received by future generations. This makes it possible to estimate how much future generations, which are not born yet, may be expected to

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1 See, for example, Auerbach, Gokhale and Kotlikoff (1991, 1992, 1994), Kotlikoff (1992), and Auerbach, Gokhale and Leibfritz (1999).

receive in net transfers from the government. This estimate can be made provided fiscal policy for current generations may be forecasted based on current policies, and provided the intertemporal budget constraint is satisfied. If generational accounting predicts that future generations' net receipts are lower than current generations' net receipts, fiscal policy will have to be adjusted eventually. In that case, the current fiscal system is not sustainable in the long run, for present fiscal rules concerning taxes and transfers have to be adjusted towards lower net benefits for future generations. This unsustainability may be caused by demographic changes, as well as the current level of public debt[2].

A crucial aspect of generational accounting concerns the assumed development of fiscal rules for current generations. These rules are assumed to remain unchanged, except for an adjustment to per capita income growth. The present study also makes this assumption, but it departs from comparable studies by adding a scenario in which the rate of productivity growth is not constant. Feedback mechanisms are included, which allow for effects of fiscal policy on productivity growth. One of the objectives of this paper is to analyse how varying endogenous rates of productivity growth can be introduced in a generational accounting model and show how large the impact of endogenous growth effects could probably be. In addition, the analysis gives updated forecasts of generational inequality in the Netherlands.

In many aspects this paper is strongly related to a previous paper on the same issue (Hebbink, 1997a). However, the current version uses an updated dataset, including renewed and more detailed population forecasts, and public finance data from the most recent (1998) National Accounts for the Netherlands. In addition, this paper presents forecasts for budget deficit and public debt, calculated with the generational accounting model. These forecasts have a sounder basis than the usual type of deficit and debt forecasts, which are based on straightforward extrapolations, given assumptions on inflation, interest rate and growth rate. Compared to the methodology for the usual type of deficit and debt

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2 Generational accounts have been constructed for many countries. Recent overviews are Kotlikoff and Raffelhüschen (1999), and Auerbach a.o. (1999). Several organisations have constructed generational accounts for the Netherlands, for example the Nederlandsche Bank (Hebbink, 1997a, 1997b), and CPB Netherlands Bureau for Economic Policy Analysis (Ter Rele, 1998).

forecasts, generational accounting allows for the effect of demographic changes on specific components of the government budget.

In the next section the baseline generational accounting model is presented. Special attention is given to the incorporation of variable growth rates of labour productivity and population, which is the main difference with other applications of the generational accounting model. Section 3 presents the results of calculations with the baseline model. The model is extended in section 4, where per capita growth rates are endogenised. As usual, generational accounting results are given by net taxes per capita for current and future generations, with the difference between the two generations expressed in terms of percentage points of lifetime income levels. In addition, here, the results of both versions of the generational accounting model – the baseline, and the baseline including feedback effects – are also presented in terms of forecasts of budget surplus and public debt in proportion to GDP. A summary and conclusions are given in the final section.

2 The intertemporal budget constraint and net taxes

Generational accounts are an expression of the government's intertemporal budget constraint. This constraint requires that in current value the balance of future expenditures and tax receipt exactly equal current government debt. Since this section mainly consists of a formal description of the generational accounting model that is used in this paper, it is useful to start with a brief explanation of the applied symbols.

G_s	government spending less transfers and age-related spending, in period s
W_t	net government assets, in period t
$T_{s,k}$	taxes per capita less transfers and age-related government spending, in period s, for generations born in k
$T'_{s,k}$	net taxes per capita; i.e., taxes less transfers, age-related government spending and other government spending per capita, in period s, for generations born in k
$N_{s,k}$	population, in period s, of generations born in k
R	discount rate
$P_{t,k}$	current value of net taxes in period t of generations born in k

S_t	residual of government assets and net taxes of current generations
y_t	labour productivity growth (defined as growth rate of GDP per capita)
d	maximum lifetime
n_t	population growth rate

For the purpose of generational accounting the intertemporal budget constraint is respecified, with taxes given separately for each generation. All taxes are net of transfers from the government. Additionally, age-related benefits other than transfers – like education and health care – are deducted from taxes.

$$W_t + \sum_{s=t}^{\infty} \left\{ (1+R)^{t-s} \sum_{k=s-d}^{s} T_{s,k} N_{s,k} - G_s \right\} = 0 \qquad (1)$$

The part of government spending that is not attributable to specific age groups (G_s) is distributed uniformly across generations[3]. Hence, net taxes are defined as $T'_{,k} = T_{,k} - \frac{G}{N}$.

Alternatively, the budget constraint (1) can be rewritten to an equivalent version in which a distinction is made between net taxes of current generations and net taxes of future generations:

$$W_t + \sum_{u=-d}^{0} P_{t,t+u} + \sum_{u=1}^{\infty} P_{t,t+u} = 0, \qquad (2)$$

with $P_{t,t+u}$ the current value in t of lifetime net taxes of a complete generation, defined as

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3 This is mainly a matter of choice. In Hebbink (1997b) not all government expenditures are treated as benefits. This only affects the level of net taxes, but not the difference between current and future generations.

$$P_{t,t+u} = \sum_{s=\max\{t,t+u\}}^{t+u+d} (1+R)^{t-s} \, T'_{s,t+u} \;\; N_{s,t+u} \; . \tag{3}$$

Equation (3) will be applied to determine intergenerational inequality between current and future generations. In order to compare net taxes over complete lifetimes, current generations will be represented by the newborn generation.

Net taxes of current generations, i.e., of the currently living population, are calculated by extrapolation of observed net taxes in base-year *t*. Accordingly, per capita net taxes are assumed to increase with the growth rate of labour productivity (GDP per capita), *y*:

$$T'_{s,k} \;=\; T'_{t,t-s+k} \prod_{a=t+1}^{s} (1+y_a) \tag{4}$$

A similar assumption is made for the development over time of the age-independent part of government spending. The growth rate of *G* is equal to the product of labour productivity growth and total population growth, *n*:

$$G_s \;=\; G_t \prod_{a=t+1}^{s} (1+y_a)(1+n_a) \tag{5}$$

Of the remaining variables, population growth of each generation and, therefore, total population growth are based on exogenous forecasts. Other exogenous variables are *R* and *y*, although in Section 4 per capita growth will be made endogenous.

From the budget constraint (2), the third term can be determined residually, when W_t is known and the second term is calculated according to the previous section. This residual consists of total net taxes of all future generations discounted to the base-year. Given a value for the residual, it is possible to calculate per capita net taxes in the future and compare them to those of the newly born generation $\left(P_{t,t}/N_{t,t}\right)$. Usually, generational accounting studies present net taxes of an average future generation, assuming a flat age-net taxes profile, adjusted each year for future economic growth. Implicitly, this also assumes a flat age distribution of the population. In the present study, however, per capita tax rates by age group are variable over time but remain unchanged relative to other age groups. Also, this study allows for different and not necessarily constant sizes of age groups. These two modifications make the analysis more consistent, since population projections that are used for current generations are the same as those for future generations. In addition, it is possible now to allow for variations in labour productivity growth, which is required, since this will become an endogenous variable in subsequent sections.

To find per capita lifetime net taxes of individuals from next year's generation, the value of $P_{t,t+1}$ must be calculated. According to the budget constraint, per capita net tax rates in period $t + 1$ can be calculated from the residual of current government assets and net taxes of current generations, i.e., the third term in (2). Defining S_t as the value of the third term in (2), and using (3), (4) and (5), it is straightforward to express $P_{t,t+1}$ in terms of S_t , future populations, productivity growth and current tax rates:

$$P_{t,t+1} = S_t \cdot \frac{\sum_{s=t+1}^{t+1+d} \left\{ \prod_{k=t+2}^{s} \frac{1+y_k}{1+R} \cdot N_{s,t+1} T'_{t,t-[s-(t+1)]} \right\}}{\sum_{u=t+1}^{\infty} \sum_{s=u}^{u+d} \left\{ \prod_{k=t+2}^{s} \frac{1+y_k}{1+R} \cdot N_{s,u} T'_{t,t-(s-u)} \right\}} \tag{6}$$

Since S_t is observable, the value of (6) can be calculated if demographic forecasts and a time-path of y are available. It is important to note that this formulation makes it possible to calculate the effects on generational accounts of alternative growth paths, where growth rates may vary over time. Also, the demographic structure of future populations is allowed to change over time. Other studies implicitly assume that y_k, n_k, $N_{s,k}$ and $T'_{s,k}$ are independent of k, in which case it is straightforward to find [4]

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4 Under the condition $(1+y)(1+n) < 1+R$.

$$P_{t,t+1} = S_t \cdot \left[1 - (1+y)(1+n)/(1+R)\right] \quad (7)$$

To complete the calculations, lifetime net taxes of next year's generation in per capita terms are equal to $P_{t,t+1}$ divided by $N_{t+1,t+1}$. The value that is found can be compared to current generation's per capita net taxes, $P_{t,t}/N_{t,t}$, after an adjustment for productivity growth is made.

3 Results of baseline projections

Generational inequality is defined as a difference between projected net taxes of the new-born generation and net taxes of future generations that are necessary for intertemporal budgetary equilibrium. In the previous section, it is shown how both levels of net taxes can be calculated. This section reports on results of calculations for the Netherlands and starts with a brief background on the data that are applied.

3.1 Data and construction of age profiles of net taxes

Net tax rates are calculated for five-year age groups, in the years 1990-1995. Taxes and benefits of the entire public sector are included, using data from National Accounts 1998, which are based on ESR 1995 methodology. Separate age profiles of various tax and benefit categories are constructed, including direct and indirect taxes, public pensions, unemployment, disability and other benefits, education expenditure, costs of health care and cost of care for elderly. Remaining government expenditures are distributed uniformly, independent of age. The resulting age-profile of net taxes is hump-shaped, with younger and older ages as net receivers of government expenditure and the middle aged paying more in taxes than receiving from benefits and other expenditures. Net government assets include gross public debt, physical capital stock and natural resources.

Population forecasts are obtained from official sources, mainly for the purpose of comparability with other studies. Netherlands Statistics produces three sets of forecasts, of which the medium scenario is applied here (CBS, December 1998). In this scenario total population in the Netherlands rises from 16 million in the first years of this century to about 17.5 million in 2035. In the years between 2035 and 2050, population growth is expected to decrease slightly, mainly due to a higher death rate. The share of population above 65 years will increase mainly between the years 2010 and 2040. Since the time horizon of the generational accounting model extends far beyond 2050, it is assumed that size and age structure of the population do not change after 2050.

3.2 Generational accounts with baseline projections

The baseline scenario is defined by the absence of any change in fiscal policy, and the absence of any feedback effects or interactions between projected developments of demographic, fiscal and other economic variables. Apart from budgetary and demographic variables, two additional variables require a value, the rates of real interest and labour productivity growth. Four combinations of assumed values for interest rate and productivity growth are used here. Three of these are from consistent scenarios of the Dutch economy, as presented by CPB Netherlands Bureau of Economic Policy Analysis (CPB, 1996). The fourth is effectively our baseline scenario, with values for real interest rate and productivity growth that are used in many other studies. Table 1 presents net taxes of newborn and future generations in the base year.

It appears that the results of four different scenarios all point in the same direction. If sustainability is required, future generations will have to pay a positive amount of lifetime net taxes to the government. Instead of the current (new-born) generation in the base year, who receive net benefits of about NLG 136 thousand, future generations have to pay on average about NLG 3 thousand. The difference, NLG 139 thousand, amounts to 10.1%-points of lifetime income.

3.3 Traditional indicators of fiscal sustainability

Generational accounts originally were meant to replace the budget deficit and public sector debt, which for various reasons were considered inferior measures of fiscal sustainability. For reasons of comparison, the same model that is used to calculate generational accounts is applied here to calculate additional forecasts of the two 'traditional' measures of public finance. Forecasts of budget deficit and public debt are essential components of generational accounts, which

Table 1. Generational accounts in four scenarios for the Dutch economy

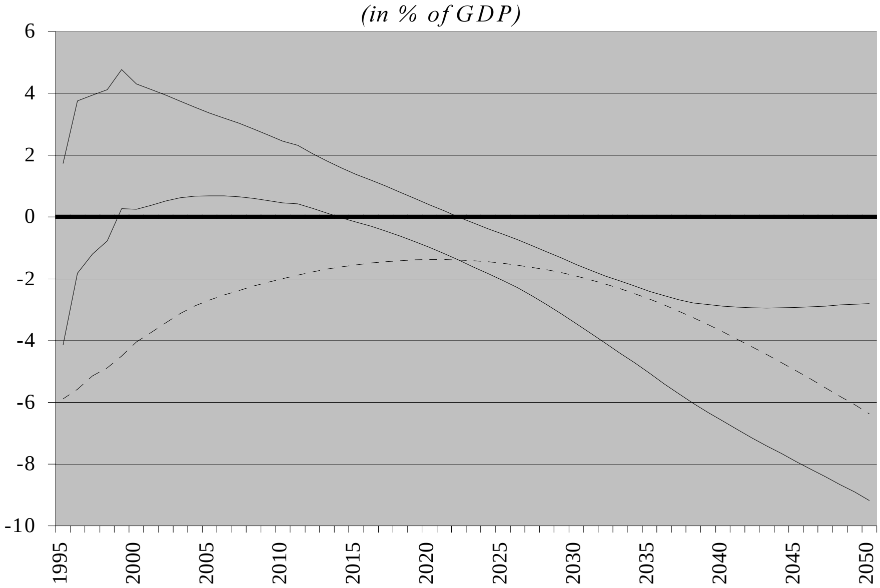
			Net taxes per capita		
Scenario	Real interest rate (%)	Product-ivity growth (%)	Current generation (NLG 1000)	Future generation (NLG 1000)	Difference (% of lifetime income)
Divided Europe	3.4	1.2	-142	-1	10.4
European Co-ordination	3.5	1.8	-135	7	9.4
Global Competition	4.6	2.4	-135	1	10.6
Baseline scenario	4.0	2.0	-136	3	10.1

Explanation: The first three scenarios are based on consistent scenarios from CPB (1996). Added is the baseline scenario. Net taxes of future generations are discounted to the base year and adjusted for productivity growth. All values are in real terms.

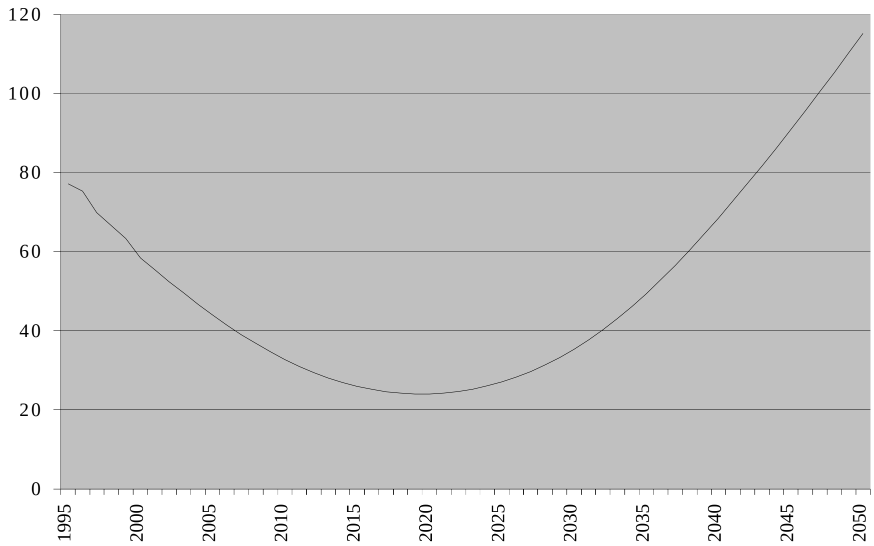
means that each scenario of generational accounting implicitly contains a forecast of deficit and debt. These forecasts have a sounder basis than the usual forecasts based on extrapolating primary deficit, interest payments and debt, given assumptions on inflation, interest rate and growth, because generational accounting allows for the effect of demographic changes on specific aspects of the budget.

Figures 1a and 1b show the development of budget surplus and public debt, both in terms of gdp. The assumed rate of inflation is 2% per year, over the entire forecast horizon. It appears that the budget surplus remains slightly positive over the next twelve years. After that period, the deficit increases to about 9% of gdp in 2050. The debt ratio decreases to a level just above 20% of gdp in 2020, when it starts to increase again, to more than 100% in the middle of the century.

Graph 1a. Budget surplus and interest payments in baseline scenario
(in % of GDP)



Graph 1b. Debt ratio in baseline scenario
(in % GDP)



4 Endogenous productivity growth

As might be inferred from Table 1, results of generational accounting are sensitive to the assumed rate of growth of labour productivity. This reinforces the need for a model that captures the influence of growth as comprehensively as possible. In this section, the assumption of a constant and exogenous labour productivity growth rate is relaxed. A feedback mechanism is explored, related to recent results on endogenous growth theory. Obviously, the choice which variables influence productivity growth in the present study is limited by the available variables in the generational accounting model.

In the empirical literature, many relationships between productivity growth and other macroeconomic variables are investigated, both using cross-section and time-series data. However, the sensitivity analysis of Levine and Renelt (1992) finds that only very few economic variables are robustly correlated with cross-country growth rates. One of these variables is the share of investment in GDP, with on average a coefficient between 0.15 and 0.20. The impact of physical capital on output is still widely discussed, with renewed interest due to studies on endogenous growth theory. Research on the impact of public capital on productivity was initiated by Aschauer (1989, 1990) and Munnell (1992a, 1992b). According to a recent overview by Sturm (1997) early studies on the output elasticity of public capital find results around a value of 0.3. Those studies, largely based on analysis of production functions, were followed by cost function approaches. All of these conclude that public capital reduces private sector costs, and find an output elasticity of approximately 0.15. However, a US time series study comparing different estimation approaches does not find conclusive results (Vijverberg, a.o., 1997). These empirical results suggest including the following relationship in the generational accounting model:

$$\Delta y = i\,\Delta(I/Y) \tag{8}$$

where I is investment and Y is GDP. This relationship will be used to extend the baseline scenario, to allow for an endogenous effect of investment on growth. As will be shown, a feedback mechanism like this has small effects on intergenerational inequality. However, combined with a budgetary neutral policy shifting expenditure on public benefits to public investment, the inclusion of an equation like (8) appears to have a substantial impact on the results.

Since generational accounting does not include private investments, only an effect of public investments on GDP is assumed. Initially, it is assumed that the share of government investment (I_{gov}) in total government expenditure remains constant. In that case

$$\Delta y = i\ (I_{gov}/G)\ \Delta(G/Y) \quad (9)$$

In (9) productivity growth is related to a variable which time path is predicted by the model. In the baseline (average) scenario, with 2% productivity growth and a 4% interest rate, the share of government expenditure increases from 40% of GDP in 2000 to 43% of GDP in 2050. This increase is largely determined by demographic developments. The share of investment in government expenditure is around 3%. With coefficient *i* at a value of 0.2, it appears that productivity growth increases slightly to a long-term value of 2.1%. Line 2 in Table 2 shows that the results of generational accounting are affected only marginally. A slightly larger effect is found when *i* is put at 0.4, which is Sturm's (1997)

Table 2. Generational accounts with feedback effect of investment

	Net taxes per capita			
	Current generation (NLG 1000)	Future generation (NLG 1000)	Difference (% of income)	Lifetime income (base year)
1 Baseline	-136	3	10.1	1381
2 Growth, *i*=0.2	-136	4	10.1	1383
3 Growth, *i*=0.4	-136	4	10.1	1386

Explanation: Net taxes of future generations discounted to base year and adjusted for productivity growth. All values are in real terms. Real interest rate: 4%; growth per capita: 2%. The fourth column gives the difference in %-points of the net tax share in lifetime income of future and current generations. Line 1: fourth scenario in Table 1. Line 2: growth is linked to investment, according to equation (8) with i=0.2. Line 3: as line 2 with i=0.4.

estimate for the Dutch sheltered sector, evaluated in the year 1993. The final column in Table 2 indicates the impact of higher growth rates on lifetime income5. It might be remarked that a final comparison among scenarios and policy variations should not only take intergenerational inequality into account, but also any difference in welfare levels. In the present study, however, most scenarios with lower inequality are characterised by higher income levels.

Table 3. Generational accounts with feedback effect of investment and shift from transfers to investment

	Net taxes per capita			
	Current generation (NLG 1000)	Future generation (NLG 1000)	Difference (% of income)	Lifetime income (base year)
1 Baseline	-136	3	10.1	1381
2 Policy, direct	-134	-3	9.5	1381
3 Policy, *i*=0.2	-121	-1	7.9	1518
4 Policy, *i*=0.4	-112	0	6.9	1619

Explanation: Net taxes of future generations discounted to base year and adjusted for productivity growth. All values are in real terms. Real interest rate: 4%; growth per capita: 2%. The fourth column gives the difference in %-points of the net tax share in lifetime income of future and current generations. Line 1: fourth scenario in Table 1. Line 2: growth of transfers is reduced by 1 percentage-point each year 2001-2010, adding the resulting budgetary surplus to public investment; no additional income effects from investment. Line 3: in addition to line 2, growth increases according to equation (8), with i=0.2. Line 4: as line 3, with i=0.4.

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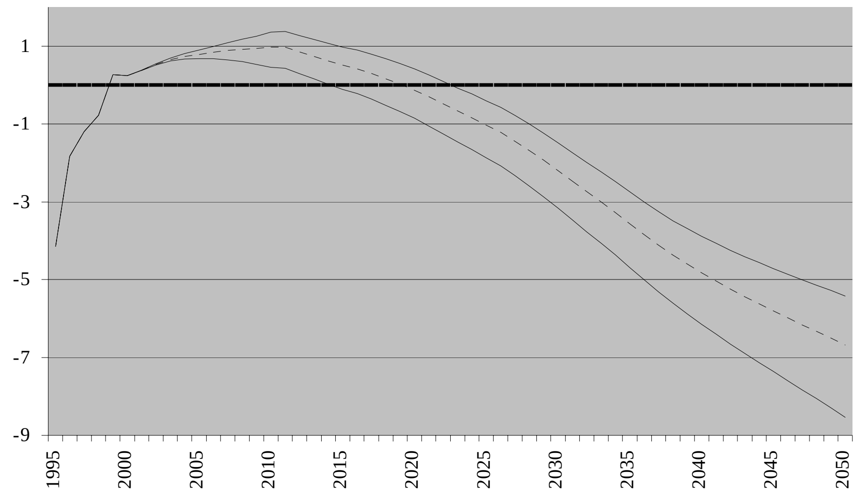
[5] Based on net national income per capita and a life expectancy of 77 year.

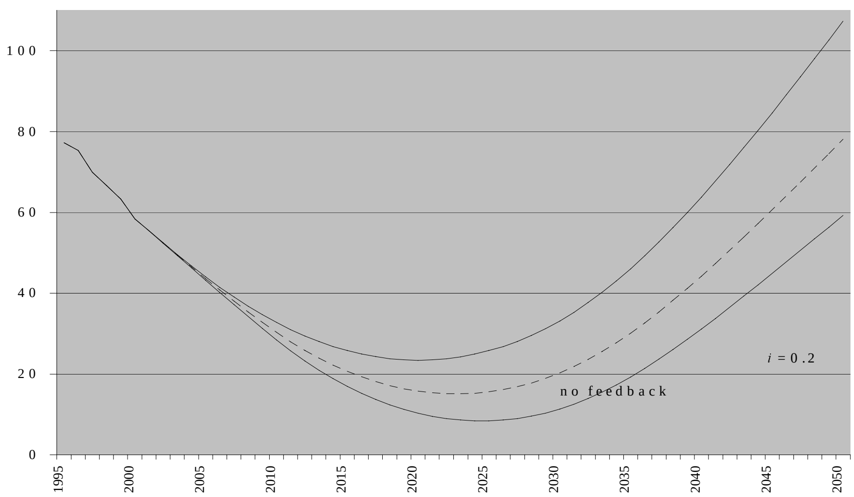
Next, a policy change is introduced, aimed at increasing growth through higher public investment. So as to not affect budget deficits and the size of the public sector, this policy is financed by lower public benefits. In the baseline model, expenditure on benefits increases with general productivity growth and with population growth. Since population growth is not uniform across age groups, this increase of public benefits takes place at a varying rate. The policy change consists of one percentage-point lower per capita growth rates of age-dependent benefits, between 2000 and 2010. At the same time the savings of this policy are shifted to public investment which increases from 3% of gdp in 2000 to 5.8% of gdp in 2010. As can be seen from line 2 in Table 3, without considering extra growth effects here, this policy reduces intergenerational inequality by 0.6%-point of lifetime income. This direct reduction is due to the fact that age-dependent benefits are collected by selected age groups, whereas public investment benefits the entire population equally. In addition, higher investment is assumed to increase per capita growth. According to equation (8), with i equal to 0.2, growth increases to 2.5% in 2050. Line 3 shows that higher growth through increased public investment without affecting the total budget, considerably affects the difference between generations. Still larger are the effects when a value of i=0.4 is assumed, as can be seen in line 4 of Table 3. In this case labour productivity growth rises to a stable value of 2.8%.

For illustration only, Figures 2a and 2b give the forecasted budget surplus and debt ratio for scenarios 2, 3, and 4 in Table 3. Obviously, the scenario without feedback effect is identical to the scenario in figure 1, since the assumed type of policy is budget neutral. With feedback effects included, the budget surplus remains positive until 2020 or 2023, and falls only to a level that is 2 or 3 percentage points above the baseline level. The debt to GDP ratio may fall to a level of 8.5% of GDP (i=0.4) or 15% of GDP (i=0.2), compared to 23.5% of GDP in the case without feedback effects. In fact, over the entire forecast horizon, the debt rate may stay below the 60% GDP level. Like the generational accounting results in Table 3, these graphs show how government investments may increase fiscal sustainability if there is an endogenous effect on labour productivity growth.

Graph 2a. Budget surplus with investment policy in 2001-2010, for different values of feedback parameter
(in % GDP)



Graph 2b. Debt ratio with investment policy in 2001-2010, for different values of feedback parameter
(in % GDP)



5 Conclusions

The government's financial situation is usually monitored by budget deficit and public debt. However, these measures give just a picture at a moment in time, and are vulnerable to year-to-year changes in accounting procedures. In issues concerning demographic change a long-term view is required. One of the tools to analyse the impact of demographic change on public finance that meets this requirement is generational accounting. In addition to the 'traditional' debt and deficit measures, generational accounting can be applied as a comprehensive methodology to express future cost and benefits of the government. In the case where generational accounting predicts that future generations' net receipts are lower than current generations' net receipts, fiscal policy will have to be adjusted eventually. In other words, the current fiscal system is not sustainable in the long run, for present fiscal rules concerning taxes and transfers have to be adjusted towards lower net benefits for future generations. This unsustainability may be caused by demographic changes, as well as the current level of public debt.

This study departs from comparable studies in the literature, where it is usual to presuppose that productivity growth does not change in the future. This is a convenient assumption, but it is not supported by empirical studies on endogenous growth. Therefore, a feedback mechanism is included here, which allows for effects of fiscal policy on productivity growth. In the baseline scenario, based on fixed per capita growth rate of 2%, future generations are expected to pay the public sector a net amount of about 3 thousand guilders over their lifetime. Compared to the newborn generation, which is expected to receive a net amount of 136 thousand guilders, this is a sizeable difference, equal to 10.1% of current lifetime income. Introduction of a positive correlation between public investment and productivity growth does not change much in the results of the baseline scenario. Combined with a policy that shifts expenditure on transfers to investment, it significantly decreases the difference in net taxes of future and current generations. Shifting one percentage point of the yearly growth of transfers to investment in the next ten years, could reduce intergenerational inequality from 10.1% to 6.9% of lifetime income.

For reasons of comparison, the generational accounting model is applied here to calculate additional forecasts of two 'traditional' measures of public finance: budget deficit and public debt. These variables are essential components of generational accounts, which means that each scenario of generational accounting implicitly contains a forecast of deficit and debt. These forecasts have a sounder basis than the usual forecasts based on extrapolating primary deficit, interest payments and debt, given assumptions on inflation, interest rate and growth, because generational accounting allows for the effect of demographic changes on specific aspects of the budget. It appears that the budget surplus remains slightly positive over the next twelve years. After that period, the deficit increases to about 9% of GDP in 2050. The debt ratio decreases to a level just above 20% of GDP in 2020, when it starts to increase again, to more than 100% in the middle of the century. In the case of a budget neutral policy to reduce generational inequality combined with feedback effects on productivity growth, however, the debt rate may stay well below the 60% of GDP level over the entire forecast horizon, although this depends on the assumed size of the feedback parameter. Like the generational accounting results, the deficit and debt forecasts show how government investments may increase fiscal sustainability if there is an endogenous effect on labour productivity growth.

Without additional policy, in all scenarios and policy variations studied here, an unsustainable fiscal system emerges. Future generations may expect to pay a net amount of taxes to the government, whereas current generations are net receivers of government benefits. Additional forecasts of budget deficit and debt to GDP ratios – based on the generational accounting model – in the long run also result in an unsustainable situation. The extension of the model with a feedback effect from public investment to productivity growth indicates that policy changes to reduce inequality between generations may be reinforced by higher productivity growth.

REFERENCES

Aschauer, D.A. (1989), "Is public expenditure productive?", *Journal of Monetary Economics,* No. 23, pp. 177-200.

____________ (1990), "Is government spending stimulative?", *Contemporary Policy Issues*, No.8 (4), pp. 30-46.

Auerbach, A.J., J. Gokhale and L.J. Kotlikoff (1991), "Generational accounts: A meaningful alternative to deficit accounting", in D. Bradford (ed.), *Tax Policy and the Economy*, Vol. 5, Cambridge, Mass., MIT Press, pp. 55-110.

____ (1992), "Generational accounting: A new approach to understanding the effects of fiscal policy on saving", *Scandinavian Journal of Economics*, No. 94, pp. 303-18.

____ (1994), "Generational accounting: a meaningful way to assess generational policy", *Journal of Economic Perspectives*, Vol. 8, No. 1, pp. 74-94.

Auerbach, A.J., L.J. Kotlikoff and W. Leibfritz (eds.) (1999), *Generational Accounting around the World*, Chicago, University of Chicago Press.

CBS (1998), "Bevolkingsprognose 1998-2050", *Statistisch Bulletin*, No 49, 17 December, pp. 14-5.

CPB (1996), "Omgevingsscenario's lange termijn verkenning 1995-2020", *Werkdocument*, No. 89, Den Haag, Centraal Planbureau.

Hebbink, G.E. (1997a), "Generational accounting with feedback effects on productivity growth: an application to the public sector of the Netherlands", *Research Memorandum WO&E*, No. 506, Amsterdam, De Nederlandsche Bank.

____________ (1997b), "De overheidslasten voor toekomstige generaties in Nederland (The fiscal burden of future generations in the Netherlands)", *Openbare Uitgaven*, No. 2, pp. 65-73.

Kotlikoff, L.J. (1992), *Generational Accounting - Knowing who pays, and when, for what we spend*, New York, The Free Press.

Kotlikoff, L.J. and B. Raffelhüschen (1999), "Generational accounting around the globe", American Economic Association, Papers and Proceedings, pp. 161-66.

Levine, R. and D. Renelt (1992), "A sensitivity analysis of cross-country growth regressions", *American Economic Review*, Vol. 82, No. 4, pp. 942-63.

Munnell, A.H. (1992a), "Why has productivity growth declined? Productivity and public investment", *New England Economic Review*, pp. 11-32.

____________ (1992b), "Policy watch: Infrastructure investment and economic growth", *Journal of Economic Perspectives*, No. 6, pp. 189-98.

Rele, H. ter (1998), "Generational accounts for the Dutch public sector", *De Economist*, No. 146, pp. 555-84.

Sturm, J. (1997), "The impact of public infrastructure capital on the private sector of the Netherlands", *Research Memorandum*, No. 133, Den Haag, Centraal Planbureau.

Vijverberg, W.P.M., C.C. Vijverberg and J.L. Gamble (1997), "Public capital and private productivity", *Review of Economics and Statistics*, Vol. 79, No. 2, pp. 267-78.