Intergenerational redistribution through the public sector –

Methodology of generational accounting and its empirical application to Germany

Stephan Boll

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Deutsche Bundesbank, Wilhelm-Epstein-Strasse 14, 60431 Frankfurt am Main,
P.O.B. 10 06 02, 60006 Frankfurt am Main, Federal Republic of Germany

Telephone (0 69) 95 66-1
Telex within Germany 4 1 227, telex from abroad 4 14 431, fax (0 69) 5 60 10 71

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Summary

As a rule, the public sector's situation is assessed by means of the annual budget deficit and the level of government debt, and the same applies in connection with European monetary union. However, both criteria have been criticised for a long time as they take insufficient account of long-term trends in and burdens on the public sector resulting, for example, from a changing population structure. Even if budgets are balanced, a shift in public financial burdens on to future tax payers can occur; this is obvious in the case of pension insurance schemes which are financed on a pay-as-you-go principle. In the light of this criticism of conventional fiscal indicators, intergenerational cost calculations were drawn up for the first time at the beginning of the nineties and later applied to different countries. These "generational accounting" calculations are an attempt to capture future public expenditure and revenue trends, with an intertemporal public budget constraint being imposed as a precondition of long-term payment equalisation. The implications of long-term payment equalisation for the individual burdens to be borne by present and future tax payers, finally, shed light on the extent to which current fiscal policy will lead to a redistribution between the generations.

The application of generational accounting to Germany, which is documented and discussed in detail in this paper in view of the underlying assumptions and sources of data used, shows that the public sector's current transfer, taxation and expenditure policy is not sustainable. Continuing this policy is incompatible with observing the intertemporal public budget constraint. Tax and contribution burdens on economic agents will have to increase considerably if transfers and other public expenditure are maintained under *status quo* conditions. Intergenerational redistributions will occur, with the nature and timing of the necessary fiscal adjustments determining the pattern of burden distribution between the generations. If future generations had to bear the entire adjustment burden, they would have to bear a burden which is approximately 40 % heavier than that of present generations. With its current policy the public sector is running up a liability in terms of the future which far exceeds the level of the published public debt. The longer the necessary adjustment measures are postponed, the more effort will be necessary to repay this debt. Apart from the adverse macroeconomic effects of an increasing burden of levies, shifting financial burdens on to future generations has very serious implications for capital supply trends and thus for future growth potential. Budgetary discipline is therefore imperative, and, indeed, it will have to be undertaken on a far larger scale than a look at public deficits and debt levels would suggest.

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a	Index of an economic agent's age
α	Percentage of future gross domestic product needed each year to close the sustainability gap
BIP_s	Gross domestic product in year s
β	Ratio of generational accounts of newborn males to females in base year t
D	Maximum age included
$E^i_{t,t}$	Net lifetime income of the newborn generation (i)
g	Annual productivity growth rate
G_s	Public expenditure excluding transfers in the year s
$GK^{i,j}_{t,k}$	Present value in t of all present and future net tax payments (generational account) of an economic agent (i, j) born in k
$h^{i,j}_{a,z,s}$	Real amount of payment type z (tax: +; transfer: -) of an economic agent (i, j) aged a in year s
$H^j_{z,t}$	Aggregate value of the payment type z in year t in region j
i	Index of an economic agent's sex. m: male; f: female
j	Index of regional domicile of an economic agent. w: western Germany; o: eastern Germany
k	Index of a generation's year of birth
n	Maximum possible growth rate of net lifetime incomes
$N^{i,j}_{t,k}$	Overall burden (as a present value in t) of the generation (i, j) born in k
$P^{i,j}_{s,k}$	Number of members of the generation (i, j) born in year k still alive in year s
r	Real interest rate, discounting factor
$R^{i,j}_{a,z}$	Burden on an economic agent (i, j) aged a in year t from payment type z, relative to the burden to be borne by a 40-year-old man from the same payment type
s	Index of time

s*	Year in which the economic adjustment of eastern Germany to western Germany will be completed
SG_t	Sustainability gap of fiscal policy in the base year
t	Base year of the analysis
T	Last year included in the calculations
$\tau^i_{t,t}$	Lifetime tax rate of the newborn generation (i).
Φ	Intergenerational burden ratio. Ratio of burdens to be borne by future economic agents to those of newborn economic agents
W_t	Public net wealth in year t
$y^{i,j}_{s,t}$	Gross labour income in year s of an economic agent (i, j) born in s
$Y^i_{t,t}$	Gross lifetime income of the newborn generation (i)
z	Index of payment types included (tax, contribution or transfer)

Intergenerational redistribution through the public sector - Methodology of generational accounting and its empirical application to Germany*

I. Introduction

A country's public sector fiscal situation may interfere with its economic development if expenditure is financed to an excessive degree by deficits. Rising levels of public debt impose a burden on the capital market, servicing the resulting debt restricts fiscal policy makers' room for manœuvre and imposes an increasing tax burden on private economic agents. However, government annual deficits and the level of accumulated public debt, which (also according to the Maastricht Treaty) are used to assess the public sector fiscal position, provide extremely inadequate information on future budgetary risks. The shift in public financing burdens on to future generations, in particular, is not fully covered by means of the fiscal deficit; the level of public debt merely includes explicit, securitised debt whereas, for example, economic agents' statutory benefit claims on the government are not included. These problems have been manifest for some time in the area of social security systems. If a country's system of old age provision is financed on a pay-as-you-go basis, the pattern of its financial position crucially hinges on demographic developments and the employment trend. In most industrial nations a distinct ageing of the population, as a result of declining birth rates and longer life expectancy, seems likely during the coming decades. Thus, a continuously decreasing number of employed persons will have to bear the load of financing old-age provision, so that their burden, compared with that of former generations, must increase for the systems to remain financeable in the long run. Nor does calculating a deficit for the systems of old-age provision in the coming years capture the full extent or scope of this, for a redistribution to the detriment of future generations can occur even in the case of a balanced budget, leading inevitably to future increases in contributions or cuts in benefits. In addition, it can be proved that the size of the public deficit can be changed by simply redesignating payment flows, without changing the direction of redistribution on which fiscal policy is based. Contributions paid by insured

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persons into the public pension scheme can be interpreted as loans raised by the state, with corresponding implications for the extent of the deficit and the level of public debt.

There has long been a consensus about the limited informative value of the government deficit in terms of the future burden. In Germany part of that burden is at present included in the budget appropriations under "authorisations for future commitments". According to the Budget Principles Act, fiscal policy measures adopted by the Federal Government and the Länder Governments which may carry an obligation for expenditure in future accounting years need to be authorised in the budget plan. In reality, however, future payment obligations are included to a very limited extent only. This paper evaluates the present public sector fiscal situation in Germany under the aforementioned aspects of intergenerational redistribution. Generational accounting is presented as an appropriate method of measuring this, and one which has been applied to different countries since the beginning of the nineties. Among other things, this paper seeks to document as comprehensively as possible the assumptions implied by these intergenerational calculations in order to present a basis for regular recalculations or further developments that are worthy of discussion. Section II. gives a detailed introduction to the concept of generational accounting in its original form, as well as in possibly more informative modified versions, and also considers inescapable points of criticism. Section III. deals with the empirical application of this concept to the public sector in Germany, presents the results of generational accounting calculations and subjects them to an international comparison. The paper concludes with an overall assessment of the concept used and the results obtained.

II. The methodology of intergenerational cost calculations: generational accounting

II.1 Basic idea and approach

Redistribution effects of public sector budgets have been established by means of intergenerational cost calculations since the beginning of the nineties. Initially, these calculations were applied to the USA under the name "generational accounting" and were appended to the US government's budget plans for several financial years.[1] This approach is built on basic assumptions of life cycle theory and on models of overlapping generations. It assumes that economic agents have information on their income situation during their remaining years of life and do not directly include subsequent generations in their economic planning. Therefore, this approach takes a middle position between two conflicting extremes.[2] On the one hand, the inheritance motive is not explicitly taken into account. In the one extreme case, inheritances aiming at maximising the welfare of future generations would imply that each economic agent has an infinitely long planning horizon. Every fiscal policy measure, together with its present and future implications, would thus form the direct basis of individual decisions on labour supply, consumption and wealth accumulation. Measures designed to influence intergenerational income redistribution (for example, the transition from tax-financed to credit-financed government expenditure) are mirrored in full in a changed saving and bequest behaviour, and thus ultimately have no macroeconomic redistribution effects.[3] At the other extreme is the Keynesian point of view, according to which economic agents are largely guided by their regular income and do not consider future developments in their optimisation calculations. According to this view, public deficits have short-term and long-term effects on overall economic developments.

Generational accounting, as mentioned, takes a middle position between these two extremes. Future trends in incomes and financial burdens are calculated without making explicit behavioural assumptions about economic agents. The definition of a broad time horizon is necessary in order to be able to estimate individual burdens as a result of present-day fiscal policy. For this purpose, so-called generational accounts are calculated,

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1 See most recently Office of Management and Budget (1994), p. 21 - 31.
2 Fehr, H. (1995), p. 17 f.
3 Since the work by Robert J. Barro (1974) was published, we talk about the Ricardian equivalence theorem in this context.

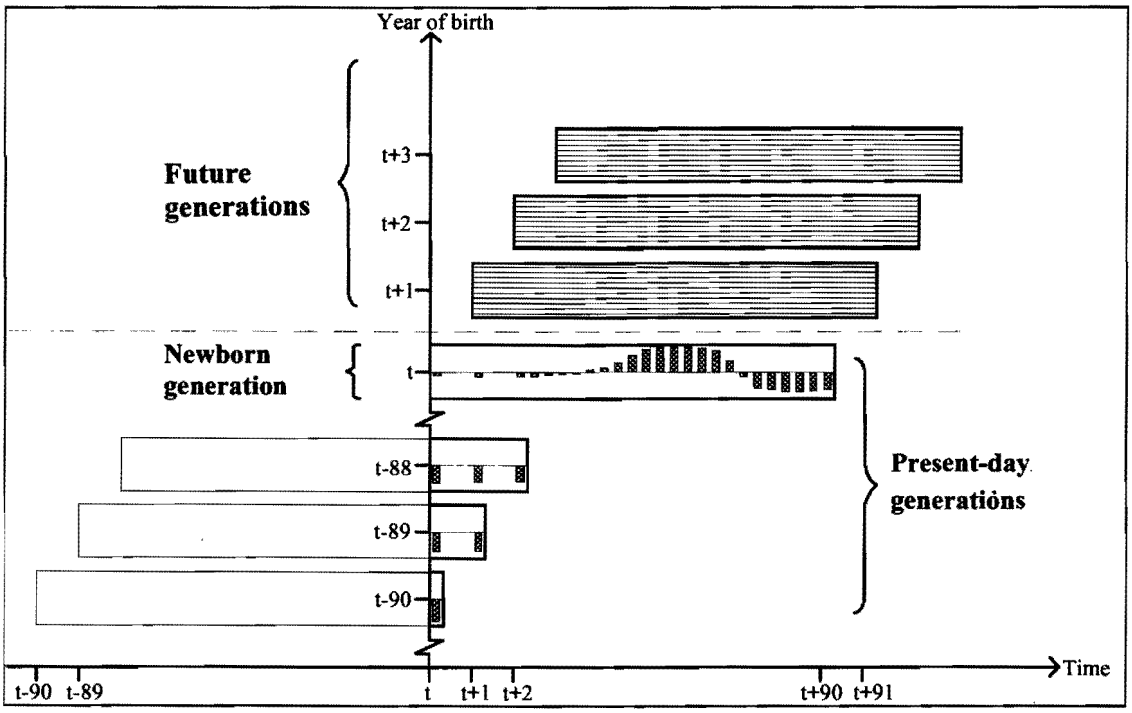
reflecting an individual economic agent's net assets and liabilities vis-à-vis the government. Each economic agent pays taxes and contributions to the government and receives transfer payments in return. If these payments are calculated over a person's remaining lifetime, the present value of his total net burdens can be calculated. This present value may be established by means of the generational account; it serves as a measure of the burden arising from public sector activity to be borne by individual economic agents. In line with this, changes in the generational accounts are interpreted as an approximation of changes in utility and welfare as a result of fiscal policy measures.

The actual economic basis of generational accounting concerns the inclusion of an explicit long-term solvency condition for the public sector in the form of an intertemporal budget constraint. Accordingly, the present value of total future expenditure must correspond to the present value of total revenue, or - expressed in non-technical terms - the government may increase or reduce its level of debt, over an infinitely long time horizon, solely in order to temporarily smooth a desired expenditure path; however, it cannot attain in the long run any additional assets or liabilities position. This condition becomes a constraint in the economic sense in that the financial burden of intertemporal payment equalisation can only be borne by taking recourse to the incomes of present and future households; only a finite amount of funds are available.

In this context, the sum of the generational accounts of all present and future economic agents corresponds to the present value of total present and future net receipts (taxes and contributions less transfers) of the public sector. In the sense of the intertemporal public budget constraint, this variable, - plus the (positive or negative) net public asset position in the period under review - must be just large enough to finance the present value of all other government expenditure. It is thus assumed that fiscal policy is sustainable, or that it will switch to a sustainable course at some future point in time. Based on this general assumption, the distribution of the financing burden between present-day and future economic agents is estimated by means of generational accounting calculations, which are presented in the following sections. A comparison between the per capita burden on present and future economic agents ultimately gives an indication of the distributional bias of present fiscal policy and thus allows inferences to be drawn about the resultant macroeconomic repercussions, which could not be drawn from an analysis of public sector fiscal balances alone.

Chart II.1 illustrates the treatment of the different generations. Year *t* is taken as the base year of the calculations. Present-day and future generations are distinguished by whether they are born before and in *t*, or after *t*. Burdens on present-day generations are estimated from observed age-specific payment profiles (dark shaded columns). All economic agents born before *t* are included in the calculations with their remaining net payments only. Only the generation born in *t* (newborn generation) is recorded in line with the age-specific payment profiles over its entire life, with the last net payment being effected in year *t+D=t+90* (*D* denotes the maximum age included). It corresponds to the net payment (which has been boosted by the intermediate productivity increase) of the generation which is 90 years old in *t*.

Chart II.1: Basic concept of generational accounting



The generational accounts of future generations, i.e. those generations born as from *t+1*, are calculated at a flat rate by distributing the overall future burden (derived from the intertemporal budget constraint), adjusted for growth differences, equally across the generations. At first glance, the assumption of an equal burden to be borne by all future generations is incompatible with the more plausible idea that a gradually rising burden will be imposed on economic agents (for example, by means of rising pension contributions) as a result of a deteriorating age structure. A sudden adjustment of burdens, which will then affect all future generations equally, cannot be regarded as a realistic policy option. It is

assumed initially merely to show the extent of the overall increase in the burden that will occur; later it is substituted by different assumptions.

II.2 Details of the method

II.2.1 Burden to be borne by present-day generations

In the application presented here, the generational accounts of different economic agents are specified in greater detail with regard to three characteristics: year of birth, sex and regional breakdown which, in the case of Germany, means a differentiation between western and eastern Germany. The generational account of a person alive today is denoted by $GK_{t,k}^{i,j}$, with t being the base year of the analysis and k the year of birth.[4] The index i denotes the economic agent's sex ($i=m,f$), and j distinguishes between the regional classifications ($j=w,o$).[5] The variable $GK_{t,k}^{i,j}$ is defined as the sum of all tax and contribution payments discounted to t less transfers received during an economic agent's remaining lifetime.[6] $h_{a,z,t}^{i,j}$ represents the real amount[7] of the payment type z (taxes assume positive and transfers negative values) which may be expected by an average a-year economic agent in year t; the age a of the present generations assumes values between 0 and $D=90$.

With regard to the future trend in these payments (in $s>t$), different simplifying assumptions are made for eastern and western Germany: the age-specific per capita burden arising from a specific payment type increases in the west in line with the assumed productivity growth rate g, i.e. a person at the age of a must expect in year $t+1$ an amount which is higher by g than an a-year person in year t:

$$h_{a,z,s}^{i,w} = h_{a,z,t}^{i,w}(1+g)^{s-t} \quad \forall z;\ \ i=m,f;\ \ a=0,\ldots,D;\ \ s>t. \tag{1a}$$

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4 In the empirical application to Germany, the base year is 1994.

5 Here and in the following, the term generation means a respective group of persons of the same age, sex and regional classification.

6 As already mentioned, net payments of present-day economic agents made in the past are not taken into account.

7 Future payments are rendered comparable by being notionally deflated with the consumer price index. Real tax payments (transfer payments) thus contain information on the purchasing power loss (increase) and hence on the change in utility.

For eastern Germany it cannot be expected that the burden profiles observed in t will remain the same in the future. On the contrary, it is assumed here that the profiles in eastern Germany will adjust to those in the west, with the duration to complete adjustment being varied in sensitivity analyses.[8] s^* denotes the year in which the adjustment between eastern and western Germany is completed. We then assume that:

$$h^{i,o}_{a,z,s} = \begin{cases} h^{i,o}_{a,z,s-1} + \dfrac{h^{i,w}_{a,z,s} - h^{i,o}_{a,z,s-1}}{s^* - (s-1)} & \forall t < s < s^* \\ h^{i,w}_{a,z,s} & \forall \quad s \geq s^* \end{cases} . \tag{1b}$$

This type of adjustment ensures that temporary changes in the figures for western Germany, occurring in the transition period, may be found to a lesser extent and in the same direction in the east German figures, too, but that the difference between the two gradually declines. In addition, if $P^{i,j}_{s,k}$ is the number of persons belonging to the generation born in k and still alive in year s, then the generational account of a member of a living age group is:

$$GK^{i,j}_{t,k} = \frac{\sum_{s=t}^{k+D} \sum_{z} h^{i,j}_{s-k,z,s} P^{i,j}_{s,k} \dfrac{1}{(1+r)^{s-t}}}{P^{i,j}_{t,k}} \qquad \forall i,j,k. \tag{2}$$

Positive (negative) values of GK thus mean that the present and the discounted future per capita tax burden on the generation concerned is greater (smaller) than the expected discounted per capita transfer payments. For the birth-year k of living economic agents $t - D \leq k \leq t$ applies, where D denotes the maximum age included and hence t-D the earliest birth-year included. As indicated in Chart II.1, all surviving members of the generations that were born in the base year and up to D years earlier are included in the group of the present generations.

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8 It is perhaps not realistic to posit a complete economic adjustment of eastern Germany to western Germany. That would assume, among other things, that the adjustment of wages and salaries, which is relatively far advanced, will be followed by an adjustment of productivity to the same extent. Permanently different levels of unemployment and a different female participation ratio in the labour force, however, could also result in lastingly different per capita tax and transfer payments. It is also conceivable that, following an adjustment in eastern Germany, a different production structure will evolve there than in the west, resulting in different per capita incomes and per capita net tax payments.

In the calculations the assumed trend in the net burden to be borne by present-day generations does not purport to be a realistic reflection of the future, but merely serves as a projection under *status quo* conditions. The approach resembles a conceptual experiment designed to quantify possible burden shifts which may occur if the current fiscal policy course is continued. The results therefore give an indication of the extent of the adjustments that have to be achieved over time, but without indicating the nature or timing of the fiscal policy measures that have to be adopted.

The calculation of separate generational accounts for west and east Germans is primarily aimed at taking account of the temporal burden adjustments in the two regions. At the same time, this lets us test what effects a variation in the assumed adjustment duration (s^*-t) will have on the per capita burden of different generations. In the subsequent sections, however, average pan-German generational accounts are presented as the result.[9] These are defined - separately for males and females and for the different age groups - as the sum of individual generational accounts that are weighted with their respective share in the population:

$$GK_{t,k}^{i} = \frac{\sum_{j=w}^{o} GK_{t,k}^{i,j} P_{t,k}^{i,j}}{\sum_{j=w}^{o} P_{t,k}^{i,j}}. \tag{3}$$

Let the total burden to be borne by any present generation living in the base year t be defined as the per capita burden multiplied by the size of the age group in t:

$$N_{t,k}^{i,j} = GK_{t,k}^{i,j} P_{t,k}^{i,j}. \tag{4}$$

The total burden to be borne by all present generations living in the base year t is hence the sum of the variables $N_{t,k}^{i,j}$ over the indices i,j and k:

$$\sum_{k=t-D}^{t} N_{t,k} = \sum_{i=m}^{f} \sum_{j=w}^{o} \sum_{k=t-D}^{t} N_{t,k}^{i,j} = \sum_{i=m}^{f} \sum_{j=w}^{o} \sum_{k=t-D}^{t} GK_{t,k}^{i,j} P_{t,k}^{i,j}. \tag{5}$$

This sum-total corresponds to the present value of total public net receipts (taxes and contributions less transfers) that the government collects from present-day economic

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9 A methodological explanation of this is given in section III.1.1.

agents. It is included in the intertemporal public budget constraint, which is explained in the following section.

II. 2.2 The economic link between the calculations: the intertemporal public budget constraint

In contrast to conventional indicators of fiscal policy, the approach presented here also includes future income trends. Firstly, this concerns households, but, secondly, also the government, which is likewise subject to an intertemporal income constraint: "*In other words, over its lifetime, although a government can shift consumption between periods by alternately saving and borrowing, it will be unable to consume more than its total income plus its initial endowment*".[10] The intertemporal public budget constraint therefore has the following form:

$$\sum_{s=t}^{T} G_s \left(\frac{1}{1+r}\right)^{s-t} - \sum_{k=t-D}^{t} N_{t,k} - W_t = \sum_{s=1}^{T} N_{t,t+s} \,. \tag{6}$$

The first term on the left-hand side corresponds to the sum of present and future government spending G_s, which is discounted using the constant real interest rate r (which should correspond to the market rate) to the base period t. This government expenditure does not contain any direct transfers to economic agents, as they are entirely ascribed to the generational accounts; hence, this spending is associated with a direct recourse to resources. Future government expenditure is extrapolated by means of the assumed demographic and economic trends from the base year level; it is assumed that per capita expenditure increases annually by the growth rate g. T denotes the last year included in the calculations.[11] The second term of the equation is the already known sum of the generational accounts of all generations living in the base year t. The difference of the first two terms is thus the government net debt,[12] raised in the future and accumulated over time, which, in line with the nature of the intertemporal budget constraint, can be used temporarily only. W_t, by contrast, denotes the government assets already available in t.[13]

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10 See Blejer, M.I., Cheasty, A. (1993), p. 284.

11 T theoretically corresponds to a point of time which lies infinitely far in the future; however, in the empirical applications it is defined in such a way that, owing to the discount effect, an additional lengthening of the observed time interval causes no significant change in the present-value sum-totals.

12 See Hagemann, R.P., John, C. (1995), p. 7 f. and Ziebarth, G. (1995), p. 74 f.

13 A negative sign for this variable means that the government has incurred a net debt.

Taken together, the left-hand side of the equation yields that (discounted) government expenditure which cannot be financed by receipts from living economic agents and existing assets. Intertemporal payment equalisation requires that this expenditure must be borne by future generations of economic agents. The right-hand side of the equation thus contains the present-value sum-total of all generational accounts of future generations, i.e. those born in a year subsequent to the base year t (i.e. $t+1$, $t+2$, $t+3$ etc.). Irrespective of their year of birth, their payments are likewise discounted to the year t.

Some explanatory remarks are needed to facilitate interpretation of the equation and the individual variables. In the short term, observance of the intertemporal budget constraint does not impose very stringent limits on fiscal policy, compared for instance with the Maastricht criteria. Deficits may have any size, as long as they are offset by surpluses from other periods. It is not imperative to reduce the initial level of debt; it may even increase, if the growth rate is lower than the discounting rate r.[14]

The distinction between government consumption, investment and transfers has to be borne in mind, too. Government consumption comprises all expenditure for consumption purposes which cannot be ascribed as direct transfers to the individual generations. However, this is primarily an empirical problem, as it can be assumed that, in reality, a major part of government consumption benefits different generations to different degrees. This fact is fairly obvious in the case of education spending but less obvious in the case of expenditure on the legal system or national defence. However, it is extremely difficult to quantify the utility differences in such government expenditure as monetary equivalents.[15] Hence, this expenditure is treated as if it benefited nobody directly, in the sense of a transfer payment by the government to private economic agents.

The treatment of investment is likewise noteworthy. In the present-value analysis undertaken in this paper, no role is played by investment whose internal interest rate corresponds to the market rate, as in that case the present value of all net income connected with investment in the base year is zero. This is probably only partly true of government investment, as a large proportion of such investment is not offset by any subsequent income flow. Nevertheless, we shall take into account the fact that government investment spending has a productive effect and also helps the government, through raising private

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[14] See Leibfritz, W. (1996), p. 55.

[15] In some approaches expenditure on education is disaggregated by age-group.

incomes, to obtain higher tax receipts. Therefore, future investment does not figure in the intertemporal public budget constraint. Public investment effected in the past, by contrast, is recorded as government fixed asset holdings in the variable W_t which, in addition, includes public net financial assets.

The intertemporal public budget constraint is able to indicate basic redistribution patterns between generations. If, for a given trend over time in government spending G_s and a given public net wealth W_t, the burden to be borne by present-day generations is relatively low or if it is reduced by means of fiscal policy measures, future generations will have to bear a relatively heavy burden or an additional burden. In other words, greater public consumption in one or several years causes an additional burden to be borne by present-day or future generations, with the choice of financing instruments and the timing determining the resultant pattern of redistribution. The distribution of burdens between the different generations cannot, however, be identified by means of the public deficit.[16] Therefore, the trend over time and the size of the financial deficit contain no information on the intergenerational redistribution effects of fiscal policy and the resultant macroeconomic implications.

II. 2.3 Burden to be borne by future generations

The intertemporal budget constraint allows inferences to be drawn about the total burden that will have to be borne by future generations. This total burden is obtained as a residual, and it is translated into per capita variables in such a way that future generations of economic agents - adjusted for growth effects - show identical generational accounts at the time of their birth, with males and females being once again shown separately.[17] As mentioned, equal treatment of all future generations is assumed only as an extreme theoretical case in order to highlight the overall extent of the necessary redistribution, without initially having to make any statements about the possible trend in the burden adjustment over time. The net burdens to be borne by all future generations are discounted in the individual generational accounts to their respective year of birth, whereas in the intertemporal public budget constraint all payments are calculated as present values in the base year t.

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16 This will be explained in more detail in section II.4 by means of simple theoretical considerations.

17 By contrast, a distinction between west and east Germans will no longer be assumed for future generations.

Let the per capita burden to be borne by each future generation be higher than that of each preceding generation by the rate of productivity growth g:

$$GK^{i}_{t+s,t+s} = GK^{i}_{t+1,t+1}(1+g)^{s-1} \qquad (i = m,f;\ \ s = 1,\ldots,T). \tag{7}$$

If it is assumed that the per capita lifetime income of each generation - the present value of overall future gross labour income - is likewise higher than that of each preceding generation by the amount g, the burden, as a share of lifetime income, is identical for all future generations.[18]

The per capita net burden to be borne by future males and females is calculated by redistributing the total burden on future generations, the expression on the right-hand side of equation (6), incorporating equation (7) and adding population data and growth assumptions. That gives us:

$$\sum_{s=1}^{T} N_{t,t+s} = \sum_{i=m}^{f}\sum_{s=1}^{T}\left(GK^{i}_{t+1,t+1}P^{i}_{t+s,t+s}\right)\frac{(1+g)^{s-1}}{(1+r)^{s}}. \tag{8}$$

$GK^{i}_{t+1,t+1}$ denotes the generational account of a male (i=*m*) or female (i=*f*) born in $t+1$, that is the respective net burdens discounted to $t+1$ (the year of birth). $P^{i}_{t+s,t+s}$ represents the size of the future generations in the year of their birth. Finally, the per capita variables must be calculated from equation (8). For this purpose, it is additionally assumed that the ratio of the generational accounts of future men and women corresponds to that of males and females born in the base year t[19] and that hence no temporal changes occur in the intragenerational redistribution - between the sexes:

$$\frac{GK^{m}_{t,t}}{GK^{f}_{t,t}} = \frac{GK^{m}_{t+1,t+1}}{GK^{f}_{t+1,t+1}} = \beta. \tag{9}$$

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18 See Auerbach, A.J., B. Baker et al. (1995), p. 9, and section II.3.1.

19 The average pan-German generational accounts are meant here.

For the generational accounts of future men and women, respectively, we then obtain:

$$GK^{m}_{t+1,t+1} = \frac{\sum_{s=1}^{T} N_{t,t+s}}{\sum_{s=1}^{T}\left(P^{m}_{t+s,t+s} + \frac{1}{\beta}P^{f}_{t+s,t+s}\right)\frac{(1+g)^{s-1}}{(1+r)^{s}}} \qquad (10a)$$

and

$$GK^{f}_{t+1,t+1} = \frac{\sum_{s=1}^{T} N_{t,t+s}}{\sum_{s=1}^{T}\left(\beta P^{m}_{t+s,t+s} + P^{f}_{t+s,t+s}\right)\frac{(1+g)^{s-1}}{(1+r)^{s}}}. \qquad (10b)$$

The assumption of an equal burden redistribution among future generations is an extreme theoretical case, which is selected, so to speak, for didactic reasons only. Other - less arbitrary, but likewise speculative - assumptions which would, for example, also tend to be more compatible with the expected trend in pension contributions, could assume a gradual increase in the future per capita burden, with the burden on very late-born generations being above that calculated here.[20] It would naturally also be conceivable to assign part of the fiscal adjustment burden to present-day generations and so reduce the burden differential vis-à-vis future generations. For our purposes, however, the assumptions made are helpful initially in determining the "implied" public burden that is shifted to the future and in revealing the extent of the corrections necessary. The implications of different patterns of burden redistribution between the generations are presented in the following sections.

II.2.4 Burden comparison between present-day and future generations

The above-mentioned procedure assumes, in addition to a given pattern of public expenditure and a given level of public net assets, that the present-day generations will pay taxes and contributions and receive transfers until the end of their life in line with the conditions prevailing in the base year of the analysis. The burden ascribed to all future generations, by contrast, is the total amount that emerges as a "residual" from the

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[20] See Auerbach, A.J., B. Baker et al. (1995), p. 9.

intertemporal public budget constraint. As the aim of this study is to compare the burdens of different present-day and unborn generations, an average per capita burden to be borne by future generations is calculated, as described above. The ratio of the burdens of future and newborn generations (adjusted for productivity growth in the meantime) serves as the measure Φ for intergenerational burden comparisons. The average per capita burden to be borne by west and east Germans, weighted with the respective population size, is used as the generational account of the newborn generations - as described in equation (3) - thus representing pan-German generational accounts. In order to be able to carry out a meaningful burden comparison, the generational accounts of future generations are discounted, as mentioned, to their respective birth year.[21] The intergenerational burden ratio Φ is therefore defined as follows:

$$\Phi = \frac{GK^{m}_{t+1,t+1}}{GK^{m}_{t,t}(1+g)} = \frac{GK^{f}_{t+1,t+1}}{GK^{f}_{t,t}(1+g)}. \qquad (11)$$

If Φ has a value above one, this implies a burden redistribution at the expense of future-born economic agents.[22] A direct comparison between the generational accounts of future generations and older present-day generations is not informative in this context, as only present and future burdens to be borne by present-day economic agents are recorded. Typically, an individual's pattern of burdens over time is characterised by relatively high tax and contribution payments in the middle of his life and relatively high transfer payments in the latter stages of his life. Therefore, an average man at the age of fifty, for instance, has already paid the major part of his total tax payments and may count on high transfer payments in future. His generational account is markedly smaller than that of a newborn individual simply because of the structure of the calculations, and thus cannot be used directly for burden comparisons.

In addition to comparing burdens between newborn and future generations, generational accounting may also be used to calculate changes in burdens of the present-day generations which are to be expected as the result of fiscal policy measures. For example, they can tell

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21 On this point Boll, S. (1994), p. 68 and Boll, S. et al. (1994), p. 89 err, as the generational accounts of future generations used in those works for the burden comparison are discounted to the base year t. The actual extent of intergenerational redistribution is thereby underestimated by the factor $(1+r)$ - that is, depending on the discounting rate chosen, it may be substantially understated. Jensen, S.E.H., B. Raffelhüschen (1995), p. 7 and Raffelhüschen, B., J. Walliser (1996), p. 184 evidently use the same method.

22 On account of equation (9), this variable exhibits the same values for men and women.

us which of the present-day generations will have to bear the brunt of the burden arising from current tax increases. Although responses in terms of economic behaviour are not explicitly included, possible overall economic repercussions of fiscal policy measures can be estimated, as it can be assumed that different age groups react differently to changes in burdens and will thus probably trigger different implications for consumer demand and capital supply. At the same time, this application of generational accounting is regarded as being especially convincing, since many inaccuracies are reflected to a larger degree in the level than in the temporal change of a variable, as is true of other indicators of fiscal policy. The basic generational accounting concept presented above can be modified to provide additional information and types of presentation. The following section describes several possible forms of further development whose application to Germany will be presented later.

II.3 Applications and modifications of generational accounting

II.3.1 Lifetime income and lifetime tax rates

In addition to the burden comparisons between present-day and future generations that were derived in the previous section, so-called lifetime tax rates may be calculated which give the ratio for each present-day and future generation of the absolute level of discounted net tax payments to their lifetime income. The lifetime income is the sum of all expected discounted gross labour incomes. Theoretically, inheritances and capital income that exceeds "normal" interest on capital should also be included. Normal capital income arising from saved labour income, by contrast, does not increase the present value of an economic agent's resources.[23] As, however, there are no generation-specific data available on the variables mentioned and as they probably constitute a relatively small percentage of lifetime income anyway, they are not included. The advantage of such tax rate calculations is obvious, as the tax burden on economic agents must be assessed primarily in relation to their economic performance. By means of the calculations presented, meaningful lifetime tax rates, however, can be computed solely for newborn and future generations, as only their income and tax burden are recorded completely. The lifetime income of newborn generations is calculated - in line with the procedure applied to generational accounting - by extrapolating age-specific labour income profiles in the base year to the future. For each age an annual increase in per capita variables in line with the productivity growth rate

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[23] See Auerbach, A.J., J. Gokhale, L.J. Kotlikoff (1993), p. 9.

[equation (1a)] is assumed (for eastern Germany an adjustment to the west German level, as described in section II.2.1, equation (1b) for tax and transfer payments). If $y_{s,t}^{i,j}$ is the gross labour income in year s of an economic agent born in t, the following holds for the average pan-German per capita lifetime income of this newborn generation:

$$Y_{t,t}^{i} = \frac{\sum_{s=t}^{k+D}\sum_{j=w}^{o} y_{s,t}^{i,j} P_{s,t}^{i,j} \frac{1}{(1+r)^{s-t}}}{\sum_{j=w}^{o} P_{t,t}^{i,j}} \qquad (i = m, f). \tag{12}$$

The present value of all incomes of the newborn generation as a percentage of the original number of individuals in the cohort corresponds to its lifetime income, and, relative to its generational account, we obtain the lifetime tax rate $\tau_{t,t}^{i}$:[24]

$$\tau_{t,t}^{i} = \frac{GK_{t,t}^{i}}{Y_{t,t}^{i}} \qquad (i = m, f). \tag{13a}$$

Finally, this variable is very easy to calculate for future generations. Their lifetime tax rate $\tau_{t+s,t+s}^{i}$ is higher than that of newborn generations by Φ, as Φ represents the respective ratio of growth-adjusted generational accounts, and the growth-adjusted per capita incomes of successive generations should be indentical, according to the assumption:[25]

$$\tau_{t+s,t+s}^{i} = \frac{GK_{t+s,t+s}^{i}}{Y_{t+s,t+s}^{i}} = \frac{GK_{t+1,t+1}^{i}}{Y_{t+1,t+1}^{i}} = \frac{\Phi(1+g)GK_{t,t}^{i}}{(1+g)Y_{t,t}^{i}} = \Phi\tau_{t,t}^{i}. \tag{13b}$$

II.3.2 Temporal adjustment paths of lifetime tax rates: limitations to public indebtedness

Lifetime tax rates provide information on the extent to which the government could be obliged to resort to the incomes of households to a larger degree in future. In this case the tax burden will increase gradually and will possibly affect future generations increasingly. So far nothing has been said about how these burdens could actually develop over time; we

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24 Strictly speaking, this variable should be designated the lifetime *net* tax rate, as it expresses the relative net tax burden (taxes less transfers) on total gross labour income.

25 This follows simply from the assumption that incomes merely rise in line with the productivity growth rate.

have merely considered a uniform redistribution of burdens among future generations as an extreme theoretical case in order to show the full extent of redistribution required. A multiplicity of temporal adjustment patterns of lifetime tax rates are conceivable. As a further alternative calculation, we shall analyse to what extent future net incomes may still rise under the fiscal disequilibrium observed. It is again assumed that the gross lifetime incomes of each successive generation increase in line with the productivity growth rate g. In addition, it is assumed that the lifetime tax rates of newborn generations remain unchanged. We will then search for a constant growth rate of net lifetime income n which just meets the intertemporal public budget constraint.[26]

The advantage of this alternative calculation is that it defines an economically clear-cut limit for the degree of intergenerational redistribution. The measure Φ used so far, as an economic norm, merely suggests an equal burden redistribution between newborn and future generations. A value of $\Phi \neq 1$ thus implies an unbalanced distribution of burdens. This norm is prone to criticism as it merely considers current fiscal policy in terms of its sustainability but says nothing about its fairness.[27] A greater burden on future generations could be justified if it were connected with an increase in net income - as a measure of prosperity. As an alternative, we can therefore deduce an intertemporally progressive tax system in which higher gross lifetime incomes are likewise subject to a heavier relative tax burden. Financial burdens arising from the public sector budgets could thus be transferred to a greater extent to more affluent future generations. This possibility comes up against limits once the necessary intertemporal progression no longer allows an increase in net lifetime incomes of future generations. For $n=O$, the burden would increase in such a way that affluence could just be maintained. Economic limits are reached even earlier than that if the changes in behaviour triggered by rising tax burdens have a persistently damaging effect on economic developments. Such changes in behaviour, however, cannot be shown here, so that initially a restricted partial analysis must suffice.

The differential $(g\text{-}n)$, i.e. the difference between the productivity increase and the potential long-term maximum growth rate of net lifetime incomes of the generations, therefore indicates the extent to which the government's redistribution policy curbs the future development of welfare. If no burdens were shifted to the future, g would equal n, and the total productivity increase could be passed on in the form of rising net incomes. If n is

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26 The technical procedure is described in Annex A.1.
27 See Congressional Budget Office (1995), p. 18.

below g, the average tax burden on successive generations must increase, that is year by year *ad infinitum*.

II.3.3 Sustainability gap of fiscal policy: "actual" public debt [28]

In their original form, intergenerational cost calculations already assume a particular pattern of redistribution between present-day and future generations. Accordingly, the net burdens to be borne by future generations are computationally adjusted in such a way that fiscal policy finally becomes sustainable in the sense of the intertemporal budget constraint. The extent of the fiscal measures necessary for this is reflected in the degree of redistribution between present-day and future generations, which is calculated as the difference between per capita burdens. Another procedure is to calculate the aggregate national sustainability gap. Unlike other fiscal indicators, such as the debt or deficit ratio, this variable includes the long-term risks associated with fiscal policy which may be hidden in implicit liabilities to an ageing population. In particular, the objection to periodic indicators, namely that they contain no information on the lasting sustainability of fiscal policy, cannot be levelled at such calculations.

This approach can be demonstrated by means of a slightly changed intertemporal public budget constraint in which net payments of present-day and future generations are no longer recorded separately but instead are calculated as a sum-total. This is based on the assumption that the age distribution of tax and transfer payments observed in the base year is maintained in each future year; the assumptions which have hitherto been applied only to present-day generations are thus extended to all future generations. The variable SG_t which, calculated as a residual, represents the sustainability gap, is newly introduced into the budget constraint:

$$SG_t = \sum_{s=t}^{T} G_s \left(\frac{1}{1+r}\right)^{s-t} - \sum_{k=t-D}^{T} N_{t,k} - W_t. \qquad (14)$$

The second sum on the right-hand side of the equation is the present value in t of total net payments made by present-day and future generations, as mentioned, under the assumption of an intergenerationally equal distribution of burdens. SG_t may be interpreted as the

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[28] I owe the allusion to this type of calculation to Professor Laurence J. Kotlikoff. Similar presentations may be found in Kotlikoff, L.J., Walliser, J. (1995), p. 5 f.

present value of total expenditure cuts or increases in revenues which the government will have to make in the future in order to change over from the present course of fiscal policy to a sustainable one. This variable expresses the actual net debt the government would incur if it continued its present fiscal policy. Nothing is said about how the adjustments needed to pay off this debt are to be structured over time and thus which of the present-day and future generations will have to bear the adjustment burden. However, the sustainability gap's informative value is enhanced by assuming, for example, that in all future years a certain proportion α of gross domestic product BIP_S has to be used to redeem the actual public debt and to close the sustainability gap. αBIP_S then represents the extent of the improvements in government financial positions (cuts in public consumption or transfer payments, or tax increases) required for *each* future year s relative to the current policy. Let:

$$SG_t = \sum_{s=t+1}^{T} \alpha BIP_s \frac{1}{(1+r)^{s-t}} \qquad \text{or, alternatively,} \qquad \alpha = \frac{SG_t}{\sum_{s=t+1}^{T} BIP_s \frac{1}{(1+r)^{s-t}}}. \tag{15}$$

Variable α illustrates, moreover, what price has to be paid for postponing public retrenchment efforts. α rises with each year in which the necessary contribution to redeeming the debt is not made. However, this formula ignores the macroeconomic implications of the measures taken or deferred which, in turn, may influence the necessary adjustments by modifying the tax base. On the one hand, these macroeconomic implications include the direct reduction in demand resulting from public sector expenditure cuts; on the other hand, the announcement of and resolute adherence to a consolidation course deemed necessary will probably have positive macroeconomic effects. Hence, this approach cannot tell us which type of fiscal policy measures should be adopted, and in which chronological order, so as to cause the least possible disturbances to overall economic developments. Nevertheless, different alternatives can be assessed in terms of which generations would have to bear particularly heavy burdens, so that inferences can also be drawn about likely behavioural adjustments, and hence about macroeconomic implications.

The sustainability concept associated with this variant of generational accounting has to be seen as merely one possible definition of fiscal policy sustainability. Sustainability, broadly defined, solely requires that the government meets a long-term, i.e. intertemporal, budget constraint. However, this sustainability criterion is only a definition and - as mentioned - provides no handy hints for fiscal policy makers about the preferable development of

explicit and implicit public debt. Further constraints can be derived by examining whether a perpetuation of current fiscal policy is compatible with meeting the intertemporal budget constraint. Such a scenario would mean that the burdens to be borne by present-day generations would not have to be adjusted over time, i.e. that there is no sustainability gap. But if such a gap is identified, it is not easy to determine whether this gap can actually be closed, e.g. through a heavier tax burden. For this purpose it is necessary to include macroeconomic repercussions in the analysis. The Fiscal Balance Rule is a sustainability concept that also takes account of this requirement. According to this concept, fiscal policy is not only constrained by the defined requirement of intertemporal solvency but must also ensure that the economy eventually returns to a balanced growth path over the long term.[29]

II.3.4 Fiscal policy variants for achieving an equal burden distribution

Closing a fiscal policy sustainability gap can be achieved by means of different measures. The timing and nature of the measure taken concurrently determine which generations will be particularly affected. Intergenerational cost calculations can be used to analyse in greater detail, regarding such measures, on what scale certain types of taxes or transfer payments must be raised or lowered for intergenerational burden imbalances to vanish.[30] Already implemented or approved fiscal policy measures may likewise be included in the calculations. Measures aimed more at short-term budget consolidation, but also steps directed towards a long-term improvement in the financial position, can be examined to see whether they are consistent with the objective of the desired intergenerational redistribution. The calculations presented later demonstrate such policy simulations by means of two examples. Firstly, the impact of the solidarity surcharge, which was (re)introduced in 1995, is described on the basis of various scenarios for its reduction over the coming years. Secondly, the increase in pension contributions expected for the future (and which appears likely following the decisions taken in connection with the latest pension reform) is included in the calculations.

II.4 Informative value and limitations of the approach

Generational accounting calculations focus our attention on events which in part lie in the distant future and hence must rely on many uncertain and more or less arbitrary

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29 See Kotlikoff, L.J. (1993).

30 For applications of this type of generational accounting to the United States see Auerbach, A.J., Gokhale, J. et al. (1995).

assumptions. Basic criticisms of this approach relate, firstly, to its consequent limited informative value and, secondly, to the often implicit behavioural assumptions made when interpreting the results, which are similar to the models of overlapping generations and thus ascribe a particularly high degree of foresight to economic agents. Nevertheless, it now seems to be accepted that the questions raised by generational accounting urgently call for answers in the theoretical and fiscal policy debate and that in the past they were insufficiently supported by empirical evidence: "*Whatever their deficiencies, they have the merit of raising issues that are too easily ignored in public debate. A clear statement of assumptions (even if somewhat arbitrary) enhances the transparency of government accounts and makes clear implicit future commitments.*"[31]

In this context it has to be stressed, in particular, that this approach is superior to periodic indicators of fiscal policy, of which the public sector deficit is still seen as one of the most important, in assessing the implications and sustainability of fiscal policy. Both regarding short-term influences and long-term interrelations, the observation of rising public sector deficits is interpreted as an indication of a current stimulation of demand and a shift in burdens to the future. This point of view is at best inadequate, for various reasons. It can be proved that the public sector deficit in its many and varied forms - for example, adjusted for cyclical or inflationary influences - is not a clearly defined variable and may thus have different values, irrespective of the underlying real economic situation. This is due to the fact that only those transactions that change government net financial assets are reflected in the deficit/surplus and that these changes in financial assets are not always recorded in an economically unambiguous way. Social security contributions, for example, are counted as deficit-reducing public revenues even though they imply future claims for benefits on the part of the contributors; they could hence just as plausibly be regarded as (deficit-neutral) public borrowing.[32] Hence a wide array of fiscal policy measures are conceivable which, though they have short-term and long-term effects, are not reflected in the recorded fiscal deficit.

Two basic redistribution factors are of crucial importance here: redistribution between young and old and between present-day and future generations. A revenue-neutral change in taxes or public transfer payments which eases the financial burden on the elderly and increases that on employed persons may serve to illustrate the information content of

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31 Masson, P.R., Mussa, M. (1995), p. 23.
32 See Kotlikoff, L.J. (1988), p. 793.

deficit accounting, on the one hand, and generational accounting, on the other hand. Assume that economic agents can be grouped each year into young people (*Y*), middle-aged people (*M*) and elderly people (*E*) and that each economic agent is subject to positive or negative net burdens imposed by the government (taxes less transfers) in each age group. Initially, these are -10 per capita for the young, 40 per capita for the middle-aged and -30 per capita for the elderly (i.e. the young and the elderly are net recipients of government transfer payments whereas the middle-aged are net tax payers). If it is further assumed that each age group is equally represented, the public sector fiscal position is balanced in the base year *t*, as total tax receipts equal the transfers paid out.

Now let the redistribution policy indicated above embrace an increase in net transfers to the elderly by 10 to -40 per capita and a corresponding increase in the net tax burden of the middle-aged likewise by 10 to 50 per capita so that the government budget in *t* remains overall unchanged and balanced.

Given a discount rate *r* of 5 % and disregarding productivity growth, intergenerational burden comparisons can be drawn from this by way of illustration, as the following calculation in table II.1 shows. The generational accounts of each present-day generation are made up of the present values of net tax payments in the remaining stages of life. Those who are young in *t*, for example, are middle-aged in *t+1* and elderly in *t+2* and are then confronted with the corresponding net tax payments. The sum of the generational accounts of the young, the middle-aged and the elderly yields the total burden to be borne by present-day generations.

Table II.1: Example of an intergenerational cost calculation.
Present values in t of net tax payments; r = 5 %

Starting position				
Age group	Year			Generational account
	t	t+1	t+2	
Y	-10	40/1.05	$-30/(1.05)^2$	0.88
M	40	-30/1.05	-	11.43
E	-30	-	-	-30
	Total burden on generations living in t			**-17.69**
Redistribution policy				
Age group	Year			Generational account
	t	t+1	t+2	
Y	-10	50/1.05	$-40/(1.05)^2$	1.34
M	50	-40/1.05	-	11.49
E	-40	-	-	-40
	Total burden on generations living in t			**-26.75**

Clearly, the policy described above increases the burden to be borne by the young and the middle-aged and eases the financial burden on the elderly. These effects are reflected in the generational accounts, which increase for the young and middle-aged (from 0.88 to 1.34 and from 11.43 to 11.91) and decrease for the elderly (negative contributions are 33 % higher); however, they are not reflected in the government fiscal balance of the base year, which remains in equilibrium. Nevertheless, short-term and long-term demand effects may occur, arising, on the one hand, from a different demand behaviour of the various age groups. If it is assumed that the marginal propensity to consume out of the remaining lifetime income rises as we grow older, a demand-boosting effect of the redistribution policy is to be expected. This effect, in turn, is reinforced by a less evident effect of the redistribution policy. The total discounted net burden to be borne by present-day generations decreases (from - 17.69 to - 26.75), so that *ceteris paribus* an increase in the burden on future generations of the same magnitude is necessary to meet the intertemporal public budget constraint.[33] The transfer of resources to today's elderly is therefore financed only in part by the present-day younger generations; the remaining financing burden is shifted to the future. At the same time, the additional consumption of the elderly (even in

33 See Auerbach, A.J. et al. (1994), p. 83.

the case of identical consumption propensities of each age group) is not fully compensated by lower consumption on the part of the young and middle-aged. Thus redistributions between different generations occur which may bring about consumption demand effects and capital supply effects without manifesting themselves in the public sector fiscal deficit position.

Ultimately, the information gain of empirically applied economics can only be judged in the light of the underlying assumptions. Some of the simplifications in generational accounting give rise to criticism and need to be improved. On the one hand, it has to be analysed whether more plausible or more reliable assumptions are available but have not been used and, on the other hand, to what extent the qualitative and quantitative results of the calculations depend on the assumptions or would remain unchanged even under modified assumptions. Some of the criticisms of generational accounting mentioned in the following lose their edge if these points are taken into consideration.

In most cases very simple incidence assumptions are made concerning the individual types of taxes and transfer payments: accordingly, taxes and contributions are seen as imposing a burden on those economic agents who pay them, while the respective recipients are the ones who benefit from public transfer payments. This approach ignores the fact that some taxes may be rolled over through intricate paths and that transfer payments may, for example, go not only to the recipient himself but also to his family members. Such correlations are taken into account in some applications of generational accounting for taxes on capital income. The reasoning here is that incentives to investment in the context of capital income taxation imply a depreciation of the existing capital stock, which has to be seen as a tax burden imposed on the owners of this capital stock.[34] As there is a higher income tax on existing "old" capital than on "new" capital, investors and owners will make corresponding valuation adjustments to existing capital stock since new investment, relatively speaking, becomes more attractive.[35] Intergenerational burden redistributions may arise because present-day generations which own the existing capital stock are additionally burdened, whereas future investors - both in the case of a new investment and in purchasing old capital - are given preferential treatment. The depreciation of the existing capital stock, however, is not a tax payment to the government but rather a tax-induced burden on capital owners resulting in a deterioration of their financial position, without the

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[34] For the reasoning behind and calculation of the arising redistribution effects see Auerbach, A.J. et al. (1991), p. 16 ff. and p. 41 ff.

[35] See Congressional Budget Office (1995), p. 57.

government obtaining revenues therefrom. To this extent, the redistributions represent macroeconomic repercussions of fiscal policy.[36] Investment incentives have been granted on a large scale in Germany since reunification with the objective of raising the productivity of the east German economy.[37] The macroeconomic repercussions, including their potential implications for the intergenerational burden redistribution, have so far only partly corresponded to the set aims. At any rate, a sharp increase in the propensity to invest in eastern Germany and a corresponding depreciation of west German capital has not materialised so far. Asset erosions as a result of tax policy investment incentives may be offset by insufficient prospects of corporate success for the subsidised investment. Hence the extent to which tax policy contributes to a valuation adjustment in favour of new investment depends on many factors, which are not subject to the government's immediate influence and will not be quantified here.[38]

Closely related to the above-mentioned incomplete recording of tax incidence is the fact (which is probably the most important economic objection to generational accounting) that this approach does not explicitly include macroeconomic repercussions of taxation and transfer policy, i.e. economic agents' responses in the form of changes in their labour supply, consumption, saving and inheritance behaviour, as well as possible shifts in enterprises' locations.[39] Apart from the theoretically conceivable extreme of a completely neutral intergenerational redistribution policy, changes in relative factor prices and the long-term growth path of the economy are to be expected as a result of these responses. Hitherto, however, intergenerational cost calculations were based on the assumption of permanently steady interest rates and growth rates - for the scale of simplicity, not because of any fundamental economic convictions.[40] Their inherent underlying incidence concept therefore focuses merely on the direct financial burden arising from fiscal policy, i.e. on the extent of and changes in the generational accounts. From a general equilibrium analysis point of view, the impact on economic agents' factor income would additionally have to be taken into account, as well as the changes in behaviour aimed at tax avoidance.[41]

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36 See Boll, S. (1994), p. 113 f.
37 See Deutsche Bundesbank (1995).
38 In spite of the objections mentioned, Gokhale, J. et al. (1995) p. 151, use the method developed by Auerbach, A.J. et al. (1991), which relates to the US tax system, to quantify the depreciation of west German capital stock. They estimate that west German capital owners will have to accept a depreciation of their capital stock by 18 %, owing to the existing system of investment incentives.
39 See, for example, Buiter, W. (1996).
40 See Auerbach, A.J. et al. (1994), p. 89.
41 See Fehr, H., Kotlikoff, L.J. (1995), p. 3.

Theoretical models of overlapping generations allow inferences to be drawn about possible changes in welfare as a result of fiscal policy measures.[42] A comparison of the results that were derived from these models with those of intergenerational cost calculations for the United States showed that, for the majority of measures analysed, changes in the generational accounts may be used as approximations of individual changes in utility, which can be deduced from a general equilibrium model.[43]

Generational accounting makes no explicit assumptions about economic agents' business activities but it is based on a special and strict burden concept according to which the future individual net tax burden may be expressed in present values using a uniform discounting rate. On the one hand, this presupposes that all future payments are known and regarded as being equally safe or risky.[44] On the other hand, it implies that, from an economic agent's point of view, it is not the actual time of payment that constitutes a burden but rather its present value in the base year or year of birth. In a perfect capital market this assumption would be correct as funds may be obtained and invested at any time at a given interest rate. In reality, problems of credit rationing confront young people, in particular, so that for them tax payments may represent a greater burden and transfer payments a greater boon than for a middle-aged economic agent.[45]

Many inaccuracies of intergenerational cost calculations are due mainly to the fact that data are not available in the required form. In many cases age-specific payment profiles for the base year can only be approximated and cannot be traced back far enough for previous years to permit complete cost calculations to be made for all present-day generations. Burden comparisons between present-day generations which were drawn up for the United States could, for example, answer the question of whether the lifetime tax rates of successive generations increased in the past, too. Furthermore, the treatment of other public expenditure is imprecise: an estimation of the utility equivalents of government consumption for individual economic agents and thus, for example, a breakdown of this variable by east Germans and west Germans is only possible with the aid of vague assumptions. Much the same is true of public sector investment: these calculations cannot tell us in what chronological order the resultant income streams will accrue to present-day

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42 For analyses and simulations in the context of such models see Auerbach, A.J., Kotlikoff, L.J. (1987).
43 See Fehr, H., Kotlikoff, L.J. (1995).
44 For the choice of the correct discounting rate see Havemann, R. (1994), p. 103 f.
45 See Congressional Budget Office (1995), p. 43 f.

and future generations, yet that is of great significance as a potential justification for shifting burdens on to the future.

Overall, intergenerational cost calculations can estimate burden redistributions which are not revealed by means of other known indicators. They should be assigned a role in the fiscal policy analysis as a supplement to periodic measures, such as the deficit and overall debt levels. At the same time, quantitative results must be interpreted cautiously in the light of the simplifications made, although that is an objection which can be levelled at virtually all findings of empirical economic research. It would, however, be a basic misunderstanding if the future-oriented statements produced by generational accounting were regarded as forecasts. The quantified burden differential gives an idea of what future burdens may arise and challenges fiscal policy makers to explain in concrete form how these burdens can be borne.

III. A look at intergenerational burden redistribution in Germany

III.1 Empirical implementation of generational accounting

We have shown above the empirical requirements which have to be met in order to be able to perform intergenerational cost calculations in the form presented here. Simplified assumptions are sometimes necessary as, on the one hand, the available data material is insufficient and, on the other hand, statements have to be made about uncertain future developments. Below we show the implementation of the empirical application to the Federal Republic of Germany, with three features of the cost calculations, in particular, meriting attention: the assumptions concerning the future demographic trend, the estimation of age-specific burden profiles and the classification of overall national aggregates according to categories of tax and transfer payments.

Also of fundamental importance are macroeconomic parameters that characterise long-term economic trends and correlations. These mainly comprise the productivity growth rate, the discount rate and the adjustment duration until convergence is achieved in economic conditions between eastern and western Germany. As the future values of these parameters cannot be gauged precisely, cost calculation findings are presented for different parameter constellations.[46] The assumed growth rate g gives the annual increase in productivity. The average values of this variable in the past are to be found in Table III.1 for different time spans and different definitions. The median reference value for the growth rate is set at $g = 2\,\%$ in the calculations, so that the trend in real gross national product per capita and per employed person over the past two decades is assumed for the future, too. The long-term real interest rate on public debt securities serves as the discounting factor. The median reference value for this variable is set at $r = 4\,\%$, which approximates to the long-term average of the past years (see Table III.1). In subsequent sensitivity analyses, results are also presented for $r = 3\,\%$ and $r = 5\,\%$. A discounting rate which is higher than the median rate could be plausible, in particular, for the following reason. Future tax and transfer payments are merely estimated and thus uncertain, so that the discounting factor could include a risk premium on the interest rate of safe government securities.[47] With regard to the time needed for eastern Germany to adjust economically to west German levels, the - relatively optimistic - assumption is initially made that this will be completed in the year

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[46] Sensitivity analyses are to be found in Annex A.3.
[47] See Auerbach, A.J. et al. (1991), p. 25 ff.

$s^* = 2010$.[48] However, in this case, too, parameter variations will show how dependent the results are upon this assumption.

Table III.1: Productivity growth and real interest rates in Germany

Item	Average of years 1960-1994	1970-1994	1980-1994
Real growth in GDP per capita [1]	2.7%	2.2%	1.7%
Real growth in GDP per employed person [1]	2.9%	2.2%	1.7%
Real growth of GDP per working hour [1]	3.6% [3]	3.0%	2.4%
Real interest rate [2]	3.9%	3.8%	4.4%
1 Western Germany. 2 Yield on public debt securities outstanding less the year-on-year change in consumer prices. 3 Annual average 1961-94.			

III.1.1 Demographic trend

Assumptions about the future size and structure of the population are an important part of the intergenerational burden comparisons presented here. Naturally, quantitative statements about the demographic trend are based on partly arbitrary assumptions; however, in general we can assume initially that the population in Germany will decline in the long term and that the proportion of elderly people who depend on public transfers will rise. The population projection used here is based on the Federal Statistical Office's Eighth Coordinated Population Forecast[49], with figures being used for the individual age groups broken down by eastern and western Germany and by women and men. From 2041 onwards a higher life expectancy of the population and an increase in birth rates is assumed, whereas the annual net immigration rate is fixed at the level of 2040.[50] The further trend is modelled such that there is a pan-German population of approximately

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48 Westermann, T. (1995). p. 58 f, estimates that by then eastern Germany will have achieved only about 70 % of west German productivity and that this figure will increase to 80 % by the year 2025.

49 The so-called median variant was used.

50 The assumption of a rising life expectancy and rising birth rates is not imperative. Without this assumption a population projection for Germany would yield a drastically declining overall population, which does not seem plausible. But it is also possible, of course, that the demographic trend in Germany may be stabilised by immigration.

57 million people around the year 2100 which remains stable from then on.[51] The figures for the population size and age structure resulting from the assumptions concerning the demographic trend are given in Table III.2.

Table III.2: Size and age structure of the German population

Year	1994	2000	2025	2050	2075	2100	2200
Total population (million)	81.8	83.6	79.3	70.1	62.0	57.6	57.0
Share of population aged over 60	*19.2%*	*21.5%*	*29.2%*	*35.1%*	*33.9%*	*30.1%*	*29.2%*

When calculating separate generational accounts for west and east German generations, a particular feature of the population structure has to be taken into account which, in connection with the calculations used, has a stong impact on the results. Each generational account is a per capita variable which uses the cohort variable in the base year ($t = 1994$) as a denominator. In the case of the newborn and very young cohorts, a distortion is captured because, in the years following unification, birth rates in eastern Germany declined dramatically and the respective age groups are thus very weakly represented. Chart III.1 illustrates this correlation: the share of east German newborn individuals in all newborns in Germany came to merely 9.8 % in 1994. For 15 year-olds this figure, by contrast, came to just under 25 %, i.e. one-quarter of all 15 year-old individuals in Germany were east Germans. In terms of the overall population, east Germans represented a share of approximately 19 %. These figures mirror a very different child-bearing pattern in eastern and western Germany: as recently as 15 years ago significantly more children were born in the former GDR in relation to the overall population than in the former Federal Republic. Since the unification of the two parts of Germany this correlation has reversed: on account of emigration and behavioural changes, markedly fewer children are born today in eastern Germany than in western Germany. According to the population forecast of the Federal Statistical Office, this disparate age structure will converge over time. Thus in 2040 just under 12 % of 46 year-olds (i.e. of the generation born in 1994) will be living in eastern Germany (see Chart III.1).

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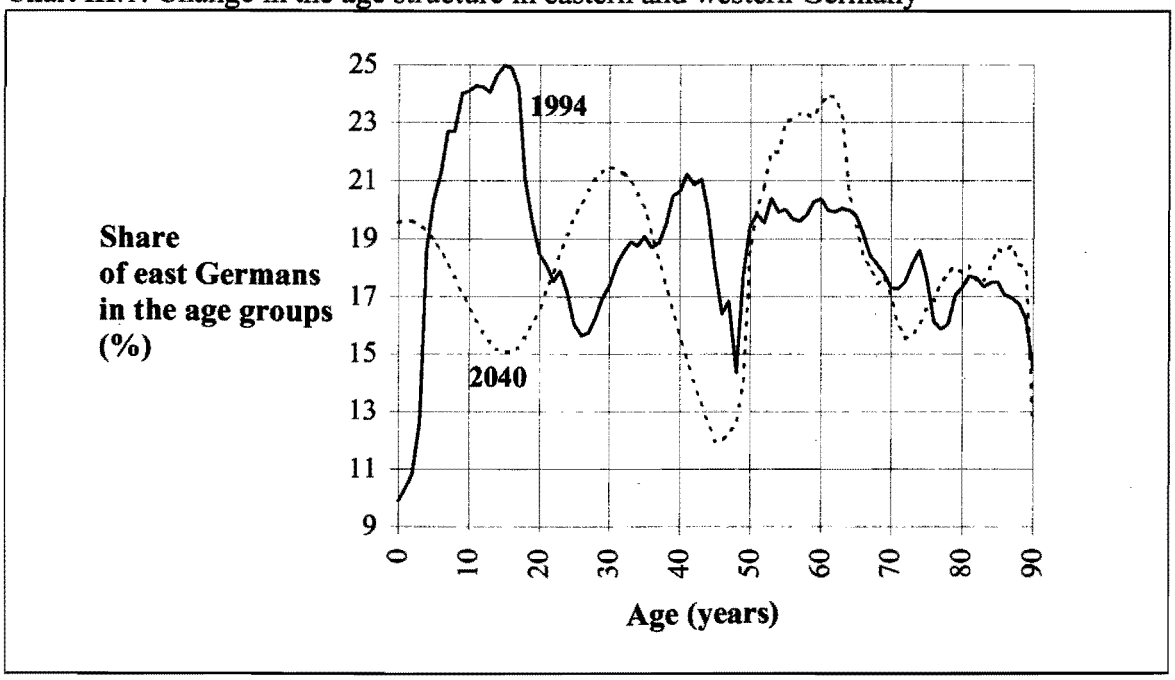
[51] The assumptions for the years following 2040 are: east and west German women have the same birth probabilities, which are raised in each age group by 2 % annually until 2054 and remain stable thereafter. The death probabilities of each age group are set at 50 % of the west German figure obtaining in 1992 from 2041 onwards and are left at that level.

Chart III.1: Change in the age structure in eastern and western Germany



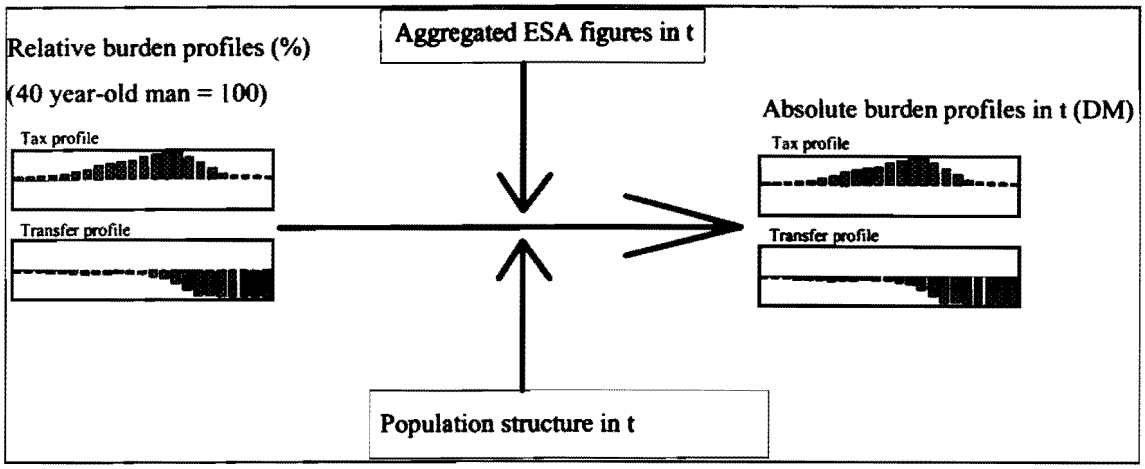
This fact has major implications for intergenerational cost calculations, particularly for the calculation of the generational accounts of newborn east Germans. As this cohort increases relatively strongly over time, the total burden on that generation rises accordingly. In order to calculate the generational accounts, the sum of all discounted burdens to be borne by each cohort is related to their size in the base year. On account of the very weak representation of newborn east German age groups, an upward distortion appears, which has to be taken into account in the interpretation. However, if average pan-German generational accounts are calculated from the regional generational accounts, this effect balances out. Hence, only these average figures are calculated in the following.

III.1.2 Age-dependent burden profiles of different transfer payments and taxes

In addition to assumptions about the future demographic trend, a quantitative basis has to be laid, in particular, for the age-specific pattern of burdens that characterises present-day tax and transfer payment policy. However, complete figures on the average amounts of taxes, contributions and transfers broken down by age and sex are not available for virtually any payment type. Hence, these payment profiles are calculated indirectly and by approximation, by harmonising or calibrating the aggregate national account figures with

the observed population structure and the relative age-specific burden profiles.[52] Chart III.2 outlines this method.

Chart III.2: Calibration of absolute tax and transfer payment profiles



The relative burden profiles are estimated partly by means of the official statistics of the social security schemes and partly by means of the incomes and consumption panel[53] carried out by the Federal Statistical Office and of the Socio-economic Panel (*SOEP*) of the German Institute for Economic Research in Berlin. Calibration ensures that the estimated average absolute burden of the cohorts can yield the macroeconomic variables. In other words, if the averaga per capita figures for each cohort are multiplied by the cohort size, we obtain the observed macroeconomic figure as the sum of all cohorts. The burden differential between western and eastern Germany in the base year, in particular, can be captured by using the national account figures broken down by region. Errors can occur solely with regard to the burden differential between different birth years and between the sexes, as the relative burden profiles assumed mostly do not provide a precise or completely up-to-date picture of the reality. The age-dependent and sex-dependent burden structure, however, is probably subject to relatively little fluctuation over time, so that these errors seem tolerable. In the following a brief description is given of the origin and structure of the age profiles used.

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52 For the detailed method see Annex A.2.

53 So far, only the 1989 survey is available in an evaluated form, so that identical relative age-specific burden profiles have to be assumed in eastern and western Germany, whereas the respective absolute burden to be borne by each age group may vary. The data are not classified according to males and females either.

Transfer payments

Pension payments are computed as age-specific averages from the *"VDR Statistik Rentenbestand am 31.12.1994"* (statistics of the Association of German Pension Insurance Funds on the number of pension recipients as of December 31, 1994),[54] and comprise statutory pensions in respect of disability, old age and death (except orphans' pensions). **Statutory health insurance payments** can likewise be classified according to age groups on the basis of reliable data. For the purpose of the risk structure equalisation scheme among the health insurance funds, a survey was carried out in 1994 among approximately 3 % of the German population which shows the relative incidence of payment claims of the different cohorts. These data on six groups of insured persons[55] contain information on the average payments made, broken down by males and females and by western and eastern Germany. These are weighted with the respective group size (measured in insured years) so as to obtain a profile of all insured persons. The age profile for **unemployment benefits** uses the figures of the Federal Labour Office.[56] Here, the average amounts of unemployment benefits and maintenance allowances, on the one hand, and unemployment assistance, on the other hand, are weighted with the respective number of recipients and related to the respective cohort size.[57] At present no comprehensive statistics are available on **social assistance** which would yield the necessary data.[58] Therefore, an age profile is derived as a rough estimate from the recipients statistics[59], with the respective share of recipients of social assistance in the individual cohorts being used as a measure of the size of the per capita transfers payment.[60] Separate profiles are calculated for recipients of social assistance living outside and inside institutions, as these categories, in particular,

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54 See Association of German Pension Insurance Funds (1995).

55 Insured persons who are entitled to sickness benefits after six weeks, insured persons with a claim to sickness benefits before six weeks have elapsed and insured persons who are not entitled to sickness benefits, in each case as recipients of occupational disability pensions or without receiving such pensions.

56 Federal Labour Office (1994), Overviews II/13, II/14, II/16, II/17, II/19, II/20, II/22, II/23, II/25, II/26, II/28, II/29.

57 The age-specific data used are available for five age groups only, so that within these age groups different per capita figures cannot be estimated. On account of the different age structure in these expenditure categories, separate profiles are used for unemployment benefits and maintenance allowance and for unemployment assistance.

58 See Deutsche Bundesbank (1996 b), p.47 f., in particular. An improved database should be available in future following a restructuring of the social assistance statistics.

59 Federal Statistical Office (1995), tables 10.2, 10.3, 13.2, 13.3. The estimate is based on 1993.

60 It is naturally assumed that each recipient of social assistance is entitled to an identical amount of social assistance. The claims in respect of children, in particular, are undoubtedly excessively weighted. However, as spending on recipients who live in institutions, i.e. mainly expenditure on elderly people, predominates in the expenditure on social assistance, the estimation error contained herein is less significant.

show very different demands made by the various age groups. Social assistance payments made to persons living outside insititutions include payments of **housing allowances. Accident insurance payments** are estimated by establishing the share of recipients of disability benefit, widows' and widowers' pensions and orphans' pensions in the respective age groups by means of official statistics and then deriving an age profile.[61] **Child-rearing benefits** are ascribed to females alone, according to the respective birth rates or birth probabilities, as a more precise profile is not available for this item either. The unavoidable error associated with this arises principally because part of the child-rearing benefits are reduced in line with the individual income situation.[62]

Taxes and contributions

Taxes on labour income and capital income are distributed age-specifically by means of SOEP microdata. In the case of tax on labour income (wage tax), the age-dependent burden profile is obtained from the difference between gross and net incomes of the persons surveyed in the panel.[63] For taxes on capital income - understood as taxes on entrepreneurial and property income - it is assumed that their distribution by age corresponds to the respective income from interest and dividends.[64] The question of the correct incidence assumption for these types of taxes will not be considered further; in particular, intergenerational redistribution effects arising from investment incentives will not be quantified here - as mentioned earlier. For small, open national economies it would also be viable to assume that capital income taxes ultimately impose a burden on labour as the immobile factor. Hence a differentiation between taxes on labour income and capital income would be superfluous.[65] Separate age profiles for turnover tax, mineral oil tax, other consumption taxes, motor vehicle tax and insurance tax are taken from a special

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61 The Federal Ministry of Labour and Social Affairs compiles statistics which record the pensions paid in 1994 by the social insurance funds for occupational accidents. Numerically and by amount, they account for the major part of benefits paid by the statutory accident insurance institutions. For the aggregate financial figures see Federal Ministry of Labour and Social Affairs (1996).

62 However, in 1994 over 53 % of applicants received full child-rearing benefits; just under 33 % received reduced child-rearing benefits.

63 However, this does not record the full extent of tax progression as part of this difference arises from contributions to the social security funds, which are largely proportionate to income.

64 The SOEP shows these income types as amounts per household. It is assumed here that all members of the household who are at least 16 years old and are related to the head of the household have an equal share in capital income, and thus in the tax burden associated with capital income.

65 For example, Auerbach, A.J., Baker, B., et al. (1995) use this incidence assumption in their application of generational accounting to New Zealand. The impact of the same assumption on the results for Germany is examined in appendix A.3.

analysis of the random sampling of incomes and consumption.[66] For turnover taxes (including turnover tax on imports and customs duties), a weighted profile is calculated according to whether turnover is taxed at the normal rate or at a reduced rate. The weighing factor is obtained from the share of the respective turnover types in the basket of goods on which the consumer price index is based.[67] All consumer taxes (except mineral oil tax) are allocated age-specifically by means of a relative profile of food, drink and tobacco purchases. Social security contributions (for pension insurance schemes, health insurance schemes, unemployment insurance funds and accident insurance schemes) are distributed according to gross labour incomes.[68] Contribution payments made by pensioners to the health insurance funds (including the shares paid by the pension insurance funds) are included in line with the pension profile.

III.1.3 National aggregates

Absolute burden profiles are calculated from the relative profiles by weighting the individual cohorts with their respective share in the aggregated national variables. For the base year 1994 these variables can be taken separately for eastern and western Germany from the national accounts. In order to meet the requirements of intergenerational cost calculations, some national account figures have to be consolidated or netted out. The results of these computations for Germany as a whole are to be found in table III.3.

Pension payments are deemed to include all social benefits rendered by the various pension insurance funds and the supplementary pension funds for government employees. The non-contributory pensions of civil servants are likewise included, as there is no separate information available on their age-specific distribution.[69] To be consistent, the grants paid by the state towards civil servants' medical bills are therefore likewise included in the **statutory health insurance payments**. In addition to cash benefits, the pension and health insurance funds and accident insurance institutions also grant non-financial benefits that are liable to turnover tax and which, in the case of the health insurance funds, constitute the bulk of payments. If government transfer payments are subject to turnover tax, they cannot be classified in full as transfers to private economic agents, as the latter

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66 The respective data are documented in Boll, S. (1994), p. 180 ff.

67 According to this index, 57.5 % of the goods included are taxed normally and 16 % at a reduced rate (26.5 % are tax-exempt).

68 Regressive burden effects stemming from the limits for the assessment of contributions are disregarded.

69 It could also be examined to what extent the treatment of civil servants' pensions as personnel costs, and thus as government consumption, would affect the scope of the redistribution.

actually only receive the net amount. The proportion of turnover tax associated with non-financial benefits is estimated on the assumption that all non-financial benefits are subject to the normal VAT rate of 15 % and is subtracted from the gross payments. Government expenditure on investment is treated analogously. On the revenue side, turnover tax is therefore recorded net of taxes paid by the government on non-financial social security benefits, on investment and on bought-in goods and services. This - estimated - percentage is included under other revenue and is ultimately offset against other expenditure.[70]

The distinction between taxes that impose a burden on the factor labour, on the one hand, and on the factor capital, on the other hand, likewise needs to be considered. Apart from analyses of the effective incidence of different types of taxes, the payment burden of taxes cannot be precisely differentiated in this respect either.[71] For the sake of simplicity, therefore, wage tax is used as a proxy for **tax on labour income**, while taxes on entrepreneurial income and on households' assets (as defined in the national accounts) and all taxes paid by enterprises[72] are regarded as **taxes on capital input**. This variable also includes, as a simplified estimate of the burden arising from seigniorage, that portion of the Bundesbank's profit which is passed on to the government.

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70 The difference between other government expenditure and other government revenue corresponds to the variable G_S in the intertemporal public budget constraint (5). As mentioned, it is assumed that this per capita variable increases in line with the constant growth rate g. Expenditure on investment and on net interest (interest payments less other investment income), by contrast, is not included in the long-run solvency requirement, on account of the present-value approach adopted; the same applies to the public deficit.

71 The practice of tax assessment in Germany is based on personal income, thus preventing a precise classification of taxes according to income types. See various Monthly Reports of the Deutsche Bundesbank, e.g. Deutsche Bundesbank (1996 a), p. 39.

72 Including taxes on land and buildings and their acquisition and motor vehicle tax paid by enterprises.

Table III.3: Government expenditure and revenue in 1994 (according to the national accounts in DM billion) *

Expenditure		Revenue	
Old-age provision including civil servants' pensions [1]	389.8	Pension insurance contributions	274.1
Health insurance including grants to civil servants [1]	193.6	Health insurance contributions	224.2
Unemployment insurance benefits	78.4	Unemployment insurance contributions	84.4
Unemployment assistance	17.5	Accident insurance contributions	18.0
Accident insurance [1]	15.0	Wage tax	270.1
Child benefits	20.4	Turnover tax [1, 2]	178.8
Child-rearing benefits	6.7	Tax on entrepreneurial and property income [3]	165.8
Housing allowances	6.0	Mineral oil tax	63.9
Social assistance	40.5	Excise taxes	39.2
		Insurance tax	11.4
		Motor vehicle tax (from households)	7.5
Net investment [1]	53.7		
Interest payments	113.4	Other capital income [4]	43.3
Other government expenditure	732.9	Other government revenue [5]	200.4
		Deficit	86.8
Total	1667.9	Total	1667.9

*) Germany, partly estimated. 1 Excluding turnover taxes paid by the government. 2 Including turnover taxes on imports and customs duties. 3 Including the profit received from the Bundesbank and motor vehicle tax paid by enterprises. 4 Excluding the profit received from the Bundesbank. 5 Other taxes, imputed social contributions, social contributions from the rest of the world, other current transfers, capital transfers, turnover tax paid by the government.

In addition to the flow variables described (transfer payments, taxes, contributions and other government expenditure), the intertemporal public budget constraint (6) includes, as a stock variable, public net assets W_t in the base year 1994. Public net financial assets (DM -1,316.2 billion) plus public net fixed assets at replacement cost, including public road building schemes (DM 2,235.7 billion), are used as an approximation; the net total is thus DM 919.5 billion.

In order to calculate lifetime tax rates, age-specific profiles of gross labour income are necessary; these allow the lifetime incomes of newborn generations to be calculated, i.e. the present-value sums of their future gross labour incomes.[73] The relative gross income profile which was elicited from the SOEP data, in turn, is translated into an absolute profile by means of gross national wage and salary incomes plus an estimated variable for imputed entrepreneurial remuneration.[74] The figure of DM 2,027 billion is obtained as the sum-total of gross labour income for 1994.

III.2 Results: the state of public finance in Germany from an intertemporal point of view

Average tax and transfer payments in Germany exhibit a distinctly age-dependent pattern. Therefore, the public sector financial position will be strongly influenced over time by a changing population structure if the existing pattern of burdens is to be maintained. Chart III.3 gives an overview of the absolute (net) burden profiles of different age groups in 1994.

In the middle years of life the tax and contribution payments of the various generations largely follow the age-dependent income distribution pattern and thus exhibit marked differences between the generations (i.e. between males and females and between eastern and western Germany). After retirement, by contrast, that is, approximately after the age of 60 when net payments to the government start to become negative, these differences become smaller, as a major part of the transfers paid is also geared to redistribution and is not based on pure equivalence considerations. Accordingly, differences in the tax burden between males and females and between west and east Germans are reflected to a much smaller degree in the amount of transfer payments received. In the context of the calculations presented here, burdens are expressed as present values, so that different temporal patterns of inpayments and outpayments play a significant role in an intergenerational comparison of these burdens.

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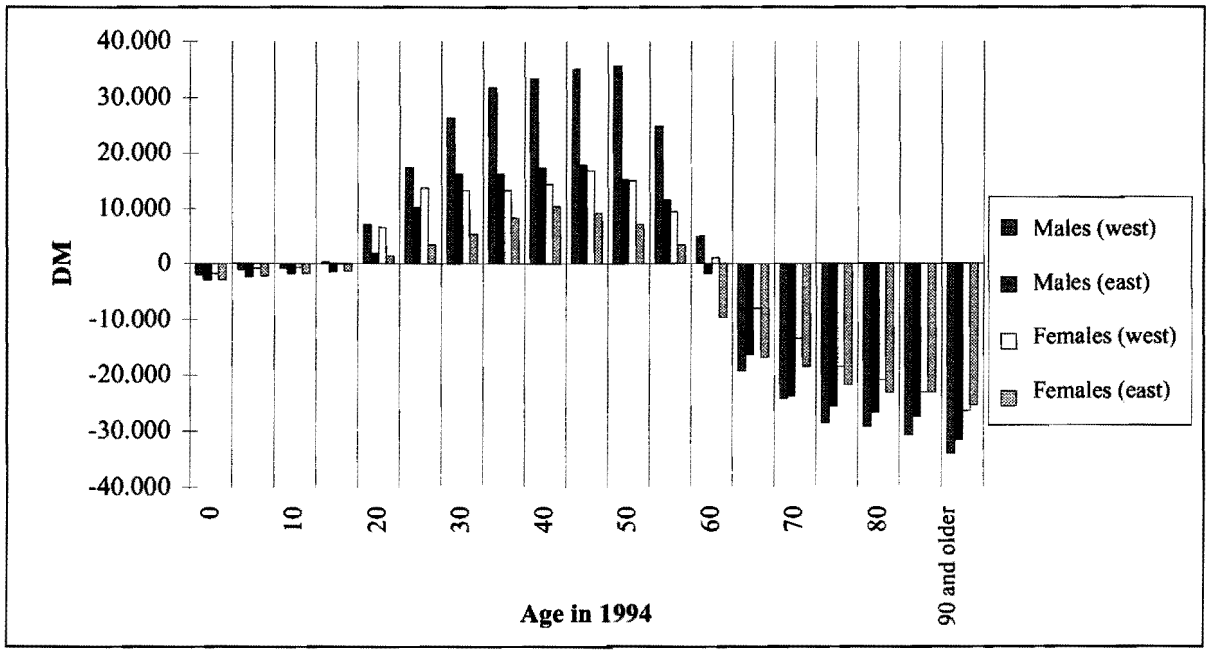
[73] See section II.3.1.

[74] The estimated imputed entrepreneurial remuneration is obtained by multiplying gross wage and salary incomes per capita by the number of self-employed persons.

Chart III.3: Absolute payment profiles
(taxes and social security contributions less transfers) in 1994



III.2.1 Burden to be borne by present-day and future generations

The following tables contain the results of intergenerational cost calculations for Germany on the basis of 1994 for the reference values of the parameters mentioned in section III.1.[75] Tables III.4a and III.4.b contain information on the present values of different tax and contribution types to be borne by present-day generations during their remaining lifetime - broken down by females and males; tables III.5.a and III.5.b contain corresponding information on the different transfer benefits received.[76]

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75 The extent to which the results presented in this section are dependent on changes in the parameters and changes in the assumptions is examined in Annex A.3.

76 In contrast to chart III.3, in which net payments of different age cohorts are presented at a fixed point in time, the figures in the tables III.4 and III.5 are present-value sums of all present and future payments during the remaining lifetime of these age cohorts.

Table III.4.a: Present values of the burden arising from taxes and social security contributions (males)[1]

Age in 1994	*Social contri-butions*	*Wage tax*	*Taxes on entre-preneurial and property income*	*Turnover tax*	*Excise taxes*	*Insurance tax*	*Mineral oil tax and private motor vehicle tax*
0	427,039	204,433	91,757	123,597	22,252	7,214	40,653
5	443,822	212,572	95,082	117,991	23,121	7,497	42,332
10	481,325	230,299	102,737	116,898	24,902	8,044	45,635
15	521,223	248,293	110,209	114,739	26,597	8,526	48,813
20	551,422	262,018	116,292	110,724	27,143	8,620	49,487
25	522,934	247,100	110,682	97,232	24,389	7,643	42,831
30	487,843	225,903	105,649	87,513	22,223	6,810	36,769
35	440,714	200,881	100,339	80,672	20,114	5,949	31,572
40	371,395	164,383	90,706	72,780	17,306	4,904	25,976
45	302,708	131,019	86,905	66,078	14,944	4,016	21,265
50	218,833	89,060	78,575	57,001	12,545	3,070	16,628
55	135,413	46,917	69,142	47,773	10,363	2,263	12,412
60	74,141	15,554	59,517	39,210	8,350	1,607	8,871
65	43,686	1,921	50,697	30,954	6,520	1,091	5,991
70	33,909	651	37,410	23,661	4,926	766	3,743
75	25,672	115	23,933	16,588	3,474	499	2,306
80	19,656	60	18,684	11,875	2,528	342	1,495
85	14,011	0	12,059	7,887	1,626	207	903
90 and older	4,009	0	2,005	1,732	363	47	193

1 Per capita amounts (DM) during the remaining lifetime. r=0.04; g=0.02; s*=2010.

The largest share of the burden to be borne by younger present-day generations is accounted for by social security contributions, which here include the employer's portion of social security contributions. Under the assumptions made regarding interest and growth rates, the total burden to be borne by a newborn male in the form of social security contributions amounts to just under DM 430,000, while that of a 20 year-old man comes to over DM 550,000.[77] Men and women who have reached the age of retirement have few social security contributions to pay, as they only need to bear the pensioner's health insurance contributions. This pattern is even more pronounced in the case of wage tax, which is only paid in the middle part of one's life. The burden arising from taxes on capital income, by contrast, has an age structure which weighs more heavily on the later years of life, as older people usually possess greater wealth than younger people. Different burdens for males and females arise mainly on account of wage-related taxes and contributions,

77 The present value of the 20 year-old is higher, as he will soon have to pay relatively high contributions, whereas the first contribution payments of the newborn individual will still be discounted over several years.

whereas - on account of the distribution and incidence assumptions chosen - the burdens imposed by other taxes show a similar distribution between the sexes.

Table III.4.b: Present values of the burden arising from taxes and social security contributions (females)[1]

Age in 1994	*Social contri-butions*	*Wage tax*	*Taxes on entre-preneurial and property income*	*Turnover tax*	*Excise taxes*	*Insurance tax*	*Mineral oil tax and private motor vehicle tax*
0	159,683	81,017	78,759	114,624	20,160	6,489	36,609
5	170,120	86,286	83,722	111,070	21,437	6,897	38,967
10	185,840	93,870	91,112	110,373	23,248	7,445	42,271
15	201,883	100,976	98,232	108,495	24,934	7,914	45,345
20	213,773	106,752	105,032	106,150	25,824	8,113	46,571
25	199,518	99,201	104,109	97,991	24,364	7,523	42,074
30	178,995	86,364	102,558	90,798	22,815	6,861	36,972
35	163,137	75,838	99,322	85,320	21,022	6,080	32,178
40	142,970	63,671	95,019	79,053	18,589	5,135	27,085
45	116,252	48,825	90,722	73,075	16,381	4,272	22,506
50	84,717	29,479	80,953	64,568	14,111	3,337	17,960
55	55,908	13,472	70,937	55,010	11,860	2,505	13,614
60	38,867	3,536	59,755	45,886	9,729	1,818	9,891
65	30,804	178	45,682	36,792	7,735	1,265	6,805
70	25,940	6	31,557	28,283	5,894	899	4,343
75	20,467	0	19,466	20,134	4,221	599	2,745
80	15,975	0	13,229	14,126	3,002	403	1,761
85	11,497	0	7,735	8,916	1,841	234	1,019
90 and older	2,996	0	1,052	1,729	362	47	193

1 Per capita amounts (DM) during the remaining lifetime. r=0.04; g=0.02; s*=2010.

Pension payments account for the bulk of government transfers (Tables III.5.a and b). At the same time, this item exhibits the most dramatic age structure, as economic agents virtually do not benefit at all before reaching retirement age. Health insurance benefits are likewise claimed to a larger extent by the elderly, but younger people also receive them. Of the social benefits, unemployment benefits and accident insurance payments are most closely linked to past contributions and are thus paid to women on a far smaller scale than to men.

However, it is striking that, considering transfer payments as a whole, there are fewer differences between males and females than is the case for taxes and contributions. Whereas social security contributions impose a burden on a newborn male economic agent during his remaining lifetime which is more than two-and-a-half times greater than that on a newborn female economic agent, the newborn male receives not quite one-and-a-half

times as much in social security transfer payments. On balance, males recoup as transfers about 90 % of the contributions they have paid into the social security funds, whereas females receive 165 %.

Table III.5.a: Present values of transfer payments received (males)[1]

Age in 1994	*Pension insurance benefits* [2]	*Health insurance benefits* [3]	*Accident insurance benefits*	*Unemploy-ment benefits*	*Unemploy-ment assistance*	*Social assistance and housing allowances*	*Child and child-rearing benefits*
0	222,514	110,721	12,128	36,237	10,284	30,133	20,341
5	229,069	106,570	12,483	37,625	10,702	26,981	15,569
10	245,602	110,178	13,421	41,078	11,633	24,817	10,355
15	260,218	113,306	14,316	45,425	12,673	23,361	4,793
20	271,519	114,646	15,052	49,363	13,602	21,809	1,088
25	260,717	106,686	14,583	44,647	12,490	18,134	321
30	265,641	103,005	14,770	41,899	11,147	16,080	0
35	277,757	100,807	15,208	40,626	10,038	14,309	0
40	291,283	96,629	15,453	39,421	8,218	12,399	0
45	319,878	94,609	16,053	37,816	6,375	10,909	0
50	349,790	89,636	16,314	33,364	4,896	9,267	0
55	381,568	82,551	16,098	28,145	3,360	8,517	0
60	419,119	73,464	15,461	4,946	594	7,952	0
65	390,337	64,740	13,744	0	0	7,446	0
70	322,309	57,266	11,556	0	0	7,487	0
75	247,106	46,499	9,062	0	0	7,916	0
80	189,759	36,720	7,149	0	0	6,015	0
85	141,213	26,451	5,590	0	0	4,314	0
90 and older	40,305	6,194	1,342	0	0	994	0

1 Per capita amounts (DM) during the remaining lifetime. r=0.04; g=0.02; s*=2010. 2 Including civil servants' pensions. 3 Including government assistance towards civil servants' medical bills.

The consolidated totals of taxes and contributions paid and transfers received are shown for the different age groups in Table III.6. Taxes and contributions less transfers yield the generational accounts, which are also contained in Table III.6 for present-day and future generations. In addition, lifetime tax rates are given for newborn and future males and females. As explained above, the burden ratio F reflects the absolute (or relative) burden to be borne by future and newborn generations.[78]

78 The generational accounts of future generations are growth-adjusted. See section II.2.4, equation (11).

Table III.5.b: Present values of transfer payments received (females)[1]

Age in 1994	*Pension insurance benefits* [2]	*Health insurance benefits* [3]	*Accident insurance benefits*	*Unemploy-ment benefits*	*Unemploy-ment assistance*	*Social assistance and housing allowances*	*Child and child-rearing benefits*
0	140,387	103,725	2,486	16,469	3,527	30,175	27,476
5	148,808	102,796	2,616	17,563	3,763	27,932	23,420
10	161,735	107,706	2,830	19,884	4,253	26,510	19,137
15	174,179	111,741	3,032	23,607	5,067	25,646	14,419
20	187,039	114,163	3,233	27,246	5,891	24,839	10,846
25	193,120	110,391	3,322	25,349	5,678	22,444	7,955
30	204,117	106,668	3,467	23,629	5,194	21,201	3,970
35	217,927	103,763	3,629	22,020	4,603	20,051	1,190
40	231,894	100,429	3,750	21,146	3,778	18,806	185
45	255,268	98,923	3,919	18,969	2,569	18,299	9
50	280.298	95.191	4.023	15.413	2.009	17.776	0
55	300,727	88,618	3,980	9,688	1,217	17,957	0
60	323,758	81,896	3,847	1,769	224	18,676	0
65	305,083	75,038	3,496	0	0	19,524	0
70	260,699	66,426	3,012	0	0	20,633	0
75	205,890	54,557	2,480	0	0	22,133	0
80	160,537	42,218	1,982	0	0	16,465	0
85	115,593	28,587	1,431	0	0	11,095	0
90 and older	30,091	5,799	241	0	0	2,244	0

1 Per capita amounts (DM) during the remaining lifetime. r=0.04; g=0.02; s*=2010. 2 Including civil servants' pensions. 3 Including government assistance towards civil servants' medical bills.

The redistribution in favour of females indicated by the absolute present values of the individual payment types is not reflected in the sex-specific lifetime tax rates. In net terms, i.e after deduction of all transfers received, men and women both pay slightly more than 30 % of their total future labour income to the government.[79] The different net burdens (generational accounts) to be borne by present-day females and males therefore commensurately reflect their respective tax-paying potential over their entire lives.

[79] Given different interest rate and growth assumptions, lifetime tax rates of between roughly 20 % and approximately 40 % are obtained (see Annex, Table A.3.1). Neither women nor men have constantly to bear a greater burden.

Table III.6: Generational accounts, lifetime tax rates and intergenerational burden comparison

	Males				*Females*			
Age in 1994	*Taxes and contri-butions, total*	*Transfers, total*	*Taxes and contribu-tions less transfers*	*Lifetime tax rate*	*Taxes and contri-butions, total*	*Transfers, total*	*Taxes and contri-butions less transfers*	*Life-time tax rate*
0	**916,945**	**442,359**	**474,586**	**31.2%**	**497,340**	**324,245**	**173,094**	**31.6%**
5	942,418	438,998	503,419		518,497	326,900	191,597	
10	1,009,841	457,085	552,757		554,158	342,054	212,104	
15	1,078,399	474,092	604,307		587,779	357,693	230,087	
20	1,125,706	487,079	638,627		612,216	373,257	238,958	
25	1,052,812	457,579	595,233		574,781	368,260	206,520	
30	972,710	452,542	520,168		525,364	368,246	157,118	
35	880,242	458,745	421,497		482,898	373,183	109,715	
40	747,449	463,404	284,045		431,522	379,987	51,535	
45	626,935	485,640	141,295		372,032	397,955	-25,923	
50	475,713	503,267	-27,554		295,126	414,710	-119,584	
55	324,283	520,240	-195,957		223,305	422,186	-198,881	
60	207,249	521,536	-314,286		169,482	430,170	-260,688	
65	140,860	476,267	-335,407		129,262	403,140	-273,878	
70	105,065	398,618	-293,553		96,922	350,769	-253,847	
75	72,587	310,583	-237,996		67,632	285,059	-217,427	
80	54,640	239,644	-185,004		48,497	221,203	-172,706	
85	36,692	177,568	-140,876		31,242	156,707	-125,464	
90 and older	8,349	48,835	-40,485		6,379	38,375	-31,996	
Future generations			**651,663**	**42.9%**			**237,679**	**43.4%**
Burden ratio			**1.37**				**1.37**	

If newborn and future generations are compared, by contrast, a strong disequilibrium to the detriment of future economic agents becomes evident. If the total burden to be borne by future generations were distributed equally among them, this net burden - adjusted for annual growth - would come to approximately DM 650,000 (males) and around DM 240,000 (females), respectively. Under the assumptions made, their net burden would hence be 37 % higher than that of newborn males and females (F = 1.37).[80] If we assume that all future generations must transfer an equal proportion of their lifetime income to the

[80] This value is obtained as the ratio of the growth-adjusted generational accounts of future and newborn generations: $\Phi = \frac{651,663}{474,586} = \frac{237,679}{173,094} = 1.373$

government, this proportion (their lifetime tax rate) could amount to approximately 43 % (compared with just over 31 % for newborn generations).

Judged by the requirement of long-term solvency, the present course of fiscal policy in Germany is therefore not sustainable. The public sector will have to make large-scale savings which definitely cannot be gauged from short-term financial deficit levels. Periodic fiscal policy indicators - in spite of their increasingly apparent negative trend - do not provide a realistic picture of the actual financial burdens on the public sector. A significant part of these financial burdens will be shifted on to yet unborn generations. A further increase in taxes and levies can only be avoided by means of a marked reduction in government spending. Future tax burdens, in turn, will have to rise considerably compared with the situation today if the current transfer and expenditure policy is to be maintained. Future generations would thus have to bear a significantly higher burden in net terms, i.e. after subtracting total benefits received from the government, than present-day generations. In addition to reduced incentives to work, which are to be expected through increasing public recourse to private incomes, other macroeconomically harmful repercussions are to be feared from an intergenerational redistribution of such a magnitude. In particular, the situation of future generations could be further aggravated by the fact that the relatively (or excessively) low net burden on present-day generations could be accompanied by a correspondingly high propensity to consume and thus by a low propensity to save. Notably the prospect of receiving comparatively high transfer payments in old age could reduce the attractiveness of private capital formation. Consequently, the trend in capital supply and production potential in Germany could evolve more unfavourably than was assumed in these calculations.

This unbalanced burden redistribution in Germany is primarily due to the anticipated demographic trend. If the population structure of 1994 were to be maintained in the coming decades, the present course of fiscal policy would even impose a heavier burden on newborn generations than on future generations ($\Phi = 0.6$). At the same time, the results obtained so far still draw an optimistic picture of the future, as the public capital stock is regarded as being fully productive. If only explicit government net debt is counted as a (negative) wealth variable, the burden ratio increases to $\Phi = 1.6$. These results correspond with those of previous studies which identified an intergenerational burden imbalance in

Germany.[81] By international standards, fiscal policy in Germany is nevertheless characterised by a relatively modest burden redistribution (see Table III.7).[82]

Table III.7: Intergenerational burden ratio Φ in an international comparison

Item	Germany		United States [2]	Italy [2]		Norwey [2]	Sweden [2]	New Zealand [5]	Thailand [6]
	Own calculation	Alternative calculation [2]		Case A [3]	Case B [4]				
Burden ratio [1)]	1.21	1.27	1.89	4.85	2.55	1.68	1.26	0.85	-0.55

1 Parameter values: r= 0.05; g= 0.02. 2 See Leibfritz, W. (1996), p. 58. 3 Population forecast by the World Bank.
4 More optimistic population forecast. 5 See Auerbach, A.J. Baker, et al. (1995), table 3.
6 See Kotlikoff, L.J., Walliser, J. (1995), table 11.

However, international comparisons have to be interpreted cautiously, as the calculations are based on assumptions that vary in detail, which may significantly influence the results. For some countries, as in this study, capital income tax was not adjusted for effects arising from investment incentives; for New Zealand, a "small, open" economy, the burden imposed by taxes on capital income was additionally included in the burden imposed on the immobile factor labour.[83] The results obtained for New Zealand indicate that the current course of fiscal policy in that country imposes a greater burden on present-day generations than on future ones.[84] This reversed type of unbalanced intergenerational redistribution is even more pronounced in the case of Thailand; there, the negative value of Φ is due to the fact that newborn generations pay net transfers to the government (i.e. they

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81 Gokhale, J. et al. (1995) calculate a smaller imbalance for 1992 of between 10 % and 20 % to the detriment of future generations given different interest rate and growth assumptions. The reasons for this are primarily a divergent definition of payment flows and government net wealth, the use of different data sources for age-specific payment profiles and the assumption made therein about the incidence of capital income taxes, which alone implies far more optimistic results. See section II.4.2.

82 For the countries listed in the table there are no calculations based on the reference values of the parameters *r* and *g* used in this study, so that Φ-values for r = 5% and g = 2% are given here.

83 The impact of this assumption on the results in Germany is examined in the annex (see Tables A.3.5.a and b).

84 The New Zealand government approved a comprehensive tax relief package at the beginning of this year - after publication of the generational accounting results, which were produced in cooperation with the finance ministry - in order to give present-day generations, too, a share in the success of savings achieved in the past.

have positive generational accounts), whereas, under the assumptions made, future generations will be net recipients of public transfers (they will have negative generational accounts). The main reasons for this result, which is probably typical of developing countries, are the more favourable demographic trend in relation to the industrialised economies and the less extensive social security systems.[85] Different assumptions were also made with regard to the treatment of expenditure on education. Whereas several applications, including this study, treat that expenditure as public consumption, others interpret it as transfers to young people. Norway represents a special case as, there, government wealth in the form of large oil reserves plays a dominant role in an intertemporal analysis of fiscal policy. The considerable stock of public wealth in Norway reduces the shift of burdens to the future but, at the same time, the absolute level of burdens to be borne by present-day and future generations is higher than in other countries.[86]

III.2.2 Trend in lifetime tax rates

Germany, as well as most other industrial countries for which generational accounting calculations were drawn up, shows burden imbalances at the expense of future generations resulting from fiscal policy. According to these calculations, a situation is unbalanced when the relative burden arising from all discounted future labour incomes (lifetime tax rates) is different for newborn and for future generations. The norm implied thereby for an intergenerationally balanced burden distribution is, as explained in section II.3.2, not the only one conceivable. If it is assumed that future generations could count on rising incomes and output on account of growing produtivity, an increase in lifetime tax rates could be justified. *A priori*, no norm can be provided for calculating the scale of this intertemporal progression. But let us theoretically consider to what extent future lifetime tax rates in Germany would have to increase in order to ensure intertemporal government solvency, or by how much less future net lifetime incomes would have to increase compared with gross lifetime incomes. The following charts illustrate this scenario by reference to the results obtained for males in Germany.

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85 See Kotlikoff, L.J., Walliser, J. (1995).
86 See Auerbach, A.J., Gokhale, J., Kotlikoff, L.J., Steigum, E. (1993), p. 16 ff.

Chart III.4.a: Development of wages and salaries given immediate adjustment of lifetime tax rates

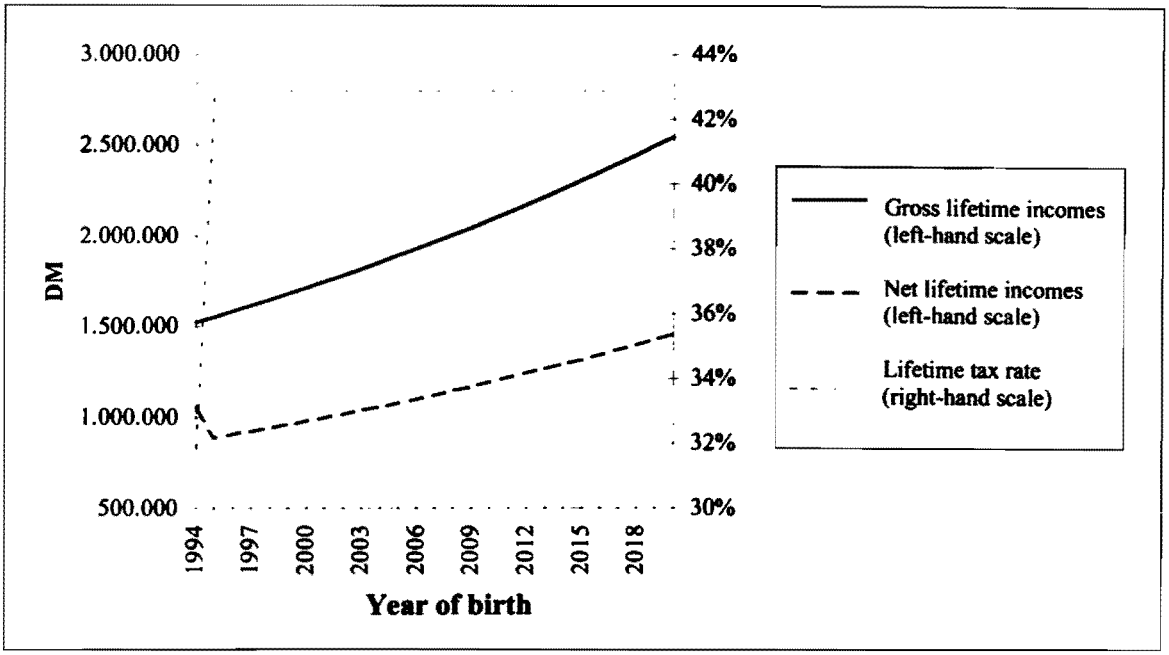

Chart III.4.a illustrates a scenario that assumes equal treatment of all future generations. Starting with the birth year 1995, the lifetime tax rates of all successive generations are raised in relation to the newborn generation's by the value Φ from 31 % to 43 % in order to render the course of fiscal policy sustainable.[87] The net lifetime incomes of all future generations grow annually in line with the productivity or gross income growth rate g; however, for "early-born" future generations they are below the net lifetime incomes of newborn generations. Hence, given the norm of increasing net incomes, this scenario is not a viable fiscal policy option, as during the transitional phase several generations would have to accept real income losses.

Let us therefore seek a temporal adjustment path of lifetime tax rates which does not imply a lower net lifetime income for any generation compared with the previous one. Chart III.4.b illustrates that case. The lifetime tax rate increases for each future generation, so that net lifetime incomes constantly grow more slowly than gross lifetime incomes. Nevertheless, all future generations have a higher net income than all individuals born earlier.

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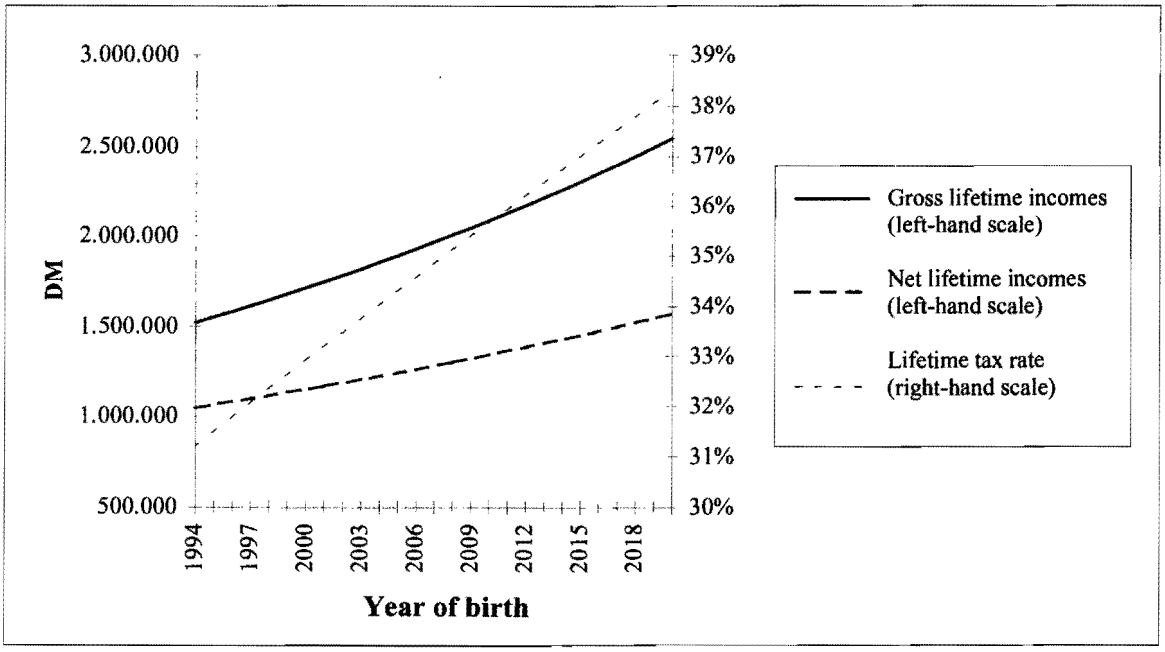
[87] See Table III.6.

Chart III.4.b: Development of wages and salaries given a gradual adjustment of lifetime tax rates



The difference between the increase in gross incomes and net incomes measures in a very simplified form the extent to which the government curbs future welfare growth by means of its redistribution policy. If the government intended to render the course of fiscal policy in Germany sustainable through increasing recourse to the incomes of future generations, net incomes could increase, under the aforementioned assumptions, by only $n = 1.55\ \%$ per year, given an annual growth in productivity of $g = 2\ \%$. Thus, almost half a percentage point of economic growth would be absorbed each year by public sector financing requirements.[88]

III.2.3 Sustainability gap in German fiscal policy

The results analysed so far give an idea of the individual (net) burdens that will have to be imposed in future on economic agents in the form of public levies. In order to lastingly consolidate the currently unsustainable course of fiscal policy in Germany, however, the government could alternatively reduce its other expenditure that does not constitute transfers. In the following we shall quantify, from a macroeconomic point of view, the adjustment requirements in the public sector, but without defining the instruments to be used in this adjustment process. Based on the considerations presented in section II.3.3 for

88 The dependency of this value on changes in the parameters is described in the Annex, Table A.3.4.

determining a fiscal policy sustainability gap, we can identify and quantify the total shortfall of financial resources in the public sector if the government continues its present course of fiscal policy. This sustainability gap (SG_t), defined as a present value, is the additional wealth which would have to be available if the government wished to continue its existing tax, transfer and expenditure policies *ad infinitum*. In other words, this variable describes the economic debt incurred by the government through its policy and for the redemption of which it has to adopt appropriate measures.

The value of this economic debt, under the assumptions made hitherto, came to approximately DM 3,460 billion in Germany in 1994, that is to 104 % of GDP.[89] In contrast to the debt-to-GDP ratio which, under the Maastricht Treaty, is to be used in order to assess the convergence situation in the European Union, this variable represents the economic *net* public debt, i.e. assets and debts have already been netted out. Excluding the public real capital stock, the sustainability gap amounts to more than 170 % of gross domestic product. However, its value depends crucially on the particular interest rate and growth assumptions, so that it is translated into annual rates (annuities), as described in section II.3.3, equation (15). Amounts of 2.1 % of each future year's gross domestic product, which must be raised in the form of expenditure cuts or additonal revenue vis-à-vis current policy, will be required permanently in order to service the "actual" public net debt in Germany.[90] In 1995 alone DM 72 billion should theoretically have been saved, or more than 4 % of total public expenditure. A crucial consideration in this analysis is that suspending the debt service by only one year leads to an increase in future financing requirements, thus necessitating ever-greater retrenchment efforts.

III.2.4 Implications of different fiscal policy measures

Intergenerational cost calculations do not tell us which measures should be preferred for reducing the fiscal policy sustainability gap, as all the macroeconomic repercussions associated with each measure would have to be taken into account. At the same time a decision would have to be made, in the sense of a social welfare function (i.e. on the basis of equitability), about which individual generations are to bear additional burdens. However, the calculations do provide information on the kind of redistribution effects that

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89 For r = 4 %, g = 2 % and $s^* = 2010$.

90 The reader should note that this would not ensure that the securitised public debt is actually redeemed. Fiscal policy merely becomes sustainable in the sense of the intertemporal budget constraint.

may be triggered by different measures and on the extent to which certain fiscal policy action parameters would have to be changed so as to ensure a sustainable policy in the end.

Tables III.8.a and III.8.b demonstrate how the net lifetime burden on each generation (the generational accounts) changes if various fiscal policy adjustments are carried out. They give the respective generational accounts in the base case (with no fiscal policy adjustment, i.e. under the assumption that no additional burden is imposed on present-day generations) and their absolute change through a fiscal policy adjustment, with an increase in the generational accounts (plus sign) representing an additional net burden to be borne by the generation in question. It should be stressed once again that economic agents' responses to higher taxation, e.g. in the form of a reduced willingness to work, are not captured.

Initially, two alternative fiscal policy instruments are analysed in various versions: pension insurance contributions and the solidarity surcharge. The assessment basis for the solidarity surcharge comprises taxes on wages and salaries, assessed income tax, corporation tax and investment income tax and so, in terms of the tax incidence assumption used in this paper, represents a burden imposed on labour income and capital income.

Firstly we tested how an arguably realistic trend in pension contributions could affect the currently unsustainable public finance situation. For this purpose, it is assumed that pension insurance contributions will develop in line with the forecast made last year by Prognos AG.[91] Burdens imposed on the German pay-as-you-go pension system by a changing population structure will be reflected in rising contribution rates that will peak at just over 28 % in the year 2030. For simplicity, a linear increase in contribution rates is assumed, with the contribution rate in 1995 of 18.6 % taken as the starting point; by the year 2030 the contribution rate will have risen to 28.5 % and will then remain constant.

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91 Without judging the reliability of the results of this forecast, this should be regarded as a feasible - probably not too pessimistic - possibile trend in future burdens in the form of contributions. For the detailed assumptions and results see Prognos (1995). The less favourable trend in contribution rates is used, which they refer to as their "lower" variant. Other pension insurance relief measures, particularly the raising of the retirement age and the coupling of pensions to the net trend in wages and salaries, are not included here.

Table III.8.a: Changes in the generational accounts through changes in policy (males, DM)

Age	Generational accounts in the base case	Changes in the generational accounts relative to the base case					
		Adjustment of pension insurance contribution rates	Solidarity surcharge (introducted in 1995, phased out by 2004)	Solidarity surcharge of 7.5% until full east-west adjustment is achieved			Adjustment of pension insurance contri-butions plus solidarity surcharge (phased out by 2004)
				s*=2010	s*=2020	s*=2030	
0	474,586	+89,638	+ 0	+ 15	+ 650	+2,943	+89,638
5	503,419	+86,664	+ 5	+ 402	+ 418	-807	+86,669
10	552,757	+84,470	+ 75	+1,941	+ 233	-4,682	+84,545
15	604,307	+78,444	+ 532	+4,662	- 350	-7,968	+78,976
20	638,627	+68,099	+1,719	+7,808	+2,648	-3,970	+69,817
25	595,233	+51,479	+2,879	+9,698	+5,141	-1,172	+54,358
30	520,168	+38,006	+3,463	+10,408	+4,145	-2,939	+41,469
35	421,497	+26,633	+3,868	+11,168	+2,601	-3,932	+30,501
40	284,045	+16,520	+3,747	+10,672	+2,052	-2,395	+20,266
45	141,295	+8,966	+4,166	+9,837	+5,207	+3,324	+13,132
50	-27,554	+3,648	+3,679	+7,066	+5,704	+5,351	+7,327
55	-195,957	+ 999	+2,531	+4,331	+4,808	+5,259	+3,530
60	-314,286	+ 149	+1,231	+2,308	+3,529	+4,153	+1,381
65	-335,407	+ 90	+ 772	+1,512	+2,491	+2,917	+ 862
70	-293,553	+ 48	+ 595	+1,109	+1,756	+2,029	+ 643
75	-237,996	+ 20	+ 390	+ 730	+1,108	+1,276	+ 410
80	-185,004	- 5	+ 370	+ 537	+ 743	+ 835	+ 365
85	-140,876	+ 0	+ 266	+ 308	+ 391	+ 429	+ 266
Future generations	651,663	-80,350	-6,141	-17,245	-6,338	+5,149	-86,509
Burden ratio	1.373	1.013	1.360	1.337	1.358	1.375	1.002

As Tables III.8.a and b show, a major part of the intergenerational burden imbalance would be reduced by such a trend in contributions. The course of fiscal policy could become permanently sustainable if a burden were imposed on future generations which was 1.3 % higher than that on newborn generations (F = 1.013). At the same time, newborn individuals would have to bear the greatest additional financial burdens (males around DM 90,000 and females DM 30,000 of additional contributions), whereas the additional burdens would become continuously smaller with rising age. Further measures relating to the pension insurance funds (which have already been approved) geared on the benefit side to raising the retirement age and limiting the increase in pensions, by contrast, would weigh

more heavily on older economic agents. The trend in contribution rates assumed here would increase the lifetime tax rates of newborn individuals from just over 31 % to more than 37 % while lowering those of future generations from approximately 43 % to just under 38 %.

Table III.8.b: Change in the generational accounts through changes in policy (females, DM)

Age	Generational accounts in the base case	Changes in the generational accounts relative to the base case					
		Adjustment of pension insurance contribution rates	Solidarity surcharge (introduced in 1995, phased out by 2004)	Solidarity surcharge of 7.5 % until full east-west adjustment is achieved			Adjustment of pension insurance contri-butions plus solidarity surcharge (phased out by 2004)
				s*=2010	s*=2020	s*=2030	
0	173,094	+30,405	+ 0	+ 7	+ 516	+ 558	+30,405
5	191,597	+29,310	+ 4	+ 396	-1,093	-3,606	+29,314
10	212,104	+27,734	+ 68	+1,679	-2,760	-5,987	+27,802
15	230,087	+24,658	+ 480	+3,129	-2,008	-5,282	+25,139
20	238,958	+20,659	+1,365	+4,391	+2,343	+ 197	+22,025
25	206,520	+15,745	+1,696	+4,646	+3,919	+1,828	+17,440
30	157,118	+11,617	+1,590	+4,777	+2,945	- 230	+13,207
35	109,715	+7,969	+1,634	+5,156	+1,849	-2,509	+9,603
40	51,535	+4,756	+1,873	+5,048	+ 241	-4,482	+6,629
45	-25,923	+2,383	+2,039	+4,564	- 243	-3,808	+4,422
50	-119,584	+ 891	+1,547	+3,358	-1,697	-4,863	+2,438
55	-198,881	+ 202	+1,182	+2,479	-1,655	-3,988	+1,384
60	-260,688	+ 9	+ 827	+1,732	- 902	-2,259	+ 836
65	-273,878	+ 4	+ 607	+1,251	- 114	- 767	+ 611
70	-253,847	+ 2	+ 450	+ 881	+ 379	+ 141	+ 452
75	-217,427	+ 1	+ 311	+ 587	+ 433	+ 365	+ 312
80	-172,706	- 0	+ 228	+ 355	+ 391	+ 407	+ 228
85	-125,464	+ 0	+ 174	+ 202	+ 246	+ 266	+ 174
Future generations	237,679	-31,623	-2,240	-6,287	-1,933	+1,170	-33,845
Burden ratio	1.373	1.013	1.360	1.337	1.358	1.375	1.002

The second policy variant analysed is the determination of the level of the solidarity surcharge in line with the current discussions. Following its introduction in 1995 at the rate of 7.5 % on the types of taxes mentioned, it is reduced for the first time in 1997 and afterwards cut annually by one percentage point until it has been completely run down by

2004. It is further assumed that the adjustment process in eastern Germany will have been completed by 2010. The intergenerational burden imbalance to the detriment of future generations would not be significantly reduced by means of such a temporary and relatively short-term additional tax burden imposed on present-day economic agents; future generations would still have to bear a burden which is 36 % higher (instead of over 37 % in the base case) than that of newborn generations. Of present-day generations, the brunt of the increase is borne by men and women in the middle years of life (the remaining net burden to be borne by 45 year-old men and women increases by over DM 4,000 and over DM 2,000, respectively), whereas newborn and very young economic agents pay only small contributions, as their future incomes will be affected only slightly or not at all by these measures.

Maintaining the surcharge until the year 2010 at the full rate of 7.5 % on income taxes would increasingly include younger economic agents in the financing of these transitional burdens (in this case thirty-five year-old men and women would have to surrender the greatest proportion of their remaining lifetime income); at a value of F = 1.34, the intergenerational burden ratio still shows a course of fiscal policy which is not sustainable. Overall, the solidarity surcharge is not capable of equalising the burden arising from the existing east-west differential, as the two following experiments will show. If we assume a longer adjustment period (until 2020 and 2030, respectively) and if the full solidarity surcharge is maintained up to that time, the burden ratio will be higher on balance than in the case of a shorter adjustment period. If adjustment took until 2030 and if the income tax surcharge were levied until then, the extent of the redistribution at the expense of future generations would be the same as in the base case, i.e. adjustment by 2010 and with no surcharge. Younger generations and older women, too, would actually gain from such a scenario compared with the base case, due mainly to the relatively low burden arising from taxes and contributions in eastern Germany which would then be maintained over a relatively long period. With F = 1.002, the burden ratio between the generations would be almost balanced only if, in addition to the aforementioned adjustment of pension contributions, the solidarity surcharge were likewise levied on a diminishing basis until 2004 in line with the first-mentioned variant.

Table III.9 gives some more examples of tax and transfer policy measures by means of which a balanced intergenerational redistribution of burdens - in the sense used here - could be achieved. This would necessitate a 40 % increase in turnover tax, i.e. raising the rate to 21 % and just under 10 %, respectively, a per capita reduction in pension benefits of 14.5 % or a lowering of pension and health insurance benefits by 10.5 %. Each measure

would yield different redistribution effects among present-day generations, which are again illustrated by means of a change in the generational accounts compared with the base case.

In addition, these measures would entail economic agents' responses in terms of consumption, saving or labour supply decisions which, owing to their macroeconomic repercussions, might give rise to additional burdens. Those measures, in particular, which would lead to a considerable increase in the tax burden to be borne by economic agents are therefore not a realistic policy option.

Table III.9: Change in the generational accounts through changes in policy that create an intergenerational burden equilibrium (DM)

Age	Changes in the generational accounts relative to the base case					
	40 % increase in turnover tax		14.5 % reduction in pensions		10.5 % reduction in pensions and health insurance benefits	
	Males	Females	Males	Females	Males	Females
0	+48,653	+45,067	+32,265	+20,356	+34,618	+25,284
5	+46,413	+43,649	+33,215	+21,577	+35,073	+26,268
10	+45,904	+43,299	+35,609	+23,449	+37,160	+28,090
15	+44,920	+42,435	+37,716	+25,243	+38,979	+29,731
20	+43,185	+41,375	+39,341	+27,095	+40,289	+31,291
25	+37,708	+38,022	+37,766	+27,962	+38,296	+31,491
30	+33,903	+35,222	+38,460	+29,523	+38,371	+32,190
35	+31,199	+33,063	+40,179	+31,467	+39,320	+33,272
40	+27,956	+30,466	+42,071	+33,393	+40,179	+34,268
45	+25,172	+27,970	+46,105	+36,622	+42,835	+36,413
50	+21,493	+24,512	+49,966	+39,610	+45,004	+38,100
55	+17,826	+20,708	+53,391	+41,247	+46,650	+38,551
60	+14,441	+17,095	+55,612	+41,837	+47,245	+38,239
65	+11,192	+13,508	+48,754	+38,074	+41,378	+34,732
70	+8,374	+10,208	+39,285	+31,843	+33,705	+29,272
75	+5,671	+7,076	+28,648	+24,023	+24,809	+22,292
80	+3,880	+4,772	+20,951	+17,930	+18,204	+16,577
85	+2,368	+2,774	+14,145	+11,896	+12,226	+10,832
Future generations	-129,622	-20,016	-143,852	-43,862	-144,407	-40,060

As the intergenerational cost calculations analyse net tax payments, i.e. taxes and contributions less transfers, reduced transfer payments from, say, the pension and health

insurance funds would have to be regarded initially as a rise in the burden equivalent to a tax increase. Nevertheless, the changes in behaviour will probably vary, depending on which stage of life the individual has reached when he/she has to bear the additional net burden. Each reduction in the net lifetime income reduces economic agents' consumption potential and prosperity. If economic agents, however, save for the purpose of old-age provision, the prospect of lower transfers in the latter stages of life will lead to additional saving efforts in earlier years of life, whereas higher taxes on labour income will limit saving.

IV. Conclusions

Generational accounting cannot evaluate different fiscal policy alternatives. It can, however, illustrate the possible implications of different alternatives, so that decision makers obtain additional information about the consequences of their actions (or failure to act). The results have to be interpreted cautiously in the light of the assumptions and simplifications made - as do all other results of empirical economic research; nevertheless, they provide valuable additional information, compared with conventional indicators, which has momentous fiscal policy implications. For Germany these can be summarised as follows:

(1.) Given the aforementioned assumptions, the current course of fiscal policy in Germany is not sustainable in the long run, primarily as a result of the expected demographic trend. The tax, transfer and other expenditure policies of the government must be changed in order to ensure sustainablility. Maintaining the current policy for present-day generations would impose a 40 % higher burden on future generations.

(2.) Achieving a sustainable course of fiscal policy requires revenue increases or expenditure cuts which correspond to a negative present value of wealth of more than one hundred per cent of gross national product. An amount corresponding to approximately 2 % of each year's gross domestic product would have to be raised annually and permanently vis-à-vis current policy in the form of expenditure cuts to close this sustainability gap.

(3.) If the government achieves the necessary budgetary economies through increasing recourse to households' lifetime incomes, the growth of net incomes would permanently have to lag approximately half of a percentage point behind the increase in productivity.

(4.) The earlier measures are adopted to obtain a balanced budgetary position, the smaller the efforts necessary for this will be. Implicit public debt caused by financially unfunded payment commitments incurs interest charges, just as explicit debt does. Their debt service requires all the more effort the longer they persist.

(5.) Tax increases curb economic agents' consumption potential and ultimately their willingness to work. The size of the additional burden and the point reached by the individual along the age scale determine his response. Thus the macroeconomic implications of a fiscal consolidation policy have to be examined with a view to their intergenerational redistribution effects as well as the associated direct demand effects and possible countervailing expectation effects. Intergenerational cost calculations can render useful assistance in this context. From a macroeconomic point of view, the negative implications of a consolidation policy are probably best held in check if the extent of public expenditure for consumption purposes, in particular, which is not based on any direct intergenerational pattern of redistribution, is reduced.

(6.) Today, the task of assessing the long-term sustainability of fiscal policy in Germany and other European countries which are preparing for the introduction of a single currency is based on periodic indicators, which capture only part of future risks and burdens. Supplementing this approach by intertemporal, i.e. intergenerational, aspects could be useful, in particular, if a judgement based solely on traditional indicators does not promise to yield sufficient information for a comprehensive assessment of the state of public finance.

Annex

A.1. Calculation of the maximum growth rate of net lifetime incomes achievable

Let the net lifetime income $E^i_{t,t}$ of newborn generations be defined as their gross lifetime income $Y^i_{t,t}$ (the sum of all present values of future gross labour incomes) less their generational accounts:

$$Y^i_{t,t} - GK^i_{t,t} = E^i_{t,t}. \tag{A.1.1}$$

Their lifetime tax rate $\tau^i_{t,t}$ is the ratio of the generational account to the gross lifetime income:

$$\tau^i_{t,t} = \frac{GK^i_{t,t}}{Y^i_{t,t}} \tag{A.1.2}$$

Gross and net lifetime incomes of future generations are to increase annually by g and n, respectively, compared with the corresponding values of newborn generations:

$$Y^i_{t+s,t+s} = Y^i_{t,t}(1+g)^s \tag{A.1.3a}$$

$$E^i_{t+s,t+s} = E^i_{t,t}(1+n)^s \tag{A.1.3b}$$

For the generational account of a (future) generation born in $t+s$ this implies:

$$\begin{aligned} GK^i_{t+s,t+s} &= Y^i_{t+s,t+s} - E^i_{t+s,t+s} \\ &= Y^i_{t,t}(1+g)^s - E^i_{t,t}(1+n)^s \\ &= Y^i_{t,t}\left[(1+g)^s - (1-\tau^i_{t,t})(1+n)^s\right] \end{aligned} \tag{A.1.4}$$

The level of future generational accounts thus depends on the - unknown - growth rate of net lifetime incomes n. It is iteratively determined in such a way that the generational accounts mirror the total burden to be borne by future economic agents:

$$\sum_{s=1}^{T} N_{t,t+s} = \sum_{i=m}^{f}\sum_{s=1}^{T}\left(GK^{i}_{t+s,t+s}P^{i}_{t+s,t+s}\right)\frac{1}{(1+r)^{s}}$$
$$= \sum_{i=m}^{f}\sum_{s=1}^{T}\left\{Y^{i}_{t,t}\left[(1+g)^{s}-\left(1-\tau^{i}_{t,t}\right)(1+n)^{s}\right]P^{i}_{t+s,t+s}\right\}\frac{1}{(1+r)^{s}} \qquad \text{(A.1.5)}$$

A.2. Methods for calibrating absolute burden profiles[92]

Let $h^{m,w}_{a,z,t}$ and $h^{f,w}_{a,z,t}$ be the - unknown - average amounts of payment type z (i.e. of a tax, a contribution or a transfer) paid or received in year t by a west German male and west German female aged a. The aggregated west German value of each payment type z in year t then corresponds to[93]

$$H^{w}_{z,t} = \sum_{a=0}^{D}\left(h^{m,w}_{a,z,t}P^{m,w}_{t,t-a} + h^{f,w}_{a,z,t}P^{f,w}_{t,t-a}\right) \qquad \forall z, \qquad \text{(A.2.1)}$$

where $P^{m,w}_{t,t-a}$ and $P^{f,w}_{t,t-a}$ again stand for the respective members of the generations born in t-a still alive in t. The data material mentioned in the main text provides relative burden profiles, where $R^{m,w}_{a,z}$ ($R^{f,w}_{a,z}$) is the relative burden to be borne by a west German man (woman) aged a arising from payment type z, compared with a west German man who is 40 years old.[94] The auxiliary variables taken from the data material, which are used to determine approximately the real burden values, are denoted by $\overline{h^{m,w}_{a,z}}$ ($\overline{h^{f,w}_{a,z}}$). That gives us:

$$R^{m,w}_{a,z} \equiv \frac{h^{m,w}_{a,z,t}}{h^{m,w}_{40,z,t}} \equiv \frac{\overline{h^{m,w}_{a,z}}}{\overline{h^{m,w}_{40,z}}} \qquad \forall a,z \quad \text{or} \qquad \text{(A.2.2a)}$$

$$R^{f,w}_{a,z} \equiv \frac{h^{f,w}_{a,z,t}}{h^{m,w}_{40,z,t}} \equiv \frac{\overline{h^{f,w}_{a,z}}}{\overline{h^{m,w}_{40,z}}} \qquad \forall a,z. \qquad \text{(A.2.2b)}$$

In combination with equation (A.2.1), we obtain:

$$H^{w}_{z,t} = \sum_{a=0}^{D}\left(h^{m,w}_{40,z,t}R^{m,w}_{a,z}P^{m,w}_{t,t-a} + h^{m,w}_{40,z,t}R^{f,w}_{a,z}P^{f,w}_{t,t-a}\right) \qquad \forall z. \qquad \text{(A.2.3)}$$

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92 See Auerbach, A.J. et al. (1991), p. 14f.

93 The same applies here and in the following, with the index o, to east Germans.

94 The values for eastern Germany correspondingly relate to a 40 year-old east German man.

The calibrated absolute burden to be borne by an average man who is 40 years old $h^{m,w}_{40,z,t}$ can be calculated from that:

$$h^{m,w}_{40,z,t} = \frac{H^{w}_{z,t}}{\sum_{a=0}^{D}\left(R^{m,w}_{a,z}P^{m,w}_{t,t-a} + R^{f,w}_{a,z}P^{f,w}_{t,t-a}\right)} \qquad \forall z. \qquad \text{(A.2.4)}$$

Finally, the calibrated absolute burdens to be borne by each generation arising from (A.2.2a) and (A.2.2b) can be calculated:

$$h^{m,w}_{a,z,t} = \frac{H^{w}_{z,t}R^{m,w}_{a,z}}{\sum_{a=0}^{D}\left(R^{m,w}_{a,z}P^{m,w}_{t,t-a} + R^{f,w}_{a,z}P^{f,w}_{t,t-a}\right)} \qquad \forall a,z \qquad \text{(A.2.5a)}$$

$$h^{f,w}_{a,z,t} = \frac{H^{w}_{z,t}R^{f,w}_{a,z}}{\sum_{a=0}^{D}\left(R^{m,w}_{a,z}P^{m,w}_{t,t-a} + R^{f,w}_{a,z}P^{f,w}_{t,t-a}\right)} \qquad \forall a,z. \qquad \text{(A.2.5b)}$$

A.3. Sensitivity analyses: dependence of the results on changes in the assumptions

The parameters on which the calculations are based cannot be quantified precisely. Hence, results are presented for different plausible parameter constellations. Given realistic changes in parameters, the finding of an intergenerational burden imbalance still holds, whereas the extent of the redistribution may change. The quantitative results, in particular, vary with changes in the differential between the interest rate and the growth rate; the level of this differential, by contrast, has a lesser influence on the results. The precise extent to which the individual values respond to changes in the parameters depends on the temporal trend in the individual payment flows. Given the present-value approach adopted, a high interest rate reduces the value of those payments that lie in the distant future, while a high growth rate partly compensates for this effect. No general pattern can be ascertained for the dependence of the results on the parameters.

If the values g and r are varied, the level of lifetime tax rates of newborn generations fluctuates between 18 % and 39 % and that of future generations between 28 % and 45 % (see Table A.3.1).[95]

Table A.3.1: Lifetime tax rates of newborn and future generations

Parameter value		r = 3%		r = 4%		r = 5%	
		Newborn generations	Future generations	Newborn generations	Future generations	Newborn generations	Future generations
g = 1.5 %	Males	29.2%	41.9%	33.0%	42.7%	35.6%	38.9%
	Females	28.1%	40.3%	34.6%	44.8%	38.5%	42.1%
g = 2.0 %	Males	26.8%	39.9%	31.2%	42.8%	34.4%	41.5%
	Females	23.5%	35.0%	31.6%	43.4%	36.8%	44.4%
g = 2.5 %	Males	23.9%	36.8%	29.1%	41.8%	32.9%	42.7%
	Females	18.0%	27.7%	27.9%	40.1%	34.4%	44.7%
g = 3.0 %	Males	-	-	26.7%	39.8%	31.1%	42.8%
	Females	-	-	23.4%	34.8%	31.5%	43.3%

The burden ratio Φ likewise changes with different parameters and assumes values between 1.1 and 1.5 (see Table A.3.2). Germany's position in an international comparison (see Table III.7) remains unchanged, however. Whereas for the range of parameter values chosen here the burden ratio is always above one (redistribution at the expense of future generations), Φ may be below one if different values are used.

95 For $r=g$ no values can be given as in this case each further extension of the time horizon would change the calculated present-value sums.

Table A.3.2: Redistribution measure Φ (burden ratio of newborn to future generations)

Parameter		r		
		3%	*4%*	*5%*
g	*1.5%*	1.435	1.295	1.094
	2.0%	1.489	1.373	1.206
	2.5%	1.538	1.437	1.299
	3.0%	-	1.489	1.376

Given the chosen reference values of the parameters, an annual amount of 2.1 % of each future year's gross domestic product is necessary to close the fiscal policy sustainability gap. If the parameters are varied, this value *a* fluctuates between 0.3 % and 4 % in the interval assumed here (see Table A.3.3).

Table A.3.3: Permanent annual fiscal adjustment rate *a* needed to close the sustainability gap (as % of GDP)

Parameter		r		
		3%	*4%*	*5%*
g	*1.5%*	2.77	1.43	0.29
	2.0%	3.46	2.09	0.85
	2.5%	4.07	2.79	1.46
	3.0%	-	3.47	2.12

The approximation value of the reduction in the future levels of income and welfare growth (g-n) as a result of fiscal policy assumes values between 0.2 and 0.5 percentage points (see Table A.3.4):

Table A.3.4: Differential between the growth of gross wages and salaries *g* and the maximum increase in net wages and salaries *n* (percentage points)

Parameter		*r*		
		3%	*4%*	*5%*
g	*1.5%*	0.37	0.47	0.21
	2.0%	0.27	0.45	0.40
	2.5%	0.19	0.37	0.48
	3.0%	-	0.27	0.45

Tables A.3.5.a and b provide sensitivity analyses for the assumed adjustment period between eastern and western Germany and the incidence assumption for capital income tax. Young and middle-aged generations and older women, too, benefit from a longer adjustment period, but it imposes an additional burden on older men and future economic agents, compared with the base case. If the taxes on capital income are borne by the factor labour (which is then regarded as being immobile), this affords relief to older men and, on account of the assumed equal redistribution of capital income in families, to all female age groups. At the same time, this relief is markedly greater than the additional burdens imposed on younger men, so that a greater burden must be shifted to future generations than in the base case.

Table A.3.5.a: Change in the generational accounts through changes in the assumptions (males: DM)

Age	Generational accounts in the base case	Changes in the generational accounts relative to the base case		
		Adjustment of eastern to western Germany		Incidence assumption
		s*=2020	s*=2030	Taxes on capital are borne by the factor labour
0	474,586	-1,108	-3,582	+38,304
5	503,419	-3,713	-10,053	+40,151
10	552,757	-6,887	-16,997	+43,693
15	604,307	-10,842	-23,814	+47,342
20	638,627	-11,236	-23,059	+49,603
25	595,233	-10,496	-20,362	+45,494
30	520,168	-11,798	-20,645	+36,884
35	421,497	-12,603	-19,770	+26,123
40	284,045	-10,673	-15,446	+12,334
45	141,295	-5,526	-7,616	-4,830
50	-27,554	-1,937	-2,420	-23,008
55	-195,957	+ 106	+ 491	-39,938
60	-314,286	+ 968	+1,594	-49,792
65	-335,407	+ 842	+1,292	-49,498
70	-293,553	+ 613	+ 899	-36,995
75	-237,996	+ 393	+ 568	-23,860
80	-185,004	+ 213	+ 308	-18,646
85	-140,876	+ 86	+ 124	-12,059
90 and older	-40,485	+ 0	+ 0	-2,005
Future generations	651,663	+19,862	+37,115	+109,642
Burden ratio	1.373	1.418	1.462	1.484

Table A.3.5.b: Change in the generational accounts throuh changes in the assumptions (females: DM)

Age	Generational accounts in the base case	Changes in the generational accounts relative to the base case		
		Adjustment of eastern to western Germany		Incidence assumption
		s*=2020	s*=2030	Taxes on capital are borne by the factor labour
0	173,094	- 975	-3,115	-27,216
5	191,597	-3,870	-8,370	-28,835
10	212,104	-6,818	-12,187	-31,491
15	230,087	-7,394	-13,043	-34,346
20	238,958	-4,634	-8,926	-37,672
25	206,520	-3,568	-7,159	-41,653
30	157,118	-4,282	-8,458	-48,462
35	109,715	-5,051	-10,055	-52,123
40	51,535	-6,003	-11,144	-55,640
45	-25,923	-5,656	-9,501	-60,519
50	-119,584	-5,635	-8,971	-62,901
55	-198,881	-4,512	-6,921	-62,631
60	-260,688	-2,882	-4,249	-57,517
65	-273,878	-1,493	-2,122	-45,569
70	-253,847	- 546	- 773	-31,553
75	-217,427	- 140	- 202	-19,466
80	-172,706	+ 42	+ 60	-13,229
85	-125,464	+ 45	+ 66	-7,736
90 and older	-31,996	+ 0	+ 0	-1,052
Future generations	237,679	+6,434	+10,892	-21,145
Burden ratio	1.373	1.418	1.462	1.484

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