Poor parents, rich children?

- A hundred years of distribution[1]

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Abstract

Conventional generational accounts are insufficient as instruments to judge the appropriateness of policies which may change intergenerational distribution. One of the reasons is that they are forward-looking and hence do not measure the impact of historical events. We construct a measure of full lifetime incomes and net government contributions for all generations born in Denmark from 1930 to 2030, combining historical figures with future projections on the large computable general equilibrium model DREAM. Despite many short-term fluctuations, the resulting development in lifetime income figures is relatively smooth, and net government contributions make up only a modest part of each generation's consumption possibilities, even though present and expected future tax rates in Denmark make up no less than half of GDP.

1. Introduction

Generational policies and intergenerational distribution are becoming increasingly more important subjects in most Western societies. This can be heard in many public debates and is also reflected in political initiatives. One of the reasons for intergenerational distribution to rise on the agenda is the increasing awareness of the challenges that the future demographic changes will impose on most Western societies. The demographic changes threaten the fiscal sustainability of many countries, (cf. Auerbach et al. (1999)), and adjustments to the fiscal systems are consequently called for. At the same time, the relatively long time-span of these challenges make relevant not only the question: What kind of adjustments should we make, which involves questions of efficiency and intragenerational distribution, but also the question: When should the adjustments be instituted? Societies have a choice as to the speed with which they will implement e.g. reforms of pension systems, tax changes or other budget-improving measures, and this choice (besides having also efficiency consequences) will affect the distribution of consumption possibilities between generations living in different periods.

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Also in academic economic circles, interest in intergenerational questions has risen. First and foremost, this has manifested itself in the popularity of generational accounts, following Auerbach et al. (1991). A recent useful survey of the use and critique of generational accounts is Bonin and Patxot (2004). Traditional generational accounts distribute income taxes and public transfers and occasionally other public revenue and expenditure on various age and – normally - gender groups, typically based on accounts for a single base year or a short time span of years, and make future projections under the assumption of unchanged age and gender distribution.

Generational accounts have been made for many countries, and various refinements of the method have been introduced. However, traditional generational accounts are not a sufficient instrument to judge the appropriateness of various policies of intergenerational distribution. There are several reasons for this, including the following:

1) Generational accounts register only actual expenditure paid by and revenue collected by the government (and often only a certain part of these figures). Other government policies which can alter consumption possibilities between generations are ignored in these accounts, e.g. general equilibrium effects via asset prices, changes in unemployment and factor income levels, etc. This critique has been raised by e.g. Buiter (1997) and Raffelhüschen and Risa (1997).

2) Suppose that we have a government which includes among its objectives a desire for a certain intergenerational distribution of consumption possibilities. One necessary condition in order to institute a policy which can achieve this objective is that the government has information on the actual (and projected future) distribution of consumption possibilities across the various contemporaneous and future generations over their whole lifespan. This is in itself an enormous task which requires data on past levels as well as projected future levels of income, among other things. But without at least some judgement of the status quo of intergenerational distribution for those generations that are presently alive in the economy, any attempts to improve on it are complete steps in the dark. Traditional generational accounts do not help fulfilling this criterion for two reasons. Firstly, they are concerned only with the position between the public sector and the individuals of the economy, which is presumably only one element affecting the utility of each generation. Secondly, they are almost exclusively forward-looking and do not take the past into account, even though most living generations have also lived in the past, and their total lifetime consumption possibilities are affected by their economic experiences in the past.

3) Even supposing that the first two problems are overcome, the optimal distribution between various generations of an economy still depends on the welfare function used. As is well known, the question of the "correct" social welfare function is one with deep ethical implications and not one on which economists can make a definitive judgement. The most we can hope for here is to clear the ground by presenting various clarifying propositions. However, normative statements about

the appropriate intergenerational distribution do not make sense without a clearly defined social welfare function.

The first point can be addressed by using a computable general equilibrium (CGE) model to simulate the effects of various policy measures on the over-all welfare of generations, as done by Raffelhüschen and Risa (1997) and others. In the present paper, we also use this approach. The main motivation for the paper, however, lies in our attempt to illustrate how the second point mentioned above can be overcome, by presenting an account of both historical and future projected lifetime incomes and public net payments of most Danish generations alive in 2004. We do this by employing a large number of historical data from 1947 to 2001 and splicing them with the projections for the period 2001-2131 made by the advanced dynamic overlapping-generations CGE model DREAM. In this way, we obtain estimates for the whole life-span of generations born from 1930 to 2030[5].

As far as we know, there exist two other attempts to do something similar: Auerbach et al. (1993) measure lifetime tax rates for Americans born 1900-1991, and Ablett and Tseggai-Bocurezion (2000) calculate lifetime Australian net average tax rates for generations born 1900-1997[6]. The two papers are quite similar in their approach. Auerbach et al. find that the lifetime tax rates of future Americans are likely to rise considerably, whereas Ablett and Tseggai-Bocurezion report rather stable net tax rates for all Australians born from around 1930 into the future[7].

While the over-all idea and approach to the calculations are the same in our case as in the two papers mentioned, three main differences distinguish the methodology used in the present paper[8]: Firstly, we include not only labour income, but also capital income, and in particular capital gains from real estate, in our calculations. Secondly, on the government expenditure side, we distribute all expenditure, i.e. beside cash transfers we distribute public consumption etc. About two thirds of public consumption (educational, health and social expenditure, etc.) can be directly attributed to individuals of various generations. Whereas the last third (expenditure for administration, defence, infrastructure, etc.) cannot be distributed in the same way and consequently is allotted in lump-sum fashion to the population alive during the year, we still find that this approach is more correct than ignoring the impact of public consumption on the total consumption possibilities of each generation. For this reason, our reported lifetime net tax rates (or net contributions) are much smaller than in the American and Australian case – indeed, they are often

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[5] Jensen et al. (2002) also use the DREAM model to discuss intergenerational distribution in Denmark, using only forward-looking data.
[6] Auerbach et al. use survey data going back to the 1960'es to distribute national accounts data back in time. Ablett and Tseggai-Bocurezion use similar data going back to 1975.
[7] In addition, a recent working paper by Bommier et al. (2004) present extremely long historical and projected public transfer accounts for US citizens.
[8] An earlier version of these lifetime accounts has been presented in Danish Economic Council (2004). Compared to those figures, the methodology and partly the data material have been revised for the present paper. Consequently, the present results deviate in a number of ways from the former ones.

negative. This is true even though Denmark is characterized by a very large public sector compared to most other Western countries. Danish government revenues and expenditures both make out around 50 per cent of GDP in recent years. Thirdly, the two mentioned papers rely on a traditional generational account for their future projection, whereas we employ a full CGE model, allowing us to catch the probable general equilibrium effects of changes in future demographic conditions and policy changes, addressing the first point above.

Even so, the task is enormous, and we view our present contribution as only a first attempt to present a comprehensive and systematic methodology for measuring the economic distribution between present and future generations in Denmark, which may be improved in future. When considering past experience, many data are insufficiently available and it is necessary to make a number of assumptions which can be discussed. When considering the future projection, also this is dependent on the modelling choices of the basic CGE model, which are naturally open for discussion. For this reason, the present paper is rather methodological in scope, discussing the wide variety of considerations which must be made in order to construct such accounts, and where we have made a particular choice. We hope that the paper can stimulate future refinements to the method. Also, the resulting present calculations should be interpreted with some caution, and one should not rely too heavily on minor details in the data. However, we believe that the major results are robust to this and find that even given these limitations, a number of interesting conclusions emerges from our work.

We should emphasize that we do not attempt to solve the third problem mentioned above. However, section 2 contains a literature review of the normative discussion concerning intergenerational distribution so far. Section 3 describes data and methodology used in our historical accounts, and section 4 describes similarly data and methodology for the projection of future generational incomes. Section 5 brings the results and discusses, and section 6 concludes.

2. Intergenerational distribution: normative aspects

What does economic theory say about the optimal distribution between generations living during different, but possibly overlapping time intervals? Like other normative issues with a distributional content, economists can hardly come up with a decisive answer as to the correct distribution over time. Nevertheless, various economists have tried to clarify the issues in various contexts.
One place to start is to look at the implications of two different benchmark models which are very popular in use as work-horses by modern dynamic macro-economic theory: The infinitely-lived representative agent Ramsey model, and the overlapping generations model contributable to e.g. Diamond (1965). In the Ramsey model, the private agents at any time internalize the well-being of all later generations, their descendants, in their own utility function. This set-up has two implications: 1) In an economy without market failures, the socially optimal intergenerational distribution is automatically obtained. 2) Even in an economy characterized by market failures, the preferences of the agents, in

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particular their discount rate, reflects "correct" wishes for intergenerational distribution. In principle, the behaviour of the private agents thus contains information that the government should follow. Discount rates can be empirically ascertained, and the government should then concentrate on correcting the possible market failures to achieve the optimal growth in consumption possibilities over time.

However, in an OLG model, things are not that simple. In this set-up, people do not care about their descendants, at least not sufficiently to let it influence their actions, and a government may need to make a judgement on the preferable intergenerational distribution which is independent from the private dispositions of the presently-living agents. One could justify this by distinguishing between the private behaviour of people and people's views as members of society, in which capacity they may still care about society's future and ask the government to act according to a social welfare function including the welfare of future generations[9].

Both modelling approaches are often in practice used together with a social welfare function implying some form of discounted utilitarianism, an approach which many economists seem to favour. However, this is not a consensus view. For instance, the pure utilitarian approach has been attacked by some ecological and environmental economists. Examining the possibility that natural resource constraints or environmental problems may reduce consumption and utility in the remote future, they have argued that discounted utilitarianism is insufficient as guidance for the optimal economic development because it may imply very low utility levels for generations living in the remote future. This has led to the advocacy of a sustainability criterion, normally interpreted as stating that all generations should leave future generations at least as well off as themselves. It is argued to be ethically indefensible to not fulfill this criterion. However, there is not compelling empirical or theoretical reasons that these environmental constraints will necessarily preclude permanent sustainable economic growth (cf. Schou (1999)), and in this case the sustainability criterion does not provide any answer to the correct intertemporal distribution. In a society with a positive trend productivity growth, the most probable outcome is that generations will permanently become more well off than their ancestors anyway, and the relevant question then seems to be: *How* much more should each generation be richer than the preceding one? The sustainability concept does not provide any answer to this.

An alternative to discounted utilitarianism is the maxi-min principle advocated by e.g. Rawls (1971). Briefly, he argues that if all individuals of a society meet in an "original position", where they know the feasible resource allocations, but do not know where they themselves will be placed in the income distribution, rather than using a utilitarian criterion they will find it optimal to agree on maximizing the utility of the least well-off member of society (the maxi-min rule). Rawls did not himself intend to apply this maxi-min rule in an intergenerational context (cf. Arrow, 1973), and the consequences of doing so are clearly striking: In a society with a positive economic per capita growth trend, the poorest generation is invariably the oldest, at least in a steady state, and maximizing the welfare of this generation would imply ceasing sacrificing present consumption in order to increase future consumption, effectively leading to a complete halt of economic growth. Roemer and Veneziani (2001), discussing this, argue that "we are under no

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[9] See Blanchard and Fischer (1989), chapter 3, for a discussion of this point.

ethical mandate to leave our descendants a world more bountiful than our own, *although we may decide to do so if that increases our welfare* by contemplating the happiness it will bring our children, and their children...”

A further complication of the issue is the insight of the relative consumption theory that utility may depend not only on one's own consumption, but also on the consumption level of others: People view their own consumption relative to some reference level, which may be that of past levels of consumption (one's own or others'), or that of other contemporaneous persons (living in the neighbourhood or in the economy generally, possibly abroad) (for some recent contributions, cf. Abel (2003) and Luttmer (2004). Frey and Stutzer (2002) and Stutzer (2004) also report empirical evidence of the importance of relative consumption levels). This creates an externality in consumption, potentially modifies many different normative results for optimal government policy from more traditional models, and makes the connection between lifetime incomes and utility levels of various generations less clear. For instance, for an open economy, this could have important implications for the effects of economic growth upon utility. A domestic consumption growth rate which is positive, but smaller than that of the rest of the world, could actually leave domestic consumers increasingly worse off in utility terms if they regard consumers abroad as their reference group. An egalitarian policy wishing to accord all generations the same utility should then ensure that lifetime consumption possibilities simply rise with the growth rate of lifetime consumption in the rest of the world.

Taken together, there is no consensus among economists concerning an appropriate social welfare function. It also follows from this that generational accounts showing imbalances, in the sense that some generations are net beneficiaries and others are net contributors vis-à-vis the government over their lifetimes, have no clear normative implications. As long as it is not evident how we would like to distribute consumption possibilities between generations, also it is not clear if an actual intergenerational distribution policy implied by a particular generational account improves or worsens matters compared to a "balanced" generational account (GA). However, we find it important that any attempts to formulate policies aiming at a particular distribution between generations must as one of its starting points ascertain the actual (and expected future) distribution of lifetime incomes. The contribution of the present paper is to present one attempt to do this consistently.

3. Construction of historical accounts

Our aim is to construct historical accounts of lifetime incomes and net government contributions for most living generations. The main principle is to collect relevant macro data from the National Accounts (NA) and various supplementary sources and to distribute them to the various generations using all available information from micro data

as to the relevant age distribution of incomes, capital gains, tax payments, etc. A number of methodological decisions must be made in order to do this meaningfully.

The Danish NA have reliable information for most main time series back until 1947, whereas going further back gives very large problems of obtaining and interpreting data reliably. For this reason, our historical accounts cover the period 1947-2000 (as the present version of DREAM is calibrated using data from 2001 and consequently uses information from this year on in its present values of future earnings and net contributions).

We define a generation as the set of all individuals which are born during a particular 5-year interval and who live in Denmark during some part of their life. One question for discussion is: To which generation should public expenditure for children such as free kindergartens and primary schools or child allowances be allocated? One possibility is to regard these expenses as benefits for the children. Alternatively, however, it can be argued that the people benefiting from these services are really the parents who would otherwise have to provide for their children. The latter principle is followed in the present calculations: Children under 17 years of age are assumed to belong to their parents' households and to have no independent income, so that public consumption regarding child-care and education, etc. for these age groups as well as child benefits are allocated to the parent generation when calculating net contributions. Consequently, the first generation for which we are able to calculate lifetime incomes and contributions are those that were born during the years 1930-1934, and who consequently were from 13 to 17 years old in 1947. As lifetimes figures are calculated as present values at the time when each generation enters the economy, our choice implies that all figures are interpreted as seen from a 17-year-old person's point of view rather than from that of a new-born baby.

Naturally, we are interested in per capita figures, which raises the question: How should we fix the number of persons in each generation, as this number varies over time due to migration and mortality? Especially for some generations, whether to include immigrants or not may affect per capita figures noticeably. We choose here to use the number of persons in each generation residing in Denmark when the generation was 17 years old. This seems most natural as the present values are also discounted to the time when the generation is 17 years. The implication is that the per capita figures should be interpreted as the lifetime income (etc.) of a representative person of the generation, given that there is a certain probability that he is an immigrant.

The question of choosing the relevant rate of discount is quite crucial to the results. Most generational accounts studies choose a rate which is comparable to the government bond rate (e.g., 5 per cent in the study by Ablett and Tseggai-Bocurezion (2000)). We want to look at the figures from the consumers' point of view: The rationale for discounting e.g. lifetime incomes is that income early in life is worth more to the consumer than income later in life, because he could invest the former and earn a positive net real return from the investment. The relevant discount rate is consequently the net (after-tax) real return for the representative member of each generation. It should be noted that this creates an

asymmetry when comparing with the net contributions seen from the government's point of view.

Historically, this real rate of return has changed considerably. One could argue that the actual historical rate should be used in the calculations. However, this would overestimate the effect of the fluctuations in the interest rate, cf. Sørensen (2004). Alternatively, we choose the steady-state after-tax weighted average return to assets (bond holdings, equity and housing stock) for households from the projections of DREAM, which is 2.38 per cent per annum. It should be emphasized, though, that the choice of discount rate may affect the size of present values considerably.

We want to examine the intergenerational distribution of income before as well as after the redistributive effect of the government. For that reason, we use the term market income for household income before tax payments and transfers. For each individual year, we must then calculate a figure for the total market income of private households and distribute this figure to the various generations living in that year. In order to perform the first task, it is necessary to consider which macroeconomic income concept to use in order to replicate total market income. The NA measure most closely resembling our concept of total household market income in a given year corresponds approximately to net national income minus direct taxes. Three circumstances ensure that the concepts are not identical, however: Firstly, part of the Danish firms is owned by impersonal foundations, which means that the capital income connected with this part of market income cannot be distributed to individuals. Secondly, part of the returns to capital is paid to pension funds; these returns are distributed to individuals in the year when the returns are actually paid out as benefits and consequently cause a displacement in time of the calculated income. Thirdly, part of the income in the national accounts comes from non-taxed (black-market) labour. Obviously, this income is not represented in the micro data age profiles which originate from tax accounts, and they are consequently not distributed to generations in the present analysis. In the base year 2001 of the CGE projection, the market income distributed to generations equals 92.1 per cent of net national income minus indirect taxes. To ensure consistency between historical and projected incomes, the same percentage is kept constant in the historical data, so that for each year from 1947 to 2000, 92.1 per cent of this measure is assumed to make out total household market income of that year.

To distribute total market income in each year to generations, we employ various sources of micro data. The appendix gives more detailed information on the exact data sources and assumptions employed. In most cases, micro data are taken from a 10 per cent random sample of the Danish population for the years 1980 and 1988-2000. For these years, the sample gives detailed information on a large number of sources of income and taxation. In years for which no available data exist, age profiles for later (and in some cases, earlier) years are used. This method implies that an important assumption for the validity of the data is that the actual profiles for the relative distribution between different ages do not change too much over the years. For the distribution of indirect taxes and age-specific public consumption, where data are particularly uncertain, age profiles from a single year are used consistently throughout. Indirect tax payments are further

subdivided into 5 different components, while public consumption is divided up into 11 different components besides a lump-sum category, with each having its own particular age profile.

4. Projection of future generational income and public accounts

The projection of future market incomes and net contributions is made using the generational accounts system of DREAM (Danish Rational Economic Agents Model). DREAM is an overlapping generations, computable general equilibrium model with focus on demographic developments and the public sector. The model represents a small open economy with a fixed exchange rate regime and perfect international mobility of financial capital, so that the nominal interest rate is given by world bond markets. Foreign products, however, are considered an imperfect substitute for products produced at home (the Armington approach), so that goods prices and real wages may be influenced by internal Danish economic developments. For a more detailed description of the model, see Knudsen et al. (1998).

The model uses a detailed projection of the Danish population from 2001-2101 which incorporates empirically estimated future developments in fertility, mortality and net immigration rates. The adult population is divided into 17 generations, each consisting of a 5-year interval, starting with people who are 17-21 years old.

Each generation is represented by a representative household with perfect foresight which optimizes its labour supply, consumption and savings decision in each period. Savings take place in owner-occupied dwellings, free financial savings (stocks and bonds) and labour-market and private pensions arrangements. The labour market is characterized by unionized behaviour giving rise to unemployment. There are two private production sectors: a construction sector and a sector producing other goods and services. Firms hire labour and use materials and capital as inputs in production. Investments are subject to convex capital installation costs, giving rise to gradual capital adjustments. Like the labour market, the product markets are characterized by imperfect competition. An exogenous Harrod-neutral labour-augmenting productivity growth rate of 2 per cent annually and an exogenous foreign inflation rate of 1.75 per cent are assumed. In steady state with a constant population, real GDP growth as well as many other variables then also grow 2 per cent annually. This is close to the historical average for Denmark since industrialization.

The public sector produces goods which are mainly used for public consumption. Also, it levies taxes and pays transfers and subsidies to households and firms. These are modelled to replicate actual budget conditions as closely as possible. The most important taxes in terms of revenue are local- and central-government income taxes, VAT, excise duties, corporate taxes, property taxes and a tax on the yield of pension funds. On the expenditure side, 23 different transfers are distinguished and paid out to individuals of each respective age, gender and origin group following the actual distribution in 2001. In the same way, expenditures for individual public consumption (mainly educational,

health and social expenditures, making up altogether about two thirds of total public consumption) are distributed to individuals. The remaining third representing collective public consumption as well as production taxes and subsidies and a few other government incomes and expenditures which are not readily attributable to individuals are lump-sum distributed to the whole population.

The government intertemporal budget constraint is respected, and the sustainability of fiscal policy can be ensured in various ways. As fiscal policy is not immediately sustainable in the projection, it is necessary to specify how this should be done. The exact way in which sustainability is enforced is central in the intergenerational distribution discussion, and in this paper we present two very different approaches concerning the timing of the adjustment. In the base-line scenario, sustainable fiscal policy is secured by a one-time permanent adjustment of the main central-government income tax rate (the bottom-bracket tax rate) from 2007.

To understand the model better, it may be useful to look at table 1, which illustrates the macroeconomic development in the base-line projection. The future demographic challenges are mirrored in the fall in effective employment of around 15 per cent during the next four decades, partly because of population ageing, partly because a larger proportion of people in the labour-market-active ages in future will be immigrants and their descendants who historically have lower participation ratios than the remaining population. Whereas participation rates for the various population groups are projected exogenously, employment is modified by the endogenous unemployment rate. This stays roughly constant, however, at a level of slightly more than 5 per cent in the projection. This is the result of various conflicting influences: The income tax rise and the fact that immigrants tend to be relatively more unemployed makes unemployment rise. At the same time, however, Denmark experiences a terms-of-trade improvement which increases real wages and consequently employment incentives. Also, during the initial years the effective replacement ratio is reduced due to the increase in Danish labour-market pensions arrangements which affects indexation of unemployment benefits.

Technological progress easily outweighs the demographic labour force shrinking to ensure that GDP grows unbrokenly, so that in 2041 production has increased around 83 per cent compared to 2001. Private consumption increases even more than GDP: The initial foreign debt is paid out during the first decade of the projection, and Denmark afterwards collects a considerable amount of net foreign assets. In the steady state, the interest incomes from these assets maintain a steady net trade deficit, financing a permanently larger consumption level than domestic production itself can supply.

Table 1. Macroeconomic development

	2001	2001	2006	2021	2041	2061	2101
	Level, billion DKK	Index in fixed prices, 2001=100					
Private consumption	624.5	100	111.4	140.0	191.8	269.6	577.2
Real GDP	1 139.1	100	109.5	137.3	182.8	256.0	555.3
Unemployment in per cent	5.2	5.2	5.1	5.2	5.3	5.4	5.3
Employment		100	99.6	93.2	84.9	81.3	82.8
Private non-construction sector		100	97.6	89.7	78.4	74.2	75.4
Construction sector		100	110.4	99.8	89.9	87.2	91.0
Public sector		100	100.8	98.8	97.3	94.7	96.2
Capital stock							
Private non-construction sector		100	111.3	138.9	180.9	251.4	542.1
Construction sector		100	126.8	159.9	215.2	307.2	680.8
Public sector		100	98.4	127.1	183.5	261.7	568.9
Net foreign assets in % of GDP	-234.0	-17.7	-1.4	40.7	62.0	70.2	47.5

The development of public finances in the base-line scenario is illustrated in table 2. Both expenditure and revenue grow as percentages of GDP to a level of close to 60 per cent in 2041. On the expenditure side, the rise is caused by demographics. On the revenue side, there are three main reasons for the rise in tax revenue: Firstly, the endogenous rise in the income tax rate in 2007 to make fiscal policy sustainable. Secondly, the present building up of large pension funds in Denmark which are taxed mainly when they are paid out to the receivers, implying that they increase the tax base gradually until maturation after 2050. Thirdly, most public transfers to households are taxable, so that when (gross) public expenditures rise as a percentage of GDP in future, this will in itself also imply a rise in income tax revenue. As there is a large primary budget surplus initially and the timing of the sustainable policy adjustment means that the tax hike comes before the full demographic expenditure impact, the government maintains a solid surplus on its budget until 2026, accumulating large assets, enabling it to run a primary budget deficit permanently afterwards.

Table 2. Public Expenditure and Revenue

	2001	2001	2006	2021	2041	2061	2101
	Level, billion DKK	Pct. of GDP					
Expenditure	665.74	50.23	50.15	55.48	59.66	59.81	59.02
Public transfers	229.57	17.32	17.35	20.45	21.84	21.37	20.49
Age-dep. pub. consumption	241.97	18.26	18.37	20.08	22.79	23.42	23.42
Non-age-dep. pub. consumption	101.30	7.64	7.61	7.61	7.61	7.61	7.61
Other Expenditure	92.89	7.01	6.83	7.35	7.43	7.42	7.50
Revenue	722.13	54.48	52.73	57.02	59.01	59.21	58.80
Primary budget surplus	56.39	4.25	2.58	1.53	-0.65	-0.61	-0.22
Net interest expenses	18.86	1.42	0.25	-1.45	-1.99	-2.11	-1.68
Net public debt	85.51	6.45	-6.36	-45.33	-48.49	-51.84	-42.59
GDP in 2001-prices	1325.51	1325.51	1488.80	1866.70	2558.79	3621.11	7839.09

In this way, the choice of sustainability adjustment makes presently-living (older) generations pay for future adverse demographic developments, which obviously influences the reported net contributions in our GA. As an alternative, we present a

scenario where government debt is kept constant as a percentage of GDP and the bottom-bracket tax rate accordingly changes over time to reflect changing expenditure patterns following from the demographic developments. Table 3 shows the development of government finances in this scenario. Here, the primary budget surplus is close to zero and net government assets make out about 7.4 per cent of GDP permanently from 2007.

Table 3. Public Revenue and Expenditure in scenario with constant debt ratio

	2001	2001	2006	2021	2041	2061	2101
	Level, billion DKK	Pct. of GDP					
Expenditure	665.74	50.23	50.09	55.10	59.79	60.05	59.26
Public transfers	229.57	17.32	17.31	20.22	21.88	21.45	20.57
Age-dep. pub. consumption	241.97	18.26	18.35	19.93	22.87	23.56	23.57
Non-age-dep. pub. consumption	101.30	7.64	7.62	7.62	7.62	7.62	7.62
Other Expenditure	92.89	7.01	6.81	7.32	7.41	7.41	7.49
Revenue	722.13	54.48	52.87	55.03	59.71	59.97	59.22
Primary budget surplus	56.39	4.25	2.77	-0.07	-0.07	-0.07	-0.04
Net interest expenses	18.86	1.42	0.25	-0.30	-0.30	-0.30	-0.29
Net public debt	85.51	6.45	-7.39	-7.39	-7.39	-7.39	-7.39
GDP in 2001-prices	1325.51	1325.51	1500.44	1885.42	2560.65	3611.59	7810.06

5. Capital gains on housing

One of the issues often raised in discussions of lucky and unlucky generations are the consequences of capital gains and losses on owner-occupied dwellings and stock holdings. Whereas in Denmark privately owned stocks are on average a minor part of private household assets, owner-occupied dwellings are a dominant part, and windfall gains and losses on this market might affect the intergenerational distribution of consumption possibilities considerably. The market for owner-occupied dwellings shows huge fluctuations during the course of time. Using figures for housing prices since 1951[10] (the first year available) and the total stock of owner-occupied dwellings in each year, we can construct figure 1, which demonstrates that aggregate capital gains (or losses) for individual years may exceed 10 per cent of GDP. Generations which on average tend to enter the housing market at a time when prices are relatively low and leave it when they are relatively high, naturally gain an advantage.

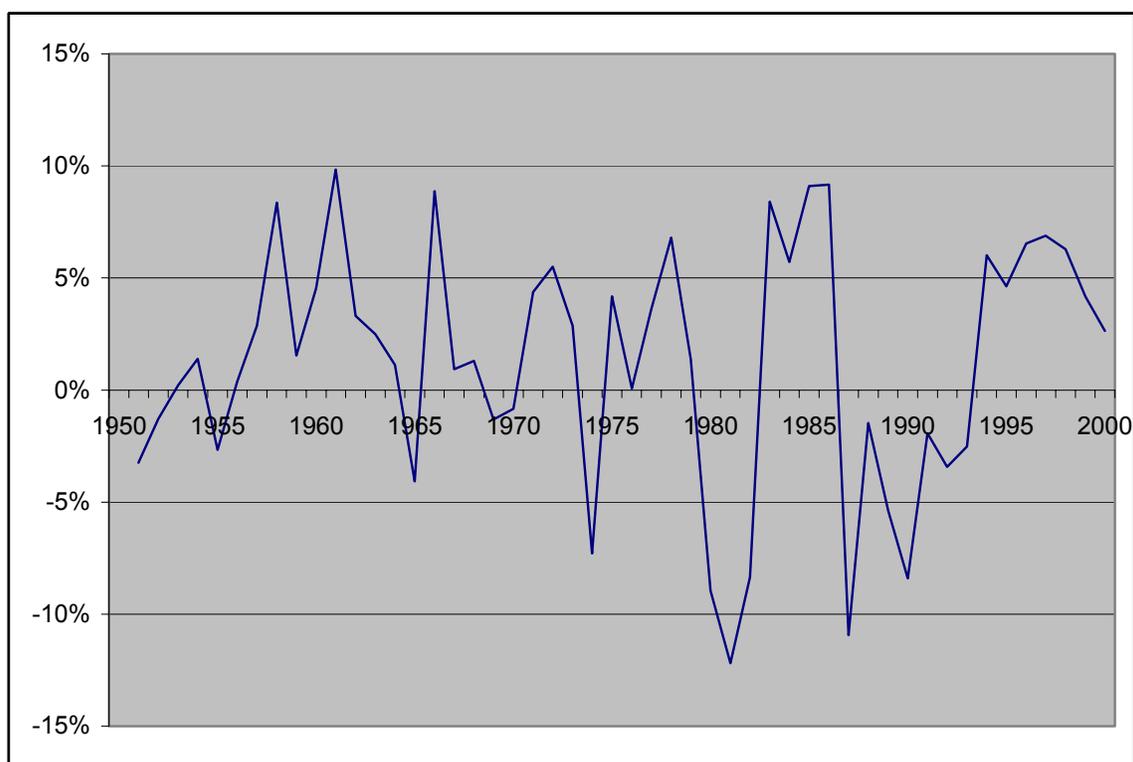[10] The figures are deflated using a chained net price index.

Figure 1. Aggregate capital gains and losses from fluctuations in the housing stock as per cent of GDP

Using the age distribution among owners of dwellings for the years 1988 to 2000 and assuming that the age distribution from before 1988 follows the distribution from that year, we can calculate the aggregate gains for the generations living in the historical period. The results, discounted to the year when the generation in question was 17 years old, are illustrated in figure 2.

For calculating capital gains, future projections are not meaningfully calculated. Most of the capital gains are caused by stochastic fluctuations, and such windfall gains and losses are ruled out in our CGE projection which features perfect foresight and consequently relatively smooth price changes over the period of the projection. Also, in the CGE model there is no trend in housing prices compared to the consumer price index. In our historical figures, however, housing prices on average rise faster than other prices, which can indirectly be seen from figure 2, where all generations during the historical period have positive capital gains. It can be seen that the figure is considerably more smooth than figure 1, which illustrates another point: even though fluctuations can be rather large during some years, the consequences tend to be spread out among many generations, as people on average are on the housing-market for very many years. Consequently, the typical house-owner experiences several both up- and down-turns during his time in the market. Gains in particular years are consequently divided out to many generations. The generations born during the second half of the 1950'es and during the 1960'es, however, do seem to have gained disproportionately from fluctuations in housing prices so far. As the general tendency in the diagram should be that total gains decrease with the birth year

13

(because younger generations in 2000 have not been on the housing market for so many years and have consequently had time to prosper from the average positive net capital gains for only a few years), this tendency is even more marked.

It should also be noted, however, that even for the oldest generation the total capital gain from housing makes out only about 1.5 per cent of their total lifetime consumption possibilities. Hence, whereas housing market fluctuations may make a marked difference in individual cases, they do not seem to matter much for the relative distribution between generations.
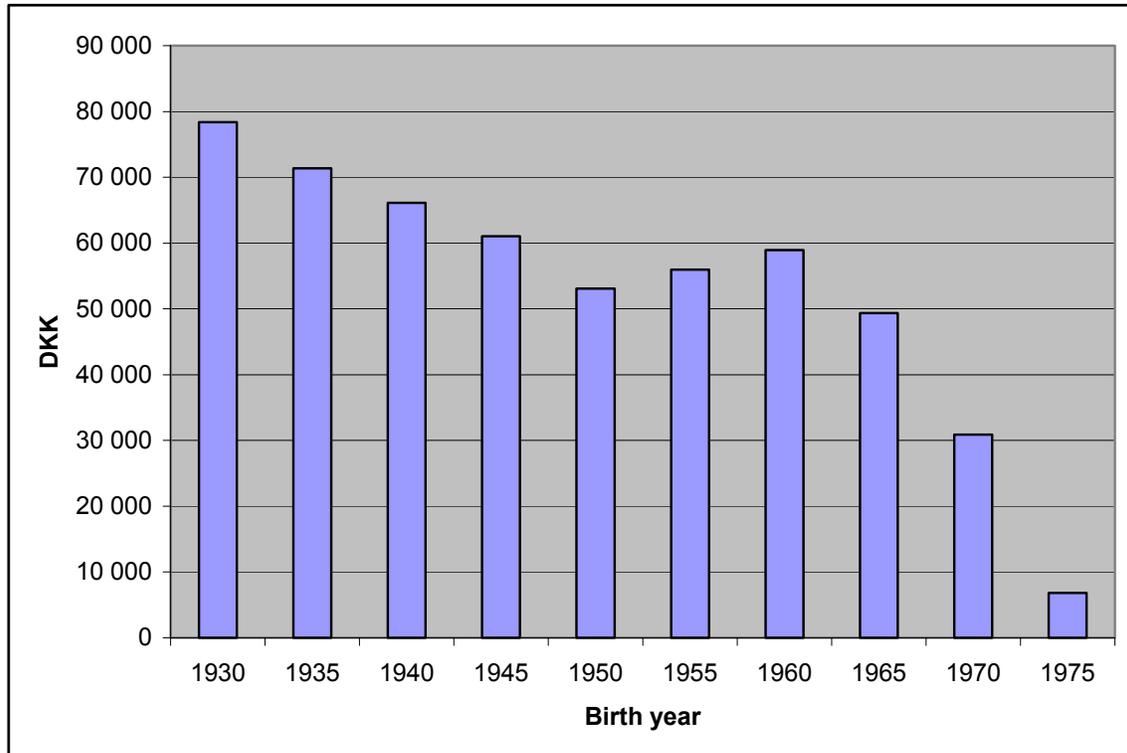
Figure 2. Capital gains 1951-2000 distributed to generations

6. Results

Market income
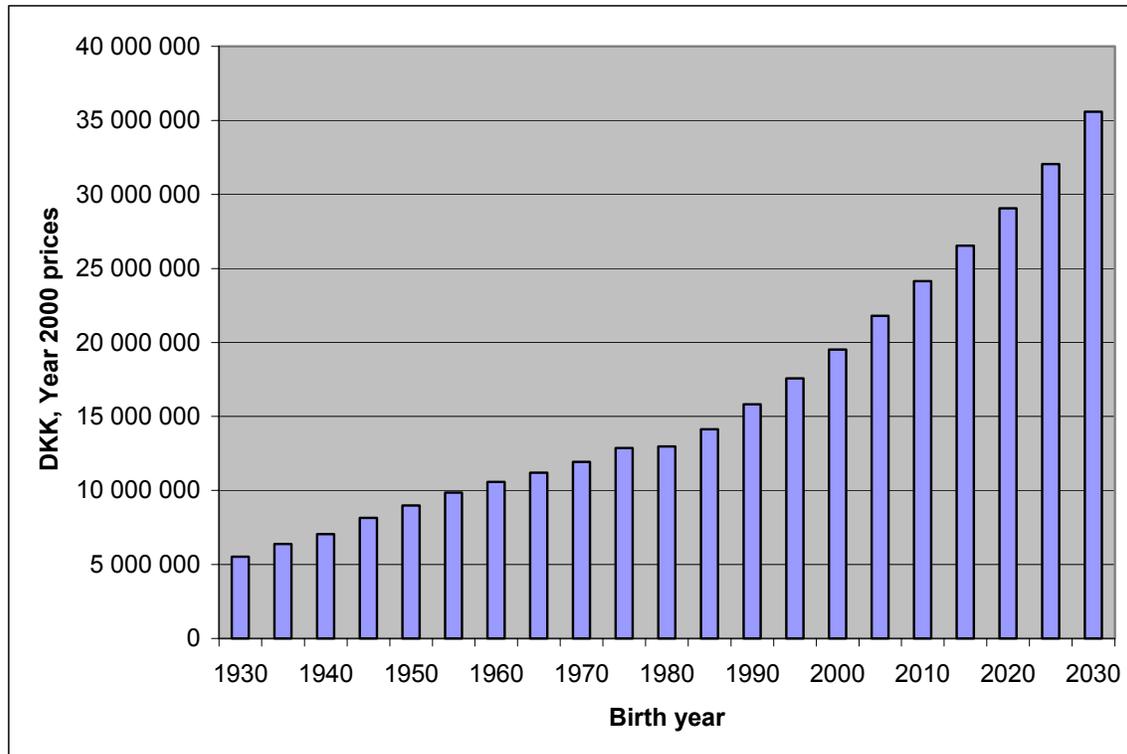
Figure 3. Market income distributed to generations

The total market income of the various generations, measured in prices of the year 2000, is shown in figure 3. It is not surprising that the figure has a general upward trend, caused by the permanent productivity growth that we have experienced in the past and project into the future. In view of the debate in Denmark on the wealth gains and losses of various generations, it may be surprising, however, to note that even for generations decomposed into 5-year intervals, the tendency that younger generations will always earn more than their predecessors, is completely unbroken: The positive structural productivity growth trend outweighs all other temporary phenomena which might blur the picture temporarily, such as business cycles. This supports the observation that such events are generally more evenly spread out among generations than is often supposed.
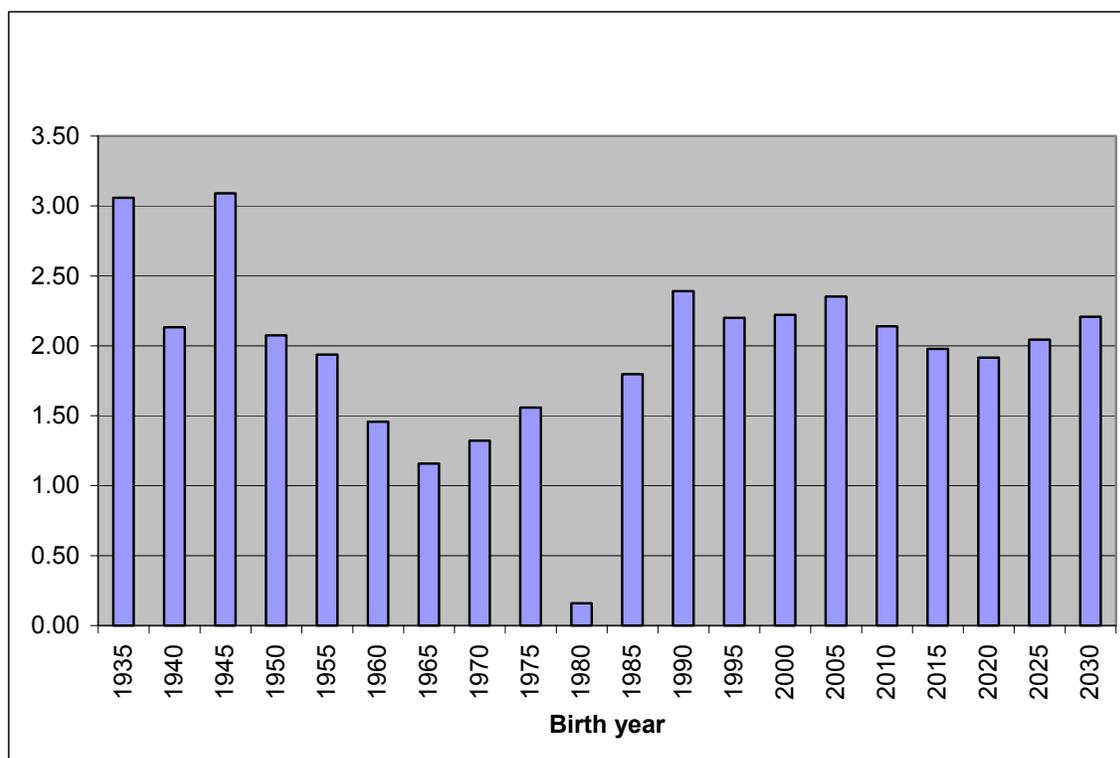
Figure 4. Growth rates in market income.

However, even though income growth is positive for each generation compared to its predecessor, it does not proceed completely smoothly. This can be seen more clearly from figure 4 which shows the annual growth rates in market incomes from generation to generation. In our calculations, the generations which experienced the most rapid growth in consumption possibilities compared to the generations before them are the earliest ones, that is the generations born in 1935-39 and in 1945-49. On the other hand, those generations born during the 1960'es throughout the 1990'es experience growth rates which are smaller than those of older as well as younger generations. This might reflect the productivity slow-down as well as the crisis years of the 1970'es and the "seven lean years" from 1987 to 1993, when economic growth in Denmark was very slow compared to its neighbours, and unemployment rose steeply.

Net contributions

Figure 5 shows net contributions to the public sector per capita for each generation as a percentage of lifetime market income. Most generations have negative net contributions, i.e. the present value of their transfer and consumption receipts exceeds their tax payments when discounted to the age of 17 years. The exception is the generations born during the 20-year period from 1955 to 1975, and again the generation born during the first half of the 1990'es. These generations pay between one and three per cent of their market income in net contributions to the public sector.

16

It is evident from the figure that direct payments to and from the public sector make only a modest difference to the consumption possibilities of the various generations. For the generation which receives relatively most (persons born from 1980 to 1984), the grant from the government amounts to less than 5 per cent of their market income. Direct government intervention over the years accordingly means relatively little for the intergenerational distribution of consumption possibilities. This is quite thought-provoking as the public sector in Denmark has grown extensively since WWII and is today quite large compared to other OECD countries. In 2002, public expenditure amounted to 53.9 per cent of GDP. Of course, it should be remembered that in addition to direct expenditures and revenue payments, economic policy may also influence intergenerational distribution by changing the possibilities of earning market income.
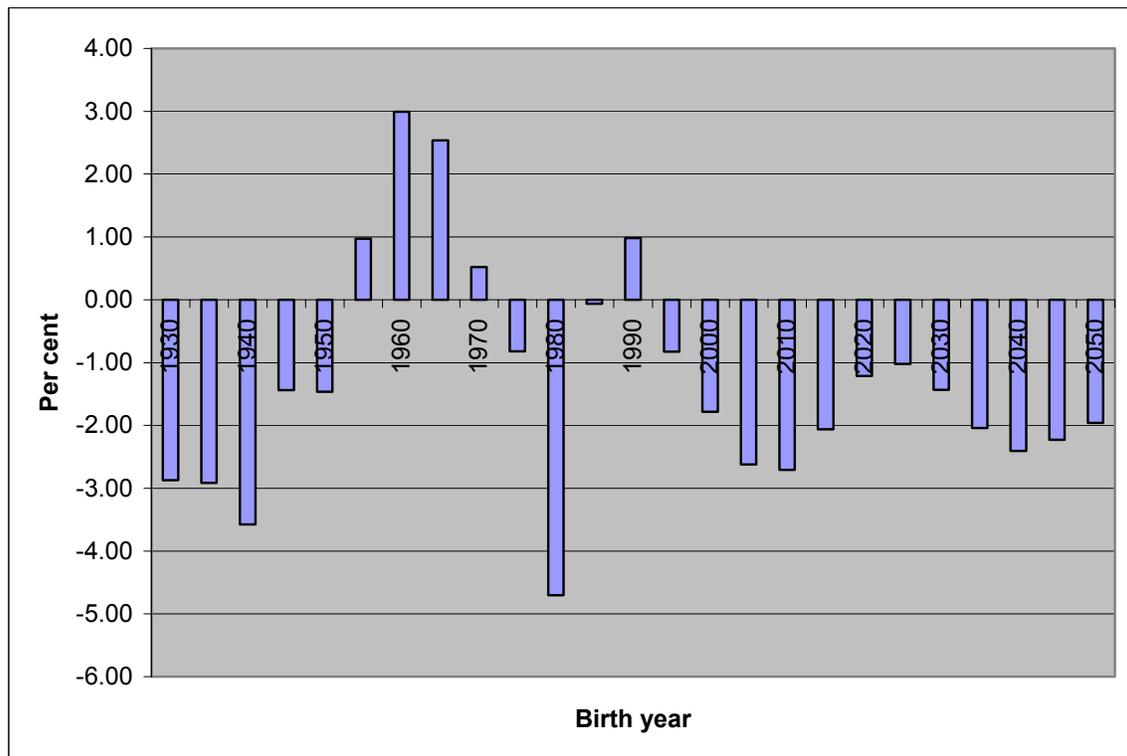

Figure 5. Life- time net contributions to the government as per cent of market income.

Total consumption possibilities

Adding market income, net contributions to the government and capital gains from housing, we arrive at a figure illustrating the total consumption possibilities for each generation. Growth rates of total lifetime consumption possibilities are presented in figure 6.

Growth rates vary somewhat over time. The oldest generations generally experienced the highest growth rates compared to their immediate seniors, whereas the generations born from the late 1960'es until 1990 have had relatively modest growth rates, but the pattern of permanently increasing consumption possibilities is completely unbroken. Taking

account of net government contributions and housing capital gains does not fundamentally alter the picture that the generations born during the 30-year period from 1960 and onwards seem to experience the relatively smallest growth rates
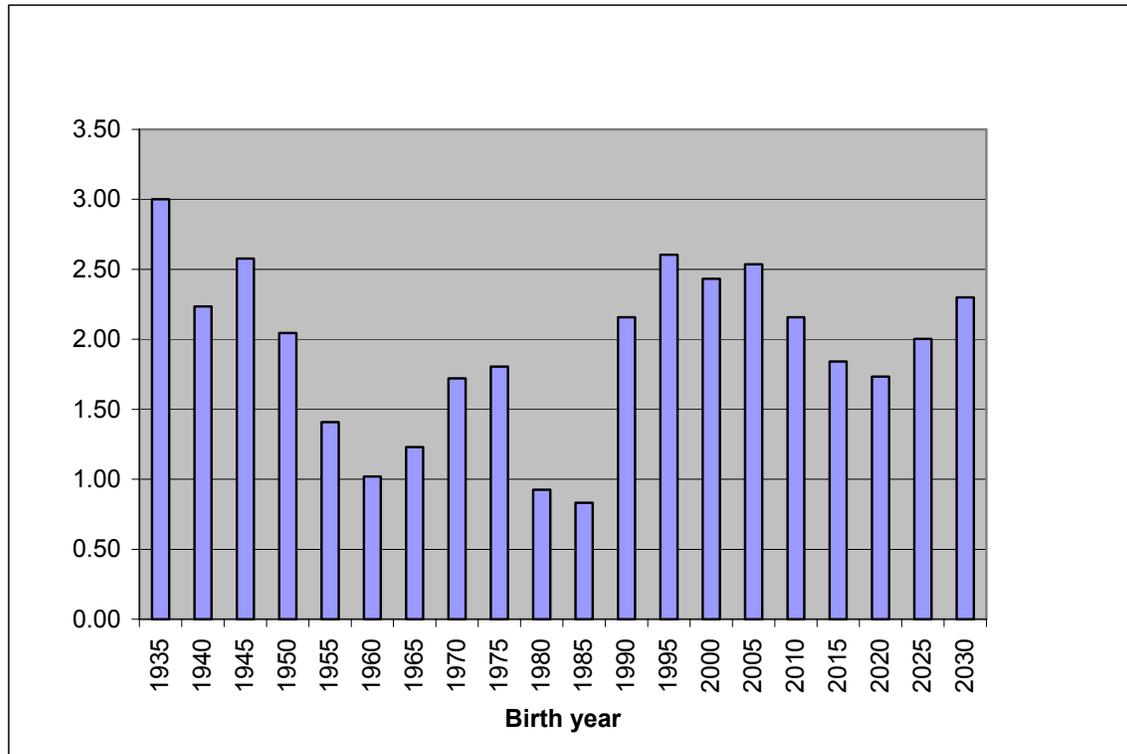

Figure 6. Growth rates of total lifetime consumption possibilities for each generation.

7. An alternative: Constant debt

When fiscal sustainability is secured by keeping a constant debt, the picture concerning net contributions are as in figure 7, and growth in total consumption possibilities are shown in figure 8. As would be expected, the oldest generations benefit from this alternative policy scenario, as their net contributions fall, whereas the youngest generations pay more. However, the youngest generations born from the late 1990'es and onwards keep their position as net beneficiaries. Again, in no case does net contributions exceed more than about +/- 5 per cent of each generation's lifetime incomes. Also the growth of total consumption possibilities is not fundamentally affected by the policy change. As this policy represents a completely different approach to the timing of the budget adjustments necessary to enforce sustainability, it is interesting to note that the ranking of the consumption possibilities of various generations does not change at all. Indeed, one must look closely at figures 6 and 8 to distinguish any differences at all. Again, the impact of even such changes in government policy is small relative to the other factors which are decisive for our lifetime consumption potential.
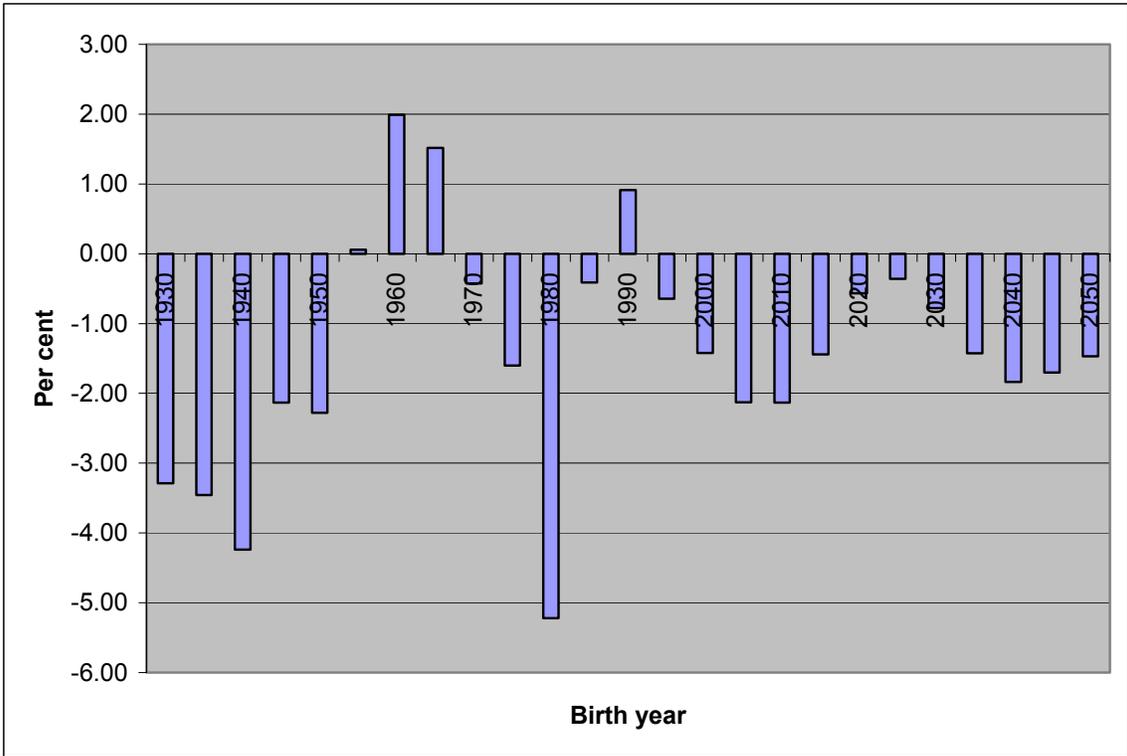
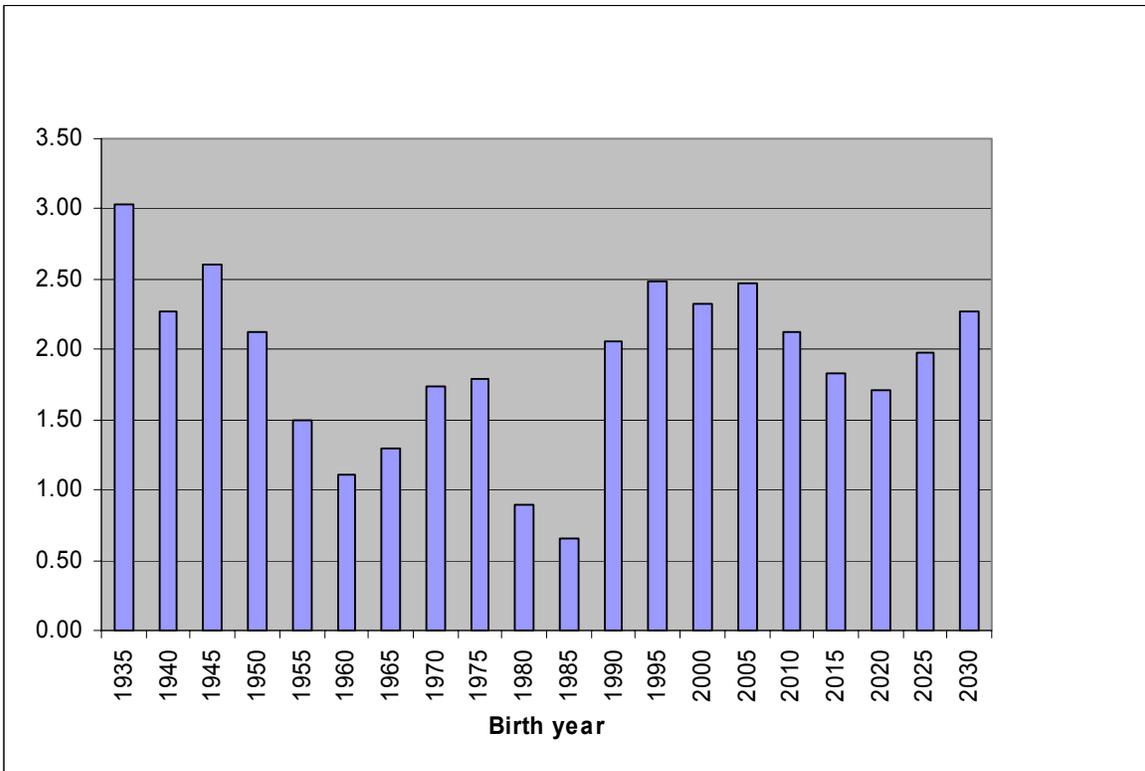**Figure 7. Net contributions vis-à-vis the government. Constant debt case.**

Figure 8. Growth rate in total consumption possibilities. Constant debt case.

8. Conclusions

We have presented figures for the expected lifetime market incomes as well as net contributions to the government for all Danish generations born from 1930 until 2030. The figures have been constructed utilizing partly available historical data, mainly from the National Accounts and micro data from a 10 per cent panel of the population, partly using a projection of the large CGE model DREAM. The figures necessarily depend on a number of assumptions which may be discussed. Nevertheless, we think that the construction of such lifetime figures are valuable as part of the information basis for judging properly the large intergenerational distribution issues which are at stake in present and future years because of the demographic changes taking place in Denmark as in most other Western countries.

The economic development in Denmark since WWII has been characterized by various phases. In the 1960'es, economic growth was relatively high and unemployment low, whereas the national foreign debt grew as a percentage of GDP. In the 1970'es and during the first part of the 1980'es, the current account deficit widened, unemployment became increasingly a problem, and government debt started accumulating. The period 1987-1993 was characterized by falling house prices, rising unemployment and government debt and falling foreign debt. Finally, in the later 1990'es, economic conditions have generally been favourable with falling unemployment and steeply rising prices of real property.

Developments like these, in particular concerning changes in government debt and in prices of real property, are often used as examples of certain generations gaining at the cost of others. Our results indicate, however, that such temporary deviations are not able to outweigh the dominant feature of post-WW II developments when looking at the ranking of consumption possibilities for generations: Younger generations are always richer than older ones, even when broken down into 5-year intervals, because of the permanently positive productivity growth. Annual growth in consumption possibilities varies over time, but is never below half a percentage point, nor more than around 3 per cent. Temporary business-cycle or real-estate developments may seem rather drastic at the time they occur, but their consequences are spread out over many generations and do not seem in any case to overrule the more general tendency.

Government intergenerational redistribution does vary from time to time, so that some generations are net contributors and some are net beneficiaries. In our calculations, the generations born from around 1955 until 1975 and again during the first half of the 1990'es are the losers in the sense that they are the only net contributors. All other generations benefit in net present value from their direct interactions with the government. It should be noted that these results are very sensitive to the size of the growth-adjusted interest rate used. Another and more robust result is that direct

government redistribution only affects consumption possibilities of generations modestly: On average, about 1.9 per cent, and in the most extreme case, 4.7 per cent of a generation's consumption possibilities were changed because of net contributions. This is interesting in view of the fact that government revenues as well as expenditures take up around 50 per cent of GDP in Denmark, a figure which rises to close to 60 per cent in the future projection.

Often, the discussion of reforms of the welfare state in light of the demographic challenges ahead may become heated. This is also true for the discussion on the consequences for various generations of possible changes in the structure or financing of the welfare state. However, there seems to be little informed knowledge on the present situation as well as little consensus on how the proper normative distribution would actually be. More attention to this would seem proper before major reforms implying also generational redistribution are taken. We view this paper as one attempt to shed some light on these matters.

Appendix on data sources for historical accounts

Age-specific profiles for income, direct tax payments and public transfers are from the 10 per cent sample from Statistics Denmark used by the Danish Economic Council, utilizing tax form data. Concerning private wage income, data from 1980 are used for the years 1947-84, and data from 1988 for the years 1985-1988. For the years 1989-2000, data for the years themselves are used. Concerning capital income, only figures going back to 1988 are available, so that the age profile for this year is used for all earlier years. Concerning direct tax profiles, data for 1980-2000 are used for these years, and data for 1980 for all previous years. Macroeconomic time-series are taken from the data-bank of ADAM (Annual Danish Aggregate Model), corresponding to the official National Accounts. Aggregate market income is calculated as a fixed percentage (92.1 per cent) of net national income minus indirect taxes from each year from 1947-2000. To deflate, a chain net price index back to 1966 has been calculated. For the years 1947-1966, the private consumption deflator from ADAM's databank has been used. Figures for aggregate direct taxes come from various editions of statistical yearbooks from Statistics Denmark. Aggregate figures for indirect taxes also are from Statistics Denmark. Age profiles for these taxes follow the Ministry of Finance (2000) and are based on registers on household possession of vehicles (for calculating taxes on cars and motorcycles), consumption of water and electricity from the Law Model population, and the Consumption Expenditure Survey from 1996. These age profiles are kept constant during the whole time period. For public consumption expenditures, age profiles are taken from the Law Model from 2000 and used throughout the analysis. Macro figures are taken from ADAM's data bank and from a special deliverance from Statistics Denmark[11].

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[11] Technical notes from the Secretariat of the Danish Economic Council, describing in more detail the figures used concerning direct taxes, indirect taxes and public expenditure, are available (in Danish) from the Secretariat upon request.

Population figures from each year are taken from the population databank of Statistics Denmark.

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