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GENERATIONAL ACCOUNTING IN THE UK*

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This paper presents the first set of *generational accounts* for the United Kingdom. We find that under our baseline scenario, in which pensions are price indexed and health expenditure grows modestly, the imbalance in UK generational policy is small when compared with other leading industrial countries like the United States, Japan, and Germany. However, under an alternative policy scenario, where all social benefits are wage-indexed and health care spending is increased, there is a larger fiscal bill left for future generations to pay. In this case, achieving generational balance would require much stronger medicine.

The rapid ageing of population and the existence of large unfunded social security systems in most of the industrialised countries have made the traditional indicators of fiscal policy (the government deficit and debt) increasingly out of line with the long-term stance of the public finances.

New methods have been proposed that try to capture the intertemporal dimension of many of the current fiscal measures, and to evaluate their effect on both the public sector solvency and the redistribution of resources between generations. This in turn may help in understanding how fiscal policies are actually affecting savings, investments and growth.

Generational accounting is one of these new methods of long-term fiscal planning and analysis.[1] It seeks to answer the following closely related questions. First, how large a fiscal burden does current policy imply for future generations? Second, is fiscal policy sustainable without major additional sacrifices on the part of current or future generations or major cutbacks in government purchases? Third, what alternative policies would suffice to

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[1] Other methods of assessing sustainability of government policy, some of which are also based on the intertemporal government budget constraint, are discussed in Wilcox (1989), Blanchard *et al.* (1990) for the OECD and Horne (1991) for the IMF.

produce *generational balance* – a situation in which future generations face the same fiscal burden, as do current generations when adjusted for growth (when measured as a proportion of their lifetime earnings)? Fourth, how would different methods of achieving such balance affect the remaining lifetime fiscal burdens – the *generational accounts* – of those now alive?

Generational accounts are specifically defined as the present value of *net taxes* (taxes paid minus transfer payments received) that individuals of different age cohorts are expected, under current policy, to pay over their remaining lifetimes. Adding up the generational accounts of all currently living generations gives the collective contribution of those now alive towards the payment of the government's bills. The government's bills refers to the present value of its current and future purchases of goods and services plus its net debt (its financial liabilities minus its financial and real assets, including the value its public-sector enterprises). Those bills left unpaid by current generations must be paid by future generations. This is the hard message of the *government's intertemporal budget constraint* – the basic building block of modern dynamic analyses of fiscal policy.

The method of generational accounting was originally developed by Auerbach *et al.* (1991) and Kotlikoff (1992). Less than a decade old, it has spread to over 25 countries around the globe, from New Zealand to Norway. Much of this accounting is being done at the governmental or multilateral institutional level. The US Federal Reserve, the US Congressional Budget Office, the US Office of Management and Budget, the Bank of Japan, the Bundesbank, the Norwegian Ministry of Finance, the Bank of Italy, the New Zealand Treasury, the European Commission, the International Monetary Fund, and the World Bank have all done generational accounting. Generational accounting has also drawn considerable interest from academic and government economists. Haveman (1994), Congressional Budget Office (1995), Cutler (1993), Diamond (1996), Buiter (1997), Shaviro (1997), Auerbach *et al.* (1994), Kotlikoff (1993, 1997), Auerbach *et al.* (1999), Bonin and Raffelhuschen (1999), Banks *et al.* (1999) and others have debated its merits and limitations.

This paper presents the first set of generational accounts for the United Kingdom. It also points out the alternative fiscal adjustments that are needed to achieve generational balance in the United Kingdom. The findings reported here and opinions expressed here are unofficial and purely those of the authors. Nonetheless, the development of these accounts benefited enormously from the advice of officials at a number of UK government agencies including HM Treasury, The Bank of England, the Department of Social Services, the Department of Health, the Office of National Statistics, the Department of Education and Employment, and the Government Actuary Department. In addition, the data used in the analysis are (a) published government data, (b) unpublished government data, or (c) data projections that appear to accord with the government's own forecasts and sense of baseline fiscal policy. In providing its assistance, the government has initiated an extremely important process of doing long-term fiscal planning for the nation on a systematic and comprehensive basis.

Compared with other leading industrial countries like the United States, Japan, and Germany, the imbalance in UK generational policy is, under our assumed baseline policy, quite modest; i.e., there is not a major intergenerational problem. Moreover the imbalance would entirely disappear if labour productivity growth should turn out to be 1/4% higher than our baseline assumption and government expenditures were not raised in line with the increase in the tax base. Should this not arise, some fiscal adjustment would be needed to achieve generational balance. This could take a variety of forms, such as the equivalent of either a £4 bn increase in tax revenue or a £4 bn reduction in government spending with proportionate tax increases or spending reductions thereafter. This level of increase amounts to keeping the total tax of the economy constant at around 37% of GDP. The required increase in revenues of £4 bn roughly offsetting the future projected decline in National Insurance contributions.

Our baseline policy scenario, which represents our sense of current government policy, is marked by very considerable fiscal restraint and prudence. In particular, it assumes (a) the price indexation of a variety of social benefits, including the Basic and SERPS pension benefits and (b) a slowdown in the growth of health care spending per beneficiary. In our baseline, pension and other social benefits payments decline by 2050 from 13% to 9% of GDP. Social security contributions also decline under the baseline, lowering total taxes relative to GDP after 2050. Due to population ageing, health care spending rises in the baseline from 6% to 8% of GDP between now and 2050 notwithstanding the assumed slower growth of benefits per beneficiary.

Despite our fiscally responsible baseline, these assumptions still leave a generational imbalance. Without great restraint in future government purchases of goods and services or increases (relative to our baseline projection) over time in the net tax payments of current British adults, future British children could well face higher *lifetime net tax rates* (the present value of lifetime net taxes divided by the present value of lifetime labour earnings) than their parents now face.

Under an alternative policy scenario, that we label *Looser Policy*, pension and other social benefits are wage indexed and health care spending is increased, in line with the Prime Ministers announcement on Sunday 16th 2000, so as to be on a par with average European levels of spending on Health care by 2005. Since current generations pay less in net taxes under this alternative scenario, there is a larger fiscal bill left for future generations to pay. In this case, achieving generational balance would require much stronger medicine, such as a 31.3% sustained increase in income tax revenues and a 46.1% increase in Social Security contributions.

The paper proceeds in Section 1 to rapidly describe generational accounting's methodology. Section 2 shows different ways of assessing the degree of generational imbalances. Section 3 describes the assumptions and sources of data used in this study, all of which are laid out in more details in the Appendix. This Appendix is available on the web site http://www.niesr.ac.uk/niesr/

discuss.htm.. With this as background, Section 4 presents the UK generational accounting results. The final section, 5, summarises and concludes the paper.

1. The Method of Generational Accounting

The method of generational accounting is based on the intertemporal budget constraint, stating that the present value of current and future government consumption spending must be paid for out of three possible sources: (1) the current net wealth of the public sector; (2) the present value of the net tax payments (taxes -transfers) by generations currently alive; (3) the present value of the net tax payments of the future generations.

Presenting the government's fiscal position through the method of generational accounts has some clear advantages. First, this method is neutral with respect to changes in finance. Second, it explicitly incorporates the effects of any future demographic changes into the budget balance. Finally, this method allows us to reflect the conflict of interest between generations. For a given present value of government consumption, a reduction in the present value of net taxes paid by present generations *must* be accompanied by a corresponding increase in the present value of the net tax payment of future generations.

Equation (1) formalises the intertemporal budget constraint:[2]

$$\sum_{s=0}^{D} N_{t,t-s}P_{t,t-s} + \sum_{s=1}^{\infty} N_{t,t+s}P_{t,t+s}(1+r)^{-s} = \sum_{s=0}^{\infty} G_{t+s}(1+r)^{-s} + D_t. \qquad (1)$$

All terms in (1) are real values, i.e., they are measured at constant prices. The first summation on the left-hand side of (1) adds together the *generational accounts* of existing generations. The term $N_{t,k}$ stands for the present value of the average remaining lifetime net tax payment – the generational account measured on a per person basis – at time t of the generation born in year k. The present value is formed as of year t for generations alive at time t and as of the year of birth for generations not yet born. For example, $N_{t,t}$ is the time-t present value of lifetime net tax payments of those born at time t, i.e., it is the generational account of time-t newborns; $N_{t,t-65}$ is the present value of the average remaining lifetime net tax payments – the generational account – of those who are 65 years olds at time t, and $N_{t,t+30}$ is the present value to the year of birth $(t+30)$ of the average lifetime net tax payments – the generational account – of those who will be born 30 years from year t.

The term $P_{t,k}$ stands for the time-t population of the generation born in year k. The term r is the government's real, before-tax, discount rate. The index k in this summation runs from $t-D$ (those aged D, the maximum length of life, in year 0) to t (those born in year 0).

The second summation on the left side of (1) adds together the present values of the generational accounts of future generations, with k again

[2] The constraint does not assume that government debt is ever fully paid off, merely that the debt grows less quickly than the rate of discount – that it does not explode. Thus, it is consistent with the long-run existence of government deficits, as long as these deficits are smaller than the amount needed simply to service the level of outstanding debt.

representing the year of birth. As each of these generational accounts is expressed in pounds of the respective generation's birth year, they must be discounted back to year t in the summation using the government's real, before-tax return r.

The first term on the right-hand side of (1) expresses the present value of government purchases. In this summation the values of government purchases in year s, given by G_s, are also discounted to year t. The remaining term on the right-hand side, D_t^g, denotes the government's net debt – its financial liabilities minus the sum of its financial assets and the market value of its public enterprises.[3]

A set of generational accounts is simply a set of values of $N_{t,k}$, one for each existing and future generation, with the property that their combined present value, when multiplied by the appropriate time-t, generation-specific population counts, adds up to the right-hand side of (1).

2. Assessing the Fiscal Burden Facing Future Generations

The comparison of the generational accounts of current newborns and the growth-adjusted accounts of future newborns provides a standard measure of the generational imbalance. The reason is that the accounts of these two sets of parties are directly comparable as they involve net taxes over entire lifetimes. But how do we determine the accounts of future generations?

The traditional method is the following: given the right-hand side and the first term on the left-hand-side of (1), we determine, as a residual, the value of the second term on the left-hand side of (1) – the collective payment, measured as a time-t present value, required of future generations.

Based on this amount, we determine the average present value lifetime net tax payment of each member of each future cohort under the assumption that these lifetime net tax payments rise for members of each successive future cohorts at the economy's rate of labour productivity growth, g. Now, if labour productivity grows at $g\%$ per year, so will real wages. Hence, the lifetime labour income of each new cohort will be $g\%$ larger than that of its immediate predecessor. So, in assuming that each successive cohort pays lifetime net taxes that are $g\%$ larger than those of its predecessor, we are assuming that each successive future cohort pays the same share of its lifetime labour income in net taxes; i.e., we are assuming that each future cohort faces the same lifetime net tax rate.

[3] The generational account $N_{t,k}$ is defined by:

$$N_{t,k} = \sum_{s=\max(t,k)}^{k+D} T_{s,k} P_{s,k} (1+r)^{-(s-t)} \qquad (2)$$

where $\kappa = \max(t, k)$. In expression (2) $T_{s,k}$ stands for the projected average net tax payment to the government made in year s by a member of the generation born in year k. The term $P_{s,k}$ stands for the number of surviving members of the cohort in year s who were born in year k. The term $P_{s,k}/P_{t,k}$ indicates the proportion of members of cohort k alive at time t who will also be alive at time s. Hence, it represents the probability that a particular member of the year-k cohort who is alive in year t will survive to year s to pay the net taxes levied, on average, in that year on year-k cohort members. Hence, $N_{t,k}$ is an actuarial present value. It represents the average present value of the amount of net taxes that members of cohort k will pay in the future, where the averaging is over not just net tax payments, but also survival.

Let $\overline{N}$ stand for the growth-adjusted generational account of future generations. $\overline{N}$ is the amount each member of a future cohort would pay in lifetime net taxes if her lifetime labour income were the same as that of a current newborn. The actual amount the cohort born in year $t+1$ will pay is $\overline{N}(1+g)$; the amount the cohort born in year $t+2$ will pay is $\overline{N}(1+g)^2$ and so on. We thus use (3) to solve for $\overline{N}$.

$$\sum_{s=0}^{D} N_{t,t-s}P_{t,t-s} + \sum_{s=1}^{\infty} \overline{N}(1+g)^s P_{t,t+s}(1+r)^{-s} = \sum_{s=0}^{\infty} G_{t+s}(1+r)^{-s} + D_t. \quad (3)$$

If the lifetime net tax payment of future generations adjusted for growth $\overline{N}$ equals $N_{t,t}$, (the accounts of newborn), generational policy is balanced. If $\overline{N}$ exceeds (is smaller than) $N_{t,t}$, future generations face larger (smaller) growth-adjusted lifetime net tax burdens than do current newborns. We thus conclude that current policy is not only generationally imbalanced, it is also unsustainable. The government cannot continue, over time, to collect the same net taxes (measured as a share of lifetime income) from future generations as it would collect, under current policy, from current newborns without violating the intertemporal budget constraint.

Our assumption that the generational accounts of all future generations are equal, except for a growth adjustment, is just one of many assumptions one could make about the distribution across future generations of their collective net tax payments to the government. We could, for example, assume a phase-in of the additional fiscal burden (positive or negative) to be imposed on future generations, allocating a greater share of the burden to later future generations and a smaller share to earlier ones. Clearly, such a phase-in would mean that generations born after the phase-in period has elapsed would face larger values of lifetime burdens (the $N_{t,k}$s) than we are calculating here.

The traditional method of assessing the long term stance of fiscal policy does not distinguish between the two concepts of sustainability and generational imbalance, as the whole burden of meeting the solvency constraint is borne by future generations (individuals born after the base year). In a way, current generations are assumed to live in a world without the long-term budget constraint, as their remaining lifetime tax burden reflects current policy even if this is unsustainable. On the contrary, each future generation will be called to pay enough revenues to meet the long-term constraint and, therefore, to service the debt today plus any future increase in the debt due to current policy.

This method has been criticised on the basis that generational imbalance arises as a result of an arbitrary cutting off the government intertemporal budget constraint at some point in the future. Assuming that future generations live under a different and more stringent set of rules (they only have to face the budget imbalance) it is as if we would be forcing them to break the generational contract implicit in many intergenerational policies and pay the price.

There are alternative methods of calculating the generational imbalance that try to distinguish between financial sustainability of fiscal policies and the degree of intergenerational redistribution that they produce. The *intergenerational balance gap* (*IGG*), expressed here as a ratio of GDP, is a summary

measure of the extent of fiscal adjustment needed to achieve generational balance. *IGG* is defined in (5) as the difference between the government's bills and the present value of net taxes it would collect from current and future generations assuming that future generations are treated exactly like the current newborn. Hence, in defining *IGG* in (5), we are assuming that, apart from growth, each member of all future generations pay $N_{t,t}$ in net taxes; i.e.

$$IGG = \left[\sum_{s=0}^{\infty} G_{t+s}(1+r)^{-s} + D_t - \sum_{s=0}^{D} N_{t,t-s}P_{t,t-s} - \sum_{s=1}^{\infty} N_{t,t}P_{t,t+s}(1+r)^{-s}\right] \Big/ GDP. \tag{5}$$

Another method of assessing the imbalance is to abstain from any specific assumption on the accounts of future generations and calculate them with the same method adopted for the current ones (using the projected values of taxes and transfers and the same relative profiles). We define the *Intertemporal budget gap* (*IBG*), expressed here as a ratio of GDP, as the imbalance in the intertemporal budget constraint:

$$IBG = \left[\sum_{s=0}^{\infty} G_{t+s}(1+r)^{-s} + D_t - \sum_{s=0}^{S} N_{t,t-s}P_{t,t-s} - \sum_{s=1}^{\infty} N_{t,t+s}P_{t,t+s}(1+r)^{-s}\right] \Big/ GDP. \tag{6}$$

The intertemporal budget gap will be less than the generational balance gap if current policy treats future newborns less favourably, in terms of their net lifetime taxes on a growth adjusted basis, than present newborns. Conversely, if the reverse is true then the intertemporal budget gap will be greater than the generational balance gap.

For example, government policy might be to phase out a particular transfer payment (such as mortgage interest tax relief or married person tax allowance) on a certain date. This might be enough of a reduction in payments to ensure that government policy is sustainable. However, this is achieved by reducing their future liabilities or equivalently by reducing payments to future generations more than presently living ones. It is therefore unlikely to close the generational balance gap unless future generations were being treated more favourably than current living generations before the policy change.

Another way of measuring the imbalance in fiscal policy, which we consider below, is to ask what immediate and permanent change in either (a) government purchases or (b) a specific tax (such as the income tax) or transfer payment (such as old-age social security benefits) would be necessary to equalise the lifetime growth-adjusted fiscal burden facing current newborns and future generations. Because such policies satisfy the government's intertemporal budget constraint, they also sustainable. They are also optimal in the sense that after such a once of increase in taxes, tax rates are expected to remain constant thereafter. Barro (1979) and Flemming (1987) show under a set of fairly weak

assumptions that this government behaviour maximises per capita utility by minimising the costs of tax collection or labour-leisure distortions. This is very similar to observing that such behaviour shares the burden of the intertemporal budget gap equally across the all living and future generations.

To be more precise about this type of calculation, suppose, for example, we want to find the immediate and permanent percentage reduction in government purchases needed to achieve generational balance. Denote this percentage reduction by d. We use (5) to solve for d under the assumption that $\overline{N}$ equals $N_{t,t}$.

$$\sum_{s=0}^{D} N_{t,t-s}P_{t,t-s} + \sum_{s=1}^{\infty} \overline{N}(1+g)^{s}P_{t,t+s}(1+r)^{-s} = \sum_{s=0}^{\infty}(1+d)\,G_{t+s}(1+r)^{-s} + D_t. \tag{7}$$

As a second example, consider the immediate and permanent percentage increase in income taxes needed to achieve generational balance. An income tax increase that achieves generational balance is the income tax increase needed to satisfy the intertemporal budget constraint under the assumption that the lifetime net tax payments of all future generations are equal (on a growth adjusted basis) to current newborns. Call this percentage increase υ. To determine the size of υ, we try different immediate and permanent income tax increase until we find the one with the following property: given the new values of generational accounts (the values inclusive of the tax increase), the calculated value of $\overline{N}$ equals $N_{t,t}$. In contrast to the calculation of d, in this calculation of υ, $N_{t,t}$, the generational account of current newborns, is not held fixed. Like the accounts of all other existing generations, $N_{t,t}$ is higher because of the increase in the income tax. Consequently, so is $\overline{N}$.

On the other hand, an income tax increase that restores the intertemporal budget balance is the income tax increase required to satisfy the intertemporal budget constraint under the assumption that otherwise policy remains the same. These two results would be identical if all tax payments and transfer receipts grew at the same rate, and the age profile of the population did not vary with time.

In Section 4 we will rely on these indicators to assess the degree of imbalance in the United Kingdom. Before showing our results, however, we present the assumptions and data used in the construction of the generational accounts for the United Kingdom.

3. Assumptions, Data Sources, and Projections

Producing generational accounts requires projections of population, taxes, transfers, and government purchases, an initial value of government net debt, and a discount rate.

Since generational accounting considers all levels government activity, the measures of taxes, transfers, and government purchases must be comprehensive. In forming the accounts for the United Kingdom, we start from the 1997 National Accounts data on the receipts – *Resources* – and expenditures – *Uses*

– of the general government (central government and local authorities). Table 1 reports the level of disaggregation employed in the generational accounts.[4] We derive the expenditure in each of these categories from the Blue Book and government expenditure departmental reports.[5] Appendix I describes the estimates in detail.[6]

3.1. *Relative Profiles*

The second stage of our study has been to obtain an age and sex distribution of as many of these taxes and transfers as possible. This required us building age and sex *relative profiles* from household or individual micro-data. These profiles are then used to construct the average net tax payment that each current generations has to pay to the government in their remaining lifetime (the $T_{s,k}$ in expression (2) in note 2). They are relative as we normalise them with respect to the value of a 40-years old male, which is calibrated so as to match the aggregate values of each tax and transfer (in the base year and in the future ones when we have official projections). The profiles are often very different for the different sexes; maternity benefits being an extreme example, health care expenditure being another and one that is far more important in financial terms. It is therefore necessary to construct different profiles for the sexes, as government expenditure will be a function of the demographic split between men and women. It would therefore be possible to construct generational accounts for each sex, but accounts these could be very misleading as they do not take account of either intra-household transfers or employment decisions. We have therefore decided to only present a generational account for each cohort, effectively an average of the male and female accounts.

Table 1 presents a list of the taxes and transfers for which we obtain an age and sex distribution at the base year. We construct the age and sex profiles for the taxes and transfers in this table by using both cross sectional survey data and a variety of other sources of data, particularly those produced by certain government departments.[7] However, some of the fiscal variables included in

[4] In line with the new ESA accounts this includes all unfunded and funded occupational public sector schemes.

[5] In particular we use: *Social Security Statistics, 1998* (Department of Social Security, DSS); *Education and Training Statistics for the UK, 1998* (Department for Education and Employment, DfEE); *Health and Personal Social Services Statistics for England, 1997* (Department of Health, DoH); *Inland Revenue Statistics, 1997*, (Inland Revenue).

[6] The complete model and the Appendix can be downloaded into an EXCEL 97 spreadsheet from the web address www.generationalaccounting.com.

[7] In particular we use the Family Expenditure Survey (FES) (ONS, 1995–96) which contains information on expenditure and incomes of about 7,000 private households in the United Kingdom. The Family Resource Survey (FRS), (ONS, 1995–96), used by the Department of Social Security and based on a sample of around 26.000 households, which contains detailed information on incomes, social security benefits, tenure and housing costs, assets and savings. And finally the General Household Survey (GHS), (ONS, 1995–96), based on information on 15,000 households, especially relevant as it contains information on the use of health care facilities. In addition to these surveys we make use of a variety of other sources of data, particularly those produced by certain government departments. For example, for most of the social security benefits we make use of administrative data received from the Department of Social Security. Appendix II describes in detail the sources of micro-data for each profile (see footnote 6 for details).

Table 1

Level of Disaggregation

Age-specific taxes and transfers

Taxes

1 Income Tax
2 Corporation Tax
3 Taxes on capital gains
4 NI Contributions: Employers
5 NI Contributions: Employees
6 NI Contributions: Self-employed and others
7 Other contributions
8 Notionally funded and unfunded schemes: employers
9 Notionally funded and unfunded schemes: employees
10 Imputed contributions
11 VAT
12 Tax on alcohol
13 Tax on Tobacco
14 Tax on Hydrocarbons oil
15 Stamp duties
16 Betting, gaming and lottery
17 Insurance premium tax
18 Payment to the National Lottery Distribution Fund
19 Other customs and excise duties
20 National non domestic rates
21 Vehicle Excise duty paid by businesses
22 Other taxes on production

23 Council Tax
24 Vehicle Excise duty paid by households
25 Inheritance tax

Transfers

30 Retirement Pensions: Basic
31 Retirement Pensions: SERPS
32 Widow's and guardian's allowances
33 Jobseekers allowance (contributory)
34 Incapacity benefits
35 Maternity Benefits
36 Statutory sick pay
37 Statutory maternity pay

38 Social Fund Benefits

39 Benefits paid to overseas residents
40 Redundancy Fund benefits
41 War Pensions
42 Family credit
43 Child benefit
44 Income support
45 Disability living allowances
46 Disability working allowances
47 Severe disablement benefits

48 Industrial injuries benefits
49 Attendance allowances
50 Invalid care allowance
51 Income support for the unemployed (Jobseeker's allowance)
52 Other social assistance benefits in cash
53 Income tax relief
54 Other grants to households
55 Students grants
56 Rent rebates/allowances
57 net intermediate consumption: Education: Schools
58 Net intermediate consumption: Education: Higher education FT
59 Net intermediate consumption: Education: Higher education PT
60 Net intermediate consumption: Education: Higher education FT
61 Net intermediate consumption: Education: Higher education PT
62 Net intermediate consumption: Health: Hospital
63 Net intermediate consumption: Health: General medical
64 Net intermediate consumption: Health: Pharmaceutical
65 Net intermediate consumption: Health: Personal Social Services
66 Net intermediate consumption: Social Protection
67 Compensation of employees: Wages: Education: Schools
68 Compensation of employees: Wages: Education: Higher education FT
69 Compensation of employees: Wages: Education: Higher education PT

Table 1
(*continued*)

	70 Compensation of employees: Wages: Education: Further education FT
	71 Compensation of employees: Wages: Education: Further education PT
	72 Compensation of employees: Wages: Health: Hospital
	73 Compensation of employees: Wages: Health: General medical
	74 Compensation of employees: Wages: Health: Pharmaceutical
	75 Compensation of employees: Wages: Health: Personal Social Services
	76 Compensation of employees: Wages: Social Protection
	77 Compensation of employees: Contributions: Education
	78 Compensation of employees: Contributions: Health
	79 Compensation of employees: Contributions: Social Protection
	80 Unfunded employees social benefits
	81 Miscellaneous current transfers: grants to higher education
	82 Miscellaneous current transfers: grants to further education
	83 Miscellaneous current transfers: other grants to non-profit institutions
	84 Miscellaneous current transfers: grants to fund NHS pension increases
	85 Subsidies: Health
	86 Subsidies: Housing
	87 Capital transfers payable: Education
	88 Capital transfers payable: Health
	89 Capital transfers payable: Housing
	90 Gross capital formation: Education
	91 Gross capital formation: Health
	92 Gross capital formation: Social Protection
	93 Gross capital formation: Housing
Non-age specific taxes and transfers	
26 Other current taxes	94 Net intermediate consumption: Other
27 Current international cooperation	95 Compensation of employees: Wages: Other
28 Miscellaneous current transfers	96 Compensation of employees: Contributions: Other
29 Other capital transfers	97 Subsidies: Other
	98 Current international cooperation
	99 Miscellaneous current transfers: contributions to the EU
	100 Capital transfers payable: Other
	101 Gross capital formation: Other

the general government budget of Table 1 cannot be imputed to any particular generation (for example, the expenditure on public order, or on defence). These are treated as unallocated government expenditure, G_t in (1) or are capitalised and added to the government debt, D_t in (1).

Our general rule regarding tax incidence is to assume that taxes are borne by those paying the taxes, when the taxes are paid: income taxes on income, consumption taxes on consumers, and property taxes on property owners. There is one exception here, which involves capital income taxes. In the case of small open economies, like the United Kingdom, marginal corporate income taxes are assumed to be borne by (and are therefore allocated to) labour. As far as transfers are concerned, our general rule is to assume that those who receive the payment are also those who benefit from it. For most social security transfers this implies that we ignore the fact that the actual amount received depends on the number of dependants in the household. As an example, consider income support. This is a means-tested benefit given to those who work less than 16 hours a week and have less income than a given threshold. Even if the actual amount received depends on the number of children in the household, the transfer is a result of the working status of the parents. So therefore we allocate the benefit only to the adults in the household. The same holds for transfers that could be thought of as targeting the children in the family, such as family credits and maternity benefits; the only exception being child benefits, that are allocated to the children. Transfers to disabled are another exception to the rule, as they are attributed to those who suffer from the disability condition, rather than to the claimant (when the two are not the same person).[8]

3.2. *Demographics*

As for the demographics projections we use the 1996-based national population projections of the Government Actuary's Department. For each year the starting population plus immigrants less the numbers of deaths produces the number in the population – one year older – at the end of the year. To this we add survivors of those born during the year.[9] Using these assumptions together with the GAD projected mortality rates (we extrapolate into the future the data of the last year available) we build demographic projections for the period 1998–2101. One implication of these projections is that the 'old age dependency ratio' (population aged 65 and older divided by population aged 25–64) which is 29.7% in 1997, decreases slightly in the next 6 years and will then increase rapidly reaching 50% by 2036. If compared to other country figures, however, these results do not look so alarming. Among the G10 countries only the United States will have a lower dependency ratio by 2050 (44.2 against 49.4 in the United Kingdom).

[8] Appendix II contains a detailed description of the incidence assumptions used for all the taxes and transfers considered in this study.

[9] The main assumptions are as follows. The fertility rate, equal to 1.72 in 1997/8, increases and reaches 1.8 children per woman in 2006/7, remaining constant thereafter. Life expectancy at birth, which is 74.7 for men and 79.7 for women in 1997, rises to 76.1 for men and 80.1 for women by 2005/6 and increases thereafter (converging to 79.2 for men and 84 for women in 2066/7). Annual net migration amounts to 66.000 people from 1998 onward.

3.3. *Taxes and Transfers Projections*

To project the level of revenue collected from particular taxes or expenditure on particular transfer payments we use official or unofficial government forecasts wherever possible.[10] These aggregate amounts are then distributed by age and sex based on the relative age-sex profiles derived in the base year from micro data sets. For years without government forecasts, we construct forecasts using both our relative profiles by age and sex and the demographic projections from the GAD with adjustments for growth. We assume that government receipts or expenditure *per capita* remain constant, except for a growth adjustment, after the last year for which we have a forecast. Therefore total aggregate spending in any year will be the sum over all age and sex groups of these *per capita* revenues or expenditures times the expected population size of that age and sex group times the growth adjustment.[11] For the purpose of projecting aggregate expenditure on the unallocated components of government expenditure (e.g. Defence), we assumed that total expenditure was only related to the size and the population and not its composition (equivalent to assuming that the age and sex profiles are flat).

Investment expenditure is treated in an identical fashion to consumption expenditure. Thus it is allocated in the year of its expenditure and not its use. It might have been desirable to adopt a different approach and allocate the flow of services from an asset rather than the investment expenditure on an asset. However the difference between the two approaches may actually not be that large; the large majority, about 70%, of investment expenditure is to repair depreciation of assets rather than the construction or creation of new assets. This depreciation is probably a reasonable first approximation of the flow of services from the assets. The alternative approach will be possible once the government has completed its estimate of the value of its tangible assets. Combining these net worth estimates with additional information on the expected length of life of the assets would enable one to allocate the flow of services. It must be remembered that this new approach would have no effect on the size of the intertemporal budget gap, as in present value terms the two approaches must be identical. However it will alter slightly the generational distribution of the benefits of government expenditure. Expenditure on education is allocated to the children and not to the parents. Thus the generational account of the new-borns will reflect the public returns to education; the present value amount of education received minus the higher level of taxes paid.

[10] These include unofficial forecasts of: firstly the growth of both income support and rent rebate payments to the non-retired population, which attempt to take into account changing household demographic structure, and secondly projections on income support payments to the retired population generated by the DSS PENSIM model.

[11] There are two exceptions to this rule; the female basic retirement pension profile and SERPS profile for both sexes. Between 2010 and 2020 the female retirement age is changing from 60 to 65, and we have incorporated this policy change as a change in the profile shape. Similarly the SERPS scheme is slowly maturing, and again we have modelled this change by allowing the profile shape to change over time in line with government forecasts.

Finally revenues from government assets (petroleum tax revenues, rents, gross operating surplus) are capitalised at 1997. The future flows of these revenues (growing with productivity) are thus discounted at the base year, and their sum is subtracted from the government debt (taken as the net financial liabilities of general government). This amount represents the government's net debt in (1). In contrast to the treatment of the market value of state enterprises, government net debt does not net out the value of the government's existing infrastructure, such as parks, highways, and tanks. Including such assets would have no impact on the estimated fiscal burden facing future generations because including these assets would require adding to the projected flow of government purchases an exactly offsetting flow of imputed rent on the government's existing infrastructure.

As far as the growth adjustments are concerned we have two alternative scenarios; our *Baseline Policy* and our *Looser Policy* scenario. Our *Baseline Policy* scenario is our sense of present current government policy. All the assumptions used in its construction reflect considerable fiscal restraint and prudence. For the period 1998–2003 we have based our estimate of both tax receipts and government personal transfers and expenditures on current government projections (the details are in Appendix III, downloadable from www.generationalaccounting.com). For the period 2004–60 the projections of aggregate government spending on contributory benefits and their corresponding social security receipts are based on the current Government Actuary's Department's projections under the assumption that the benefits are all price indexed. All other government transfer payments after 2004 and all contributory benefits and social security receipts after 2060, except rent rebates and income tax relief,[12] are assumed to rise in line with prices. Therefore, in real terms the only increase or decrease in aggregate spending on these categories is due to demographic changes. Finally, all other receipts and expenditures per beneficiary are assumed to grow in line with productivity, which we have set at 1.75%. This implies that aggregate spending or receipts in these categories may increase or decrease at a rate greater than 1.75% per annum in real terms because of demographic changes. In Fig. 1 we show the implications of these assumptions in terms of the spending on all personal transfers (all social security benefits), education and health care expressed as a share of Gross Domestic Product (GDP). For our forecast of GDP, we use government's projections until 2003 and thereafter we assume that GDP grows in line with income tax revenues.

Under the baseline scenario government spending on personal transfers falls dramatically as a percentage of GDP, despite the ageing of the population. This is a direct consequence of the government policy of price indexation. Aggregate health spending under these assumptions grows slightly slower than it has done historically until 2050 before stabilising at around 8% of GDP.

Under our alternative policy scenario, that we have labelled *Looser Policy*, we

[12] As rent rebates will rise in line market rents and income tax relief is likely to rise in line with income tax these two categories are assumed to rise in line with productivity.

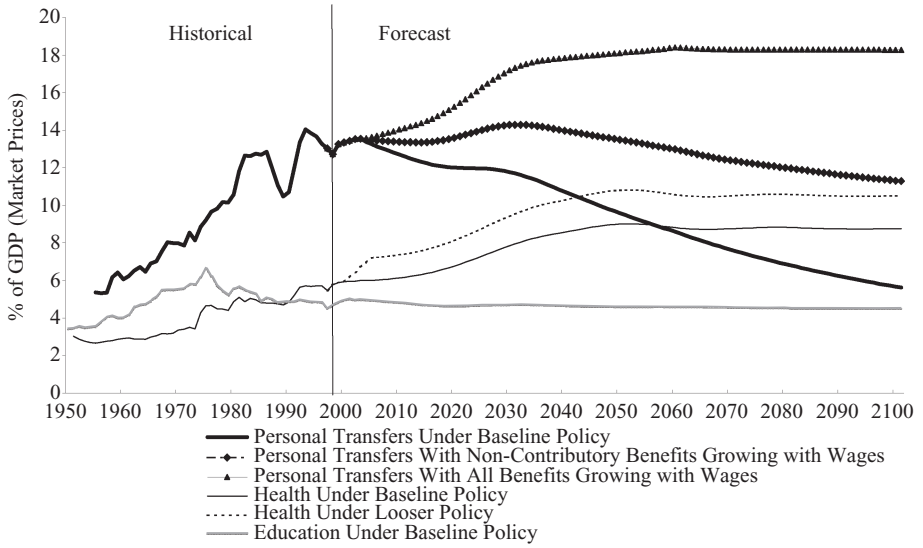

Fig. 1. *Projected Transfer Payments as a Share of GDP under Alternative Scenarios*

relax some of the fiscal restraints embedded within our baseline policy. In this scenario pensions and other social benefits are wage indexed after 2004 and, therefore, on a per-beneficiary basis grow in line with all other government transfers and receipts. In addition to this we also increase health care spending in line with the Prime Minister's announcement on January 16th 2000. He pledged to raise health spending in the United Kingdom substantially over the coming years, aiming for it reach the European average by 2005. According to the OECD health database spending on health (including private expenditure) in the United Kingdom is 6.8% of GDP as compared to the EU average of 8%. We therefore interpreted this pledge as a steady increase in health expenditure until 2005, by which point there would be an additional expenditure of £12bn (approximately 1.2% of GDP) on Health as relative to baseline policy. After 2005 health expenditure per capita rises in line with productivity growth. Fig. 1 also shows the implications of these assumptions on personal transfer and health care spending as a ratio of GDP. If only non-contributory social security transfers rise in line with wages, then total social security transfers as a percentage of GDP remain fairly constant until 2030 before starting to fall. This is because the rise in social security transfers arising from the maturation of SERPS programme and the ageing of the population approximately offset the decline due to price indexation until 2030. If, however, all social security transfers rise in line wages, then social security transfers as a share of GDP rise to nearly 18% before stabilising in 2050. Moreover, in this scenario health care spending rises roughly at the same rate as it has done historically until 2020. It then increases at a faster rate from 2020–40, the period when the 'baby boomers' retire and the old age dependency ratio rises by almost 30%, before stabilising at around 10% of GDP.

4. Findings

Table 2 presents the generational account under our baseline policy for an average individual (a weighted average of the male and female accounts) of each of the living generations respectively.[13] The first column shows the values $N_{t,k}$, in (1). The average total value of net transfers has been disaggregated into 11 different components. Thus from Table 2, a current living newborn will expect to make a net payment of £25,161 in 1997 present value prices to the government. The payments will be made up predominantly of £33,573, £43,354 and £21,783 of income tax, indirect tax and social security contributions respectively; and the receipts predominantly of £26,555, £24,404 and £16,218 of health care, education and social benefits respectively.

In the first few years of his life, a newborn expects the government to spend a significant amount on both his health care and education. Thus, if we look at a member of the generation aged 15, we see that the his expected receipts of health care and education have fallen with respect to the newborn, as he has now received these benefits.

Also the present value of his tax payments has risen, because his working life (when he pays his taxes) is now only between 1–10 years off and so is discounted far less heavily than a newborn's, whose working life is 16–25 years off. Therefore, the net tax payments of a currently living 15-year-old male is considerably higher than the equivalent for a current male newborn (£54,150 against £33,573). Current living 25-year-old males have the largest net tax payment to the government (£62,166).

At 25, most people have the majority of the working life ahead of them, a period during which they will pay taxes and will receive very little from the government in terms of health care and pension payments for nearly forty years. By 65, though, the situation is reversed. Most people will have paid the majority of their lifetime taxes and will be in receipt of a state pension and/or expecting a significant expenditure on health services by the government in the next few years. Consequently, a current living 65-year-old will be expecting a net receipt from the government of £87,703.

Table 4 shows the growth adjusted generational account of future generations under the baseline policy scenario. The generational account remains relatively constant over time, suggesting that current policy is generationally equitable. However, the composition of the account changes, with social security transfers and N.I contributions becoming less significant and health care more.

Table 3 shows the generational accounts of individuals under looser policy, and Table 4 gives the account for future generations. The only difference between these tables and the earlier ones is on the transfer side. The impact of indexing social security benefits to prices only slowly reduces the value of these benefits relative to average incomes. Therefore, the relaxation of this fiscal constraint does not greatly affect the entitlement of those already receiving these transfer payments. However, it dramatically affects the entitlement of the

[13] For simplicity we shall refer to this individual as a male.

Table 2

Generational Accounts Under Baseline Policy (in 1997 £)

		Taxes					Transfers					
Age	GA	Income Tax	Capital Taxes	Taxes on Prod.	Social Security Contrib.	Other Revenues	Pensions	Health	Education	Youth/ Maternity	Social Insur.	Other Expend.
0	25,161	33,573	11,999	43,354	21,783	5,898	−5,404	−26,555	−24,404	−8,131	−16,218	−10,735
5	41,217	39,233	14,029	50,629	26,128	6,635	−6,392	−26,124	−25,311	−6,958	−19,132	−11,521
10	65,632	46,064	16,461	59,226	31,292	7,513	−7,629	−26,893	−20,069	−5,369	−22,535	−12,430
15	92,783	54,140	19,345	69,065	37,430	8,524	−9,161	−28,616	−14,412	−3,378	−26,690	−13,465
20	115,779	61,385	21,839	74,795	42,720	9,074	−10,844	−27,618	−9,730	−2,138	−29,615	−14,089
25	121,712	62,166	21,918	72,712	42,124	8,911	−12,730	−23,018	−6,089	−2,032	−28,677	−13,574
30	111,045	59,176	20,759	69,611	38,493	8,698	−15,453	−23,053	−5,030	−1,762	−27,435	−12,959
35	93,480	53,479	18,980	64,680	33,936	8,241	−18,711	−23,436	−4,069	−1,320	−26,100	−12,201
40	69,679	45,893	16,542	58,761	28,378	7,687	−22,815	−24,208	−3,304	−749	−25,108	−11,397
45	35,730	35,859	13,340	51,182	21,675	7,116	−30,079	−25,357	−2,353	−318	−24,701	−10,634
50	976	23,659	9,583	41,988	14,401	6,283	−35,365	−24,464	−1,565	−109	−23,936	−9,499
55	−39,095	13,282	6,449	34,496	7,592	5,643	−46,424	−26,937	−798	−30	−23,574	−8,793
60	−71,927	5,755	4,129	27,119	2,528	4,833	−58,199	−28,539	−269	−7	−21,478	−7,799
65	−87,703	2,258	3,151	20,362	408	3,929	−63,040	−29,737	−48	−1	−18,294	−6,689
70	−85,811	1,365	3,027	14,782	14	3,046	−55,147	−30,667	−1	0	−16,609	−5,621
75	−80,183	732	3,228	10,828	12	2,278	−44,448	−31,863	−1	0	−16,250	−4,699
80	−72,369	400	3,423	7,495	3	1,665	−33,840	−32,127	0	0	−15,529	−3,857
85	−67,877	271	3,633	5,241	0	1,292	−27,767	−31,802	0	0	−15,391	−3,353
90	−58,054	152	2,998	2,901	0	981	−22,633	−25,187	0	0	−14,442	−2,823
95	−46,003	4	2,162	1,412	0	745	−18,015	−17,654	0	0	−12,372	−2,285
FUT	35,159											

Table 3

Generational Accounts Under Looser Policy (in 1997 £)

		Taxes					Transfers					
Age	GA	Income Tax	Capital Taxes	Taxes on Prod.	Social Security Contrib.	Other Revenues	Pensions	Health	Education	Youth/ Maternity	Social Insur.	Other Expend.
0	10,830	33,573	11,999	43,354	21,783	5,898	−9,431	−29,623	−24,851	−9,021	−22,116	−10,735
5	26,436	39,233	14,029	50,629	26,128	6,635	−10,906	−29,216	−25,697	−7,582	−25,296	−11,521
10	50,306	46,064	16,461	59,226	31,292	7,513	−12,671	−30,115	−20,346	−5,818	−28,872	−12,430
15	76,865	54,140	19,345	69,065	37,430	8,524	−14,772	−31,997	−14,553	−3,740	−33,112	−13,465
20	99,443	61,385	21,839	74,795	42,720	9,074	−16,942	−31,121	−9,813	−2,403	−36,004	−14,089
25	105,356	62,166	21,918	72,712	42,124	8,911	−19,230	−26,575	−6,141	−2,197	−34,759	−13,574
30	94,158	59,176	20,759	69,611	38,493	8,698	−22,503	−26,806	−5,060	−1,850	−33,402	−12,959
35	76,261	53,479	18,980	64,680	33,936	8,241	−26,261	−27,390	−4,083	−1,356	−31,764	−12,201
40	52,317	45,893	16,542	58,761	28,378	7,687	−30,802	−28,352	−3,309	−762	−30,323	−11,397
45	17,636	35,859	13,340	51,182	21,675	7,116	−38,994	−29,759	−2,355	−322	−29,473	−10,634
50	−15,334	23,659	9,583	41,988	14,401	6,283	−43,526	−28,706	−1,565	−109	−27,841	−9,499
55	−55,411	13,282	6,449	34,496	7,592	5,643	−54,506	−31,664	−798	−30	−27,081	−8,793
60	−86,622	5,755	4,129	27,119	2,528	4,833	−64,988	−33,471	−269	−7	−24,453	−7,799
65	−99,790	2,258	3,151	20,362	408	3,929	−67,935	−34,610	−48	−1	−20,614	−6,689
70	−95,365	1,365	3,027	14,782	14	3,046	−58,309	−35,242	−1	0	−18,426	−5,621
75	−87,481	732	3,228	10,828	12	2,278	−46,345	−35,860	−1	0	−17,653	−4,699
80	−77,314	400	3,423	7,495	3	1,665	−34,887	−35,035	0	0	−16,519	−3,857
85	−71,214	271	3,633	5,241	0	1,292	−28,407	−33,760	0	0	−16,131	−3,353
90	−59,666	152	2,998	2,901	0	981	−22,935	−26,128	0	0	−14,811	−2,823
95	−46,469	4	2,162	1,412	0	745	−18,102	−17,933	0	0	−12,472	−2,285
FUT	77,256											

Table 4

Growth Adjusted Net Lifetime Tax Payments of Present and Future Newborns under Baseline and Looser Policy Assumptions

Newborns in	Baseline Policy	Looser Policy Scenario
1997	25,161	10,830
2007	26,440	8,452
2017	27,196	6,477
2027	27,237	4,361
2047	27,598	0
2097	27,597	1,203

newborns, who will be receiving their pension after 65 years. The lifetime net taxes of current newborns under this looser policy is £10,830. Table 4 shows that the account of newborns slowly moves into surplus over the next 50 years. However, this policy is not sustainable and will lead to ever growing debt to GDP ratio.

4.1. *Assessing the Imbalance in UK Generational Policy*

The generational accounts enable us to assess both generational equity and the sustainability of current government policy. In Table 6 we record both the intergenerational balance gap and the intertemporal budget gap under the different policy assumptions. These gaps are significant at around 1/2 of the value of present government debt (which is about 40% of GDP). The intertemporal budget balance is slightly smaller than the intergenerational balance because, as Table 4 showed, under baseline policy future individuals have to make very slightly larger net tax payments than current generations. Therefore, even under the tight fiscal restraint, baseline policy, still leave both an intergenerational and intertemporal budget imbalances. The generational implications of this budget imbalance can be assessed in terms of the rise in lifetime net tax payments that future generations will have to sustain in order to close this gap. The last row of Table 2 and 3, labelled FUT, shows the net tax payments that every future generation has to sustain (on a growth adjusted basis) to ensure fiscal sustainability (this is $\overline{N}$ in equation (3)). To ensure fiscal sustainability the average individual net tax payments needs to rise from around £25,000 to just above £35,000.

Relaxing the fiscal restraint of the baseline policy, by allowing both non-contributory and contributory benefits to rise in line with wages and introducing levels in health care spending per beneficiary, has substantial fiscal implications. Both the intergenerational balance and intertemporal budget gap rise to nearly twice GDP. Under this policy, the fiscal bill left for each member of every future generation on a growth-adjusted basis would be £77,000 as compared to £11,000 paid by current newborns.

Table 5

Generational Accounts Under Looser Policy, but with Income and Social Security Tax Increases to Achieve Generational Balance
(in 1997 £)

		Taxes					Transfers					
Age	GA	Income Tax	Capital Taxes	Taxes on Prod.	Social Security Contrib.	Other Revenues	Pensions	Health	Education	Youth/ Maternity	Social Insur.	Other Expend.
0	33,263	44,249	11,999	43,354	33,540	5,898	−9,431	−29,623	−24,851	−9,021	−22,116	−10,735
5	50,630	51,709	14,029	50,629	37,846	6,635	−10,906	−29,216	−25,697	−7,582	−25,296	−11,521
10	76,247	60,713	16,461	59,226	42,585	7,513	−12,671	−30,115	−20,346	−5,818	−28,872	−12,430
15	104,439	71,357	19,345	69,065	47,788	8,524	−14,772	−31,997	−14,553	−3,740	−33,112	−13,465
20	127,754	80,905	21,839	74,795	51,511	9,074	−16,942	−31,121	−9,813	−2,403	−36,004	−14,089
25	131,851	81,935	21,918	72,712	48,850	8,911	−19,230	−26,575	−6,141	−2,197	−34,759	−13,574
30	118,041	77,994	20,759	69,611	43,558	8,698	−22,503	−26,806	−5,060	−1,850	−33,402	−12,959
35	96,780	70,485	18,980	64,680	37,448	8,241	−26,261	−27,390	−4,083	−1,356	−31,764	−12,201
40	69,078	60,486	16,542	58,761	30,546	7,687	−30,802	−28,352	−3,309	−762	−30,323	−11,397
45	30,185	47,262	13,340	51,182	22,821	7,116	−38,994	−29,759	−2,355	−322	−29,473	−10,634
50	−7,340	31,182	9,583	41,988	14,871	6,283	−43,526	−28,706	−1,565	−109	−27,841	−9,499
55	−51,062	17,505	6,449	34,496	7,718	5,643	−54,506	−31,664	−798	−30	−27,081	−8,793
60	−84,775	7,586	4,129	27,119	2,546	4,833	−64,988	−33,471	−269	−7	−24,453	−7,799
65	−99,071	2,975	3,151	20,362	410	3,929	−67,935	−34,610	−48	−1	−20,614	−6,689
70	−94,930	1,799	3,027	14,782	14	3,046	−58,309	−35,242	−1	0	−18,426	−5,621
75	−87,248	965	3,228	10,828	12	2,278	−46,345	−35,860	−1	0	−17,653	−4,699
80	−77,187	527	3,423	7,495	3	1,665	−34,887	−35,035	0	0	−16,519	−3,857
85	−71,128	357	3,633	5,241	0	1,292	−28,407	−33,760	0	0	−16,131	−3,353
90	−59,618	200	2,998	2,901	0	981	−22,935	−26,128	0	0	−14,811	−2,823
95	−46,468	5	2,162	1,412	0	745	−18,102	−17,933	0	0	−12,472	−2,285
FUT	33,263											

Table 6

Achieving Generational and Intertemporal Balance Under Alternative Policy Scenarios

	Generational balance gap as % of GDP	Intertemporal budget gap as % of GDP	Income tax increase needed to achieve generational balance (%)	Income tax increase needed to achieve intertemporal budget balance (%)	Assumed increase in social security contributions relative to baseline (%)
Baseline policy	26.1	20.2	7.5	5.7	0.0
Non contributory benefits grow with wages	71.9	81.3	20.6	23.2	0.0
All benefits grow with wages	138.0	150.3	21.2	21.1	46.1
Looser policy*	173.2	187.7	31.3	31.8	46.1

* All benefits grow with wages and there is additional expenditure in health care per beneficiary.

Table 7

*Achieving Generational and Intertemporal Budget Balance Assuming Higher Labour Productivity Growth and No Commensurate Higher Growth in Expenditures**

	Generational balance gap as % of GDP	Intertemporal budget gap as % of GDP	Income tax increase needed to achieve generational balance (%)	Income tax increase needed to achieve intertemporal balance (%)
Baseline Policy	26.1	20.2	7.5	5.7
Rise in Labour Productivity	1.2	−8.5	0.4	−2.7

* In this scenario, income tax and VAT tax payments per taxpayer rise at 2% per annum as compared to 1.75% in the baseline scenario, with all other receipts, transfers and expenditures remaining unchanged relative to the baseline.

4.2. *Achieving a Sustainable and Generationally Balanced Fiscal Policy*

We have said in Section 1 that another way of measuring the imbalance in fiscal policy is to ask what immediate and permanent change in income tax is necessary to close either the intergenerational balance gap or the intertemporal budget gap. In Table 6 we have recorded the different tax increases required to achieve intergenerational and intertemporal balance under different policy alternatives. Where contributory benefits are assumed to rise in line with wages, we also assume a commensurate increase in social security contributions and then let the income tax increase to close the gap.

Under baseline policy a rise of 5.7% in income tax revenues is required to restore both intergenerational and intertemporal balance. This is equivalent to a increase of about £4bn in the income tax revenues and a permanent and

Table 8

Alternative Permanent Income Tax Increases Needed to Achieve Generational Balance and Intertemporal Budget Balance Assuming Immediate and Delayed Adjustments

		Immediate		5 years delay		15 years delay		25 years delay	
	Generational balance gap as % of GDP	Income tax increase needed to achieve generational balance (%)	Income tax increase needed to achieve intertemporal budget balance (%)	Income tax increase needed to achieve generational balance (%)	Income tax increase needed to achieve intertemporal budget balance (%)	Income tax increase needed to achieve generational balance (%)	Income tax increase needed to achieve intertemp. balance (%)	Income tax increase needed to achieve generational balance (%)	Income tax increase needed to achieve intertemp. balance (%)
Baseline policy	26.1	7.5	5.7	9.1	7.1	13.2	10.8	19.0	16.5
Non contributory benefits grow with wages	71.9	20.6	23.2	25.4	27.3	35.1	40.0	48.3	57.8

Table 9

The Savings from Delaying Wage Indexation of Non-Contributory Benefits in terms of future required Tax Increases

		Wage indexing of non-contributory benefits starting in 2004		Wage indexing of non-contributory benefits starting in 2010		Wage indexing of non-contributory benefits starting in 2020		Wage indexing of non-contributory benefits starting in 2030	
	Generational balance gap as % of GDP	Immediate income tax increase needed to achieve generational balance (%)	Immediate income tax increase needed to achieve intertemporal budget balance (%)	Immediate income tax increase needed to achieve generational balance (%)	Immediate income tax increase needed to achieve intertemporal budget balance (%)	Immediate income tax increase needed to achieve generational balance (%)	Immediate income tax increase needed to achieve intertemp. balance (%)	Immediate income tax increase needed to achieve generational balance (%)	Immediate income tax increase needed to achieve intertemp. balance (%)
Non contributory benefits grow with wages	71.9	20.6	23.2	16.8	18.7	12.0	12.8	9.6	10.1

proportionate increase thereafter, or about a 2p increase in the basic rate of income tax.[14] If the government were to implement this policy immediately, the government to debt ratio would be expected to fall from its present level of about 40% of GDP to below 10% of GDP by 2020 before rising again to about 40% GDP by 2050. The optimal tax policy is therefore to pay off current debt before the UK dependency ratio (the percentage of working aged people to retired) starts to rise around 2020, so that during the subsequent ageing of the population the government can meet some of the increase in spending from borrowing. Current government policy, as outlined in its Code for Fiscal Stability, though is to maintain a constant debt to GDP ratio. This policy will inevitably place a greater burden on future generations.

Table 11 compares the adjustments needed to achieve intergenerational balance in the United Kingdom under baseline policy with those in the United States, Japan, Germany, France, Italy, and 12 other European, Asian, and South American countries. The source for the non UK numbers reported in the table is Kotlikoff and Leibfritz (1999) and Bonin and Raffelhueschen (1999). It is evident that if the government is able to keep to these tight fiscal constraints then the UK fiscal position if considerably brighter than most other developed nations.

An alternative scenario is investigated in Table 7: productivity is assumed to rise at 2% rather than 1.75%, with a similar rise in VAT payments and no commensurate rise in any other tax payments, transfer receipts or government expenditures. Our calculations suggest that if government were able to raise productivity by this $\frac{1}{4}$% and stick otherwise to the tight fiscal targets demanded by our baseline scenario, then present policy would be sustainable.

Table 6 also highlights the fiscal implications of relaxing these tight fiscal constraints. Under the scenario labelled looser policy, income tax would have to rise to about 32%, around 21% to cover the increase in non-contributory

Table 10

Sensitivity of Findings to Assumed Interest and Growth Rates

	Generational balance gap as % of GDP	Intertemporal budget gap as % of GDP	Income tax increase needed to achieve generational balance (%)	Income tax increase needed to achieve intertemporal balance (%)
Baseline policy	26.1	20.2	7.5	5.7
Interest rate fall to 3%	63.4	25.3	6.4	3.2
Interest rate increase to 7%	22.4	19.8	10.4	9.1
Increase in growth of all receipts and transfers by 0.25%	31.2	22.5	7.6	6.3
Increase in growth of all receipts and transfers by 0.5%	36.2	24.7	8.2	6.1

[14] In the 1999 Budget, H.M. Treasury estimated that the 1p reduction in income tax rates would reduce revenue by about £2.2 bn.

Table 11

International Comparisons of Generational Accounting Alternative Ways to Achieve Generational Balance

	Cut in government purchases		Cut in government transfers		Increase in all taxes	
Country	*A*	*B*	*A*	*B*	*A*	*B*
United Kingdom	5.1	7.6	7.1	7.3	2.1	2.1
United States	18.7	27.0	19.8	20.3	10.5	10.8
Japan	26.0	29.5	28.6	25.3	15.5	15.5
Germany	21.1	25.9	17.6	14.1	9.5	9.5
Italy	52.7	87.9	41.0	40.0	66.7	61.4
Canada	0.0	0.1	0.0	0.1	0.0	0.1
Thailand	−38.1	−47.7	−185.1	−114.2	−25.0	−25.0
Australia	8.8	10.2	12.1	9.1	5.1	4.8
Denmark	9.9	29.0	4.7	4.5	3.4	4.0
Netherlands	21.0	28.7	21.4	22.3	8.5	8.9
New Zealand	−1.0	−1.6	−0.8	−0.6	−0.4	−0.4
France	17.2	22.2	11.5	9.8	7.1	6.9
Norway	11.5	9.9	9.4	8.1	7.4	6.3
Portugal	7.6	9.8	9.6	7.5	4.2	4.2
Sweden*	34.6	48.8	21.2	18.0	14.8	14.8
Sweden†	−7.6	−8.7	−7.7	−6.0	−3.4	−3.1
Argentina	24.6	29.1	16.8	11.0	10.7	8.4
Belgium	11.2	12.4	6.0	4.6	3.7	3.1
Brazil	23.8	26.2	21.3	17.9	12.4	11.7

na – not available.
A. Education expenditure treated as government consumption.
B. Education expenditure treated as government transfers and distributed by age groups.
Sources: Kotlikoff and Leibfritz (1999) and Raffelheuschen (1998)
* The source of these numbers is the study for the E.C. described in Raffelheuschen (1998)
† The source of these numbers is the IMF study by Haggerman and John reported in Kotlikoff and Leibfritz (1999).

benefits and 11% to cover the increase in health care spending. Social security contributions would also have to rise by 46% to cover the cost of the increase in contributory benefits[15].

Fig. 2 plots the implications of these results in terms of increases in the total tax revenue expressed as a percentage of GDP, where the total tax revenue is defined as the sum of all government receipts excluding only imputed social security contributions. Under looser policy the tax revenue would need to rise to historically unsurpassed rates of 40–45% of GDP. In contrast, the tax rises needed to ensure sustainability under the baseline scenario only return the total tax revenue to about its post second world war average. In fact the income tax rise approximately compensates for the fall in forecasted NIC payments, leaving the overall tax burden roughly constant.

In Table 5 we show how the tax rises needed to ensure intergenerational balance under looser policy affect the generational accounts of the currently

[15] We have used alternative forecasts of the level of means-tested income support payments under the two policy assumptions from the DSS PENSUM model.

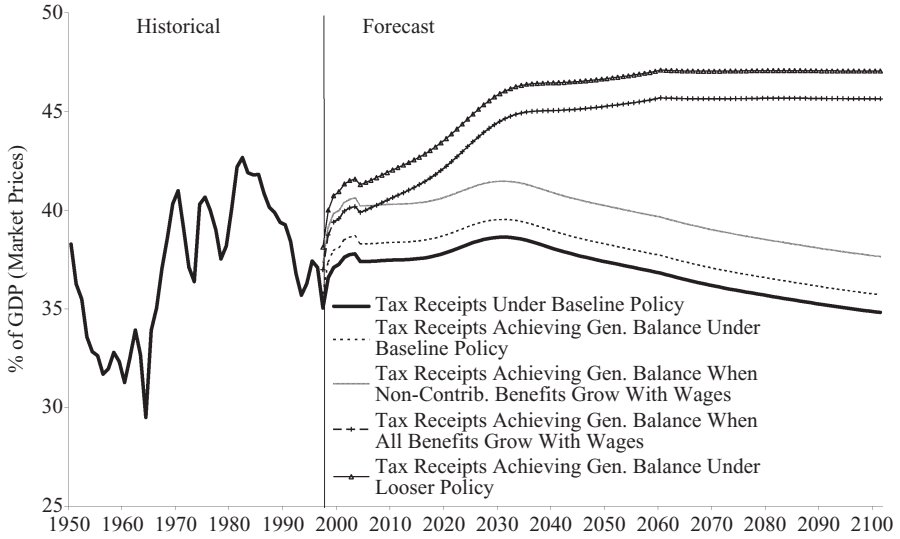

Fig. 2. *Projected Taxes as a Share of GDP under Alternative Scenarios*

living generations (recorded in Table 3 before these tax increases). The huge tax rises are recorded in the columns labelled 'income tax and social security contributions'. The net lifetime tax payments of individuals have increased by nearly 50%. However, generational equity has now been restored.

4.3. *The Cost of Delaying the Tax Rises and the Savings in Delaying Wage Indexation*

Table 8 aims to illustrate the cost of delaying the income tax rises needed to restore either intergenerational or intertemporal balance by 5, 15 or 25 years. These costs are expressed in terms of the tax rise that would be then required. It is evident that, even under the baseline policy, the cost of delaying these income tax increases soon becomes substantial. Even a delay of five years implies that the income tax rise would need to be more than 1.5 percentage points larger than if the rise was implemented immediately. Under a slightly looser policy scenario (wage indexation of non-contributory benefits) the costs of the delay soon spiral out of control.

Table 9 looks at the converse situation, the savings in terms of reduced income tax increases arising from delaying the return to the wage indexation of non-contributory benefits until 2010, 2020 or even 2030. The necessary tax rise drops quite rapidly, as the value of these benefits fall relative to average.

4.4. *Sensitivity of Findings to Interest and Growth Rate and Other Policy Assumptions*

In this study we have assumed an interest rate of 5%, and a growth rate in productivity of 1.75% for the majority of payments and transfers. To demon-

strate that our findings are not particularly sensitive to these assumptions we report in Table 10 the results of a number of experiments where we have varied these assumptions. We show the intergenerational imbalance and intertemporal budget gap and the income tax rises needed to restore the balance when (a) the interest rate is 3% and 7%, and (b) when the rate of growth of all payments and transfers rises $\frac{1}{4}$% and $\frac{1}{2}$% in real terms faster than the baseline. The results only vary slightly, because the interest rate and the productivity rate are applied to both government receipts and payments. Thus, if the baseline assumptions are changed, then both receipts and payments change broadly in the same proportion, leaving the gap roughly the same and the required tax increases to restore the balance very similar.

5. Summary and Conclusion

With the critical assistance of various agencies of Her Majesty's Government, particularly HM Treasury, this study has developed the first set of generational accounts for the United Kingdom. The United Kingdom does not, under our assumed baseline policy, exhibit a large imbalance in its generational policy that seriously threatens the economic wellbeing of future generations. On the other hand, baseline policy, while entailing significant fiscal restraint, does not achieve generational balance. This suggests that additional fiscal measures will be needed to prevent Britain's children from paying higher lifetime net tax rates than those now being paid by their parents. Moreover, if the fiscal responsibility embedded in current policy is neither enhanced nor maintained, Britain's children could face significantly higher lifetime net tax rates than their parents now face.

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