

Long-term public finance report: an analysis of fiscal sustainability

November 2002



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**Long-term
public finance report:
an analysis of fiscal
sustainability**

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HM Treasury contacts

For enquiries about this publication or to obtain further copies, contact HM Treasury Public Enquiry Unit:

Public Enquiry Unit
HM Treasury
1 Horse Guards Road
London
SW1A 2HQ

Tel: 020 7270 4558

Fax: 020 7270 4574

E-mail: public.enquiries@hm-treasury.gov.uk

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OVERVIEW

INTRODUCTION

The Government needs to be aware of long-term trends

1.1 The *Long-Term Public Finance Report* provides a comprehensive analysis of long-term economic and demographic developments, and their likely impact on the public finances. It is intended that the Report will continue to be published on an annual basis in the future.

1.2 The Government believes that sustainable public finances are a prerequisite to achieving stable long-term economic growth, which in turn is essential in guaranteeing that everybody participates in the growing prosperity of the country. The Government also seeks to ensure that spending and taxation impact fairly between generations.

1.3 One of the key challenges facing the Government is the ageing of the population. This trend will have profound effects on Britain's society and economy over the coming decades. The demand for health care, for example, is likely to rise as a result of the increase in the number of older people. A good understanding of the challenges which arise is essential for the Government to make the right long-term strategic policy decisions and to ensure that government policy will be long-term sustainable.

1.4 The Report aims to provide:

- a comprehensive picture of the sustainability of the public finances over the long term based on a range of plausible assumptions;
- an indication of the degree of inter-generational fairness;
- better quality information to guide policy and enhance decision-making and planning by both the Government and individuals; and
- a framework for examining the effects of demography and other long-term trends on the public finances.

1.5 The Report confirms earlier studies that the UK fiscal position is sustainable in the long-term on the basis of current policies and that the UK is in a strong position relative to many other developed countries. The Report also finds that there is a high degree of inter-generational fairness; particularly so when account is taken of the increase in public investment that has been announced and which will provide benefits for both current and future generations.

1.6 Since coming to office in 1997, the Government has introduced a wide range of measures and publications that have increased transparency, credibility and accountability in policy-making and implementation. The Report complements existing publications, including the *Code for Fiscal Stability*¹, Annex A of the Economic and Fiscal Strategy Report (EFSR), and further develops the credibility and transparency of the fiscal framework alongside the *End of Year Fiscal Report* (EYFR), which is also being published alongside the *Pre-Budget Report* for the first time. Both are intended to provide further reassurance that the tough decisions made in the past have put the UK in a secure position to face the challenges of the future without resorting to sudden and unexpected changes in policy.

¹ *Code for Fiscal Stability*, HM Treasury, March 1998.

OUTLINE OF THE REPORT

Long-term public finances and the fiscal framework

1.7 The *Code for Fiscal Stability* requires the Government to specify its objectives for fiscal policy. The Government's medium-term objectives for fiscal policy are to ensure sound public finances and that spending and taxation impact fairly both within and between generations. Chapter 2 provides a full discussion of the role of long-term projections of public finances in the Government's fiscal framework.

1.8 The Government's fiscal policy is implemented through two fiscal rules – the golden rule and sustainable investment rule. These rules strengthen the commitment to sustainability and generational fairness, by specifying that over the economic cycle the Government will borrow only to invest and not to fund current spending, and that public sector net debt will be maintained below 40 per cent of GDP over the economic cycle. This report underpins the Government's commitment to these objectives over the long term.

1.9 The *Code for Fiscal Stability* requires the publication of the EFSR, outlining the Government's long-term goals, strategy for the future, and how it is progressing in meeting its fiscal policy objectives. Within the EFSR, Annex A assesses the outlook for the long term. This Report provides an update of the Annex A projections in Chapter 6 and then provides a more detailed, complementary analysis of long-term fiscal sustainability using a range of indicators.

Long-term challenges

1.10 When assessing the long-term sustainability of the public finances and generational fairness of current policies, it is necessary to make an assessment of expected future trends. Chapter 3 looks at these long-term challenges in detail. One significant future development is the UK's ageing population. The number of people of retirement age is projected to rise over the coming decades, partly due to the post-war baby boom generation reaching retirement age, but also due to predicted increases in life expectancy. By contrast, the number of people of working age is projected to rise only until around 2020-21 before falling back. This implies that the number of people of retirement age relative to those of working age (the 'old-age dependency ratio') is projected to rise in the coming decades. This change in the population structure has implications for spending and revenues that are sensitive to demographic change, such as health-care expenditures.

1.11 The continued rapid advancement of technological knowledge, and changes in expectations and preferences in the consumption of goods and services are also likely to be important drivers of future public finance trends. However, there is a high degree of uncertainty about the nature and timing of these trends that make them difficult to quantify and model in a long-term study.

Approaches to assessing long-term fiscal sustainability

I.12 The Government already publishes top-down projections in Annex A of the EFSR of the Budget, and these projections are updated in this Report. Chapter 4 presents some different approaches to assessing long-term sustainability. The Report quantifies the impact of future trends on the public finances using fiscal gaps assessed in the context of the Government's fiscal rules, and generational accounting techniques. The latter uses a model that has been developed through a project by the National Institute of Economic and Social Research (NIESR), part-funded by HM Treasury².

I.13 The Report complements the fiscal gap and generational accounting concepts with 'bottom-up' projections of individual spending items as a share of GDP. Attention is focused on those items that are most likely to be affected by changing demographic or other long-term drivers, notably education, pensions and health care.

Assumptions

I.14 Given the high degree of uncertainty regarding future developments, it is important to state clearly the main assumptions used. The key assumptions used in this Report are presented and discussed in Chapter 5. As the Report studies in detail the potential impact of a changing population structure on the public finances, the demographic assumptions are crucial. This Report uses the Government Actuary's Department's 2001-based interim principal population projections for the UK³. These take account of the 2001 Census. To provide a sensitivity analysis, the Report considers a range of plausible productivity growth and discount/debt interest rate assumptions.

Results

I.15 Chapter 6 provides an update of the illustrative long-term fiscal projections published in Annex A of Budget 2002, using the medium-term forecast as presented in the *2002 Pre-Budget Report*. As in Budget 2002, the updated projections show that the UK's public finances are broadly sustainable. Chapter 6 also presents the results of using the different approaches given in Chapter 4. These results demonstrate that on the basis of current policies the public finances are sustainable in the long term and that current policy is broadly generationally neutral. This confirms earlier findings by HM Treasury, the NIESR and other organisations such as the OECD. International comparisons also show that the UK is in a strong position to face the fiscal challenges of an ageing population relative to many other developed countries.

I.16 As projected, revenues are fairly insensitive to demographic changes and only fall marginally as a share of GDP over the next five decades. By contrast, spending is projected to increase slightly as a share of GDP over the next 30 years and then fall back. So total spending as a share of GDP is projected to be very similar in 2051-52 as in 2007-08, the end of the medium-term forecast period. The substantial increase in spending between 2001-02 and 2007-08 largely reflects the Government's increased spending on public services, in particular on health and education.

² For further details see *Generational accounting in the UK*, Roberto Cardarelli, James Sefton, and Laurence J. Kotlikoff, NIESR, 1998.

³ Available at http://www.gad.gov.uk/Population_Projections/Population_projections_background.htm.

I.17 A detailed breakdown of total spending reveals that the share of age-related spending in total spending is likely to increase over the coming decades. This is mainly because health spending is predicted to edge up as a share of GDP. By contrast, other age-related spending such as education, pensions and long-term care, can be expected to fluctuate around their current shares. The slight increase in age-related spending (relative to GDP) is predicted to be more or less offset by lower other spending.

I.18 As with any long-term projection, the results in the Report should be interpreted with care. The uncertainties looking so far ahead are, of course, enormous. For this reason the emphasis in this Report is on demonstrating the public finances are sustainable on a range of plausible assumptions for discount/debt interest rates and productivity growth. Several specific qualifications are also noted including the uncertainty over future trends in: health spending, tax revenues and employment.

CONCLUSIONS

I.19 The *Long-Term Public Finance Report* represents an important strengthening of the UK fiscal framework. The indicators used in this Report do not supplant the fiscal rules which govern the Government's fiscal policy. What the Report does show, using a range of indicators, is that on plausible assumptions and on current policies the UK public finances are sustainable in the long term and are broadly generationally fair. International comparisons also suggest the UK is in a relatively strong position to face the challenges ahead.

INTRODUCTION

2.1 There has been a shift towards more medium-term planning within fiscal frameworks by governments around the world, and a greater emphasis on the long term. This has been motivated mainly by countries attaining control over their short and medium-term fiscal positions and becoming increasingly aware of the importance of looking at the long term, in part so as to prepare for the common problem of an ageing population. The focus of attention has been on long-term fiscal sustainability.

Sustainable public finances

2.2 Sustainable public finances are an essential prerequisite to achieving steady long-term economic growth. Focusing on long-term stability creates an environment conducive to sustained long-term economic growth and should help to promote inter-generational fairness.

2.3 It is important for the Government to have information on the outlook for the long term, and the long-term implications of current policy. As well as assisting strategic long-term decision making, more information on the long term greatly improves fiscal transparency and credibility. The next sections look at the UK's fiscal framework, and present what information is published in the UK and other countries.

THE UK FISCAL FRAMEWORK

Long-term focus

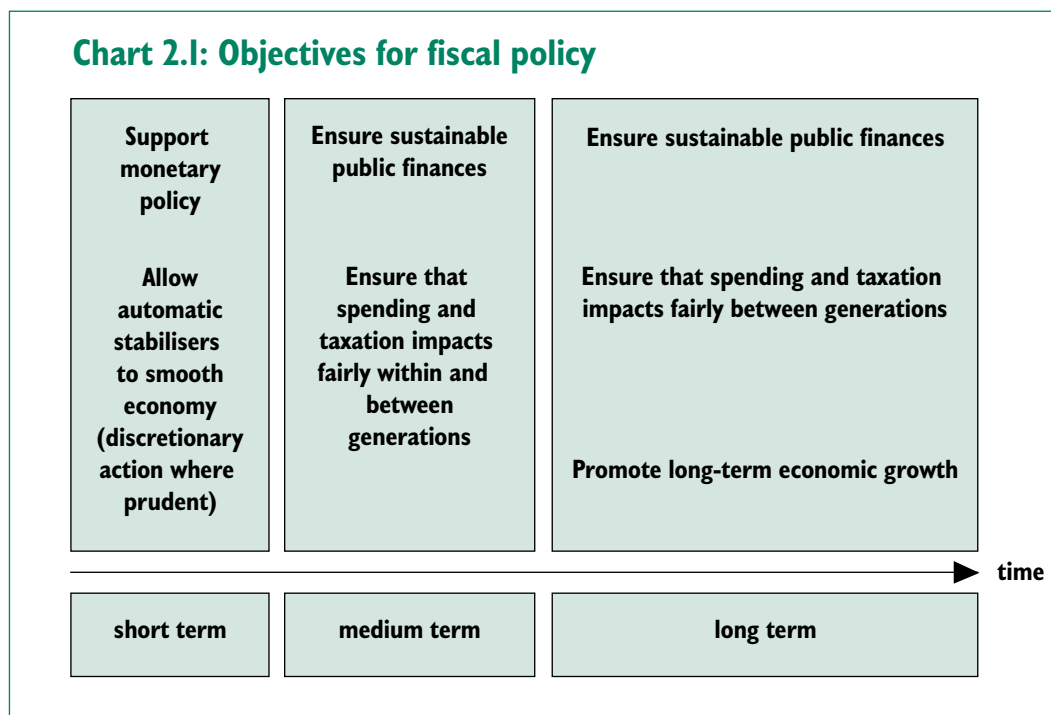
2.4 The UK's fiscal framework provides the setting for transparent, long-term decision-making. The framework is guided by the *Code for Fiscal Stability*, which sets out a commitment to managing the public finances in the long-term interests of Britain. The five key principles of the *Code* – transparency, stability, responsibility, fairness and efficiency – also support a long-term focus to policy making.

Objectives for fiscal policy

2.5 Fiscal policy is set with consideration to the short, medium and long term. The *Code* requires the Government to state its objectives and the rules by which fiscal policy is operated. The Government's objectives for fiscal policy are:

- over the medium term, to ensure sound public finances and that spending and taxation impact fairly both within and between generations; and
- over the short term, to support monetary policy; and, in particular, to allow the automatic stabilisers to play their role in smoothing the path of the economy.

2.6 In the long run, fiscal policy supports the Government's long-term goals by ensuring that the public finances are sustainable, contributing to a stable environment that promotes economic growth. While it is beyond the scope of this Report to explicitly model the linkages between long-term economic growth and long-term fiscal policy, there exists a general consensus that a stable environment assists economic growth in the long run¹. This environment is important for achieving the Government's objective to build a stronger, more enterprising economy and a fairer society, extending economic opportunity and supporting those most in need, to ensure that rising national prosperity is shared by all. The objectives for fiscal policy are summarised in Chart 2.1 alongside the relevant time horizons.



Fiscal rules 2.7 The Government has formulated two fiscal rules through which the objectives for fiscal policy are implemented, which also reflect the commitments to fiscal sustainability and generational fairness. They are:

- the **golden rule**: over the economic cycle, the Government will borrow only to invest and not to fund current spending; and
- the **sustainable investment rule**: public sector net debt as a proportion of GDP will be held over the economic cycle at a stable and prudent level. Other things being equal, net debt will be maintained below 40 per cent of GDP over the economic cycle.

2.8 The golden rule specifies that current spending should be financed by current taxes (and not by future generations) over the economic cycle, thus ensuring generational fairness and fiscal sustainability. In addition, the sustainable investment rule ensures debt sustainability and also supports generational fairness by limiting the scope for the current generation to leave excessive debt burdens to future generations.

¹ See *Reforming Britain's Economic and Financial Policy: Towards Greater Economic Stability*, edited by Ed Balls and Gus O'Donnell, HM Treasury, Palgrave, 2002.

Current reporting arrangements **2.9** To measure progress against the Government's commitment to its objectives and long-term interests, the *Code* requires the publication of an Economic and Fiscal Strategy Report (EFSR) outlining the Government's long-term goals, strategy for the future, and how it is progressing in meeting its fiscal policy objectives.

PURPOSE OF THIS REPORT

2.10 The Government has already conducted a top-down assessment of long-term fiscal sustainability in Annex A of the EFSR in Budget 2002 but, due to the modelling approach, these do not identify specific long-term spending trends. Furthermore, the aggregate nature of the illustrative long-term fiscal projections makes it difficult to raise awareness for specific policy choices so that informed decisions can be taken. More specific long-term projections may be useful to facilitate long-term planning. For example, the specific projections for health spending in the Wanless Review² were helpful in building a consensus on the long-term direction of policy.

Box 2.1: The uses of long-term fiscal projections

Long-term fiscal projections can be used to help the Government to meet the following objectives:

- ascertain the long-term sustainability of public finances;
- provide insights into the issue of inter-generational fairness;
- identify long-term economic trends so as to allow time for planning and changes in policy; and
- raise public awareness so as to allow informed decisions to be made.

In addition long-term fiscal projections should indicate how well the Government is likely to perform against its own fiscal rules; in the case of the UK these are the golden rule and the sustainable investment rule.

Relationship with Annex A **2.11** This Report seeks to extend and complement the analysis in Annex A of the EFSR (which is updated in this Report) so that the objectives stated in Box 2.1 are met. To this end the Report aims to provide:

- a comprehensive picture of the sustainability of the public finances over the long term based on a range of plausible assumptions;
- an indication of the degree of inter-generational fairness;
- better quality information to guide policy and enhance the decision-making and planning by both the Government and individuals; and
- a framework for examining the effects of demography and other long-term trends on the public finances.

2.12 This Report does not aim to provide a unique answer to the degree of long-term fiscal sustainability and inter-generational fairness. Given the high degree of uncertainty of long-term projections this would be unrealistic.

² *Securing our Future Health: Taking a Long-Term View*, Derek Wanless, April 2002.

INTERNATIONAL EXPERIENCE AND BEST PRACTICE

International guidelines for fiscal transparency

2.13 The increased emphasis on the long term is reflected in the reporting requirements in many countries and in international practices for budget transparency. The OECD's Best Practices for Budget Transparency state a long-term report: "should be released at least every five years, or when major changes are made in substantive revenue or expenditure programmes" and that the report: "should assess the budgetary implications of demographic change, such as population ageing and other potential developments over the long term..."³. The Manual on Fiscal Transparency by the International Monetary Fund (IMF) argues that: "...policy commitments with a future financial impact should be taken into account, particularly public pension programmes"⁴.

2.14 The OECD has produced a number of studies that have looked at the impact of an ageing population on the future. A 2001 study provides projections on the fiscal impact of age-related spending for OECD countries for the next 50 years⁵. The study was carried out in collaboration with the European Union's Economic Policy Committee (EPC) and differs from previous OECD studies in that it uses a standardised modelling approach and provides more detailed projections⁶.

OECD countries

2.15 Various OECD countries have also published their own long-term reports or included information on the long term in their annual budgets. Countries that have published long-term analyses include Australia, Belgium, Finland, France, Ireland, New Zealand and Norway. In addition, New Zealand and Norway publish assessments of the long term in conjunction with their regular budgetary cycle. The US publishes assessments of the long term, either included as part of Budget publications or as separate stand-alone policy briefs⁷.

EU countries

2.16 More specifically, within the EU there has been a greater interest in the long-term aspects of the public finances. EU member states, including the UK, presented information in their 2001 Stability and Convergence Programmes on long-term trends that might affect the public finances in the future⁸.

2.17 With a view to identifying the impact of such long-term developments, the EPC established a specific working group in 1999, made up of officials from the Member States and the European Commission, to examine the economic and budgetary implications of ageing populations. In October 2001 the group published a major study that looked at the impact of demographic changes on a number of age-related expenditures, with a view to assessing the long-term sustainability of public finances⁹. ECOFIN (the ministers for economic affairs and finance in the EU) endorsed the study in November 2001, and requested the EPC to update the findings every three to five years¹⁰.

³ *OECD Best Practices for Budget Transparency*, OECD, May 2001, page 6.

⁴ *IMF Manual on Fiscal Transparency*, IMF, March 2001, paragraph 103.

⁵ *Fiscal implications of ageing: projections of age-related spending*, in *OECD Economic Outlook*, OECD, June 2001.

⁶ Previous studies include: *Ageing and income: financial resources and retirement in 9 OECD countries*, in *Social Issues*, OECD, 2001; *The macroeconomic implications of ageing in a global context*, OECD, 1998; and *Ageing population, pension systems and government budgets: simulations for 20 countries*, OECD, 1996.

⁷ The Bibliography provides more details on these analyses.

⁸ *Convergence Programme 2001: Maintaining Economic Stability*, HM Treasury, December 2001.

⁹ *Budgetary Challenges Posed by Ageing Populations*, EPC Working Group on Ageing, October 2001.

¹⁰ For the press release of the relevant ECOFIN council meeting, see <http://ue.eu.int/Newsroom/LoadDoc.asp?MAX=1&BID=93&DID=68581&LANG=1>.

CONCLUSIONS

2.18 Sustainable public finances are an essential prerequisite to achieving long-term economic growth. It is therefore important for the Government to have information on the outlook for the long term, and the long-term implications of current policies.

2.19 This chapter set out the UK fiscal framework and explained the role of long-term fiscal projections within that framework. The chapter stated that the Government assesses long-term fiscal sustainability in Annex A of the EFSR and that this Report extends and complements that analysis.

INTRODUCTION

3.1 This chapter looks at the long-term challenges that could affect current and future fiscal policies. The main focus is on demographic changes but other potential trends such as technological advancements, and changing expectations and preferences are also presented.

THE CHANGING STRUCTURE OF THE UK POPULATION

Demography 3.2 One of the most important future developments is the continued changing structure of the UK's population. In the UK the Government Actuary's Department (GAD) provides population projections based on different scenarios. GAD published updated principal projections in early November. These interim 2001-based population projections take account of the findings of the 2001 Census, which showed that the total population was over one million lower than previously estimated in 2000¹. The Office for National Statistics (ONS) attributed this to an underestimation of emigration of mainly males between 25-39 years of age².

3.3 GAD's 2001-based interim principal projections differ from the 2000-based projections in that they have a lower starting point for total population but also in that they are based on a lower net migration assumption. A number of international organisations such as Eurostat (the statistical office of the European Commission) and the United Nations also regularly publish population projections for the UK. A comparison of these projections is given in Table 3.1. The projections in this Report are based on GAD's 2001-based interim principal population projections.

Table 3.1: UK population projections (millions)

	2000	2010	2015	2020	2050
Government Actuary's Department	58.8 ¹	60.3	61.3	62.2	63.7
Eurostat	59.6	60.9	61.5	62.2	61.8
United Nations	59.4	60.3	60.6	60.9	58.9

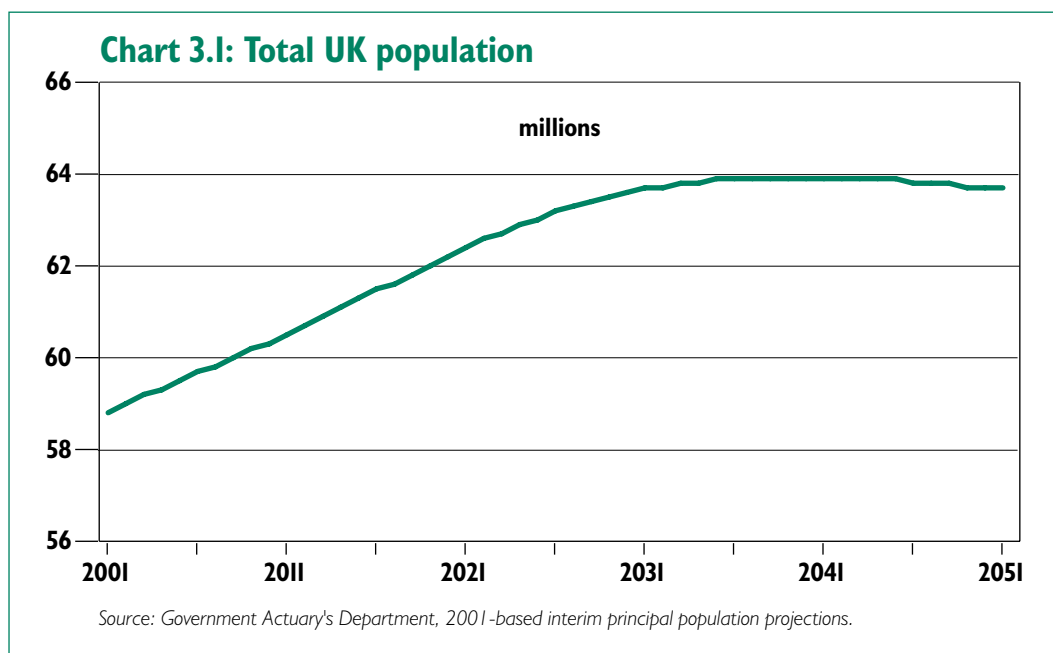
¹ Refers to 2001.

Sources: Government Actuary's Department (2002), Eurostat (2002) and United Nations (2001).

3.4 According to GAD's 2001-based interim principal projections the UK population will rise from 58.8 million in 2001 to nearly 64 million by the mid 2030s. After 2035 total population will remain more or less stable until at least 2050, as illustrated in Chart 3.1.

¹ http://www.gad.gov.uk/Population_Projections/Population_projections_background.htm.

² <http://www.statistics.gov.uk/census2001/> provides more details.



3.5 However, population projections this far ahead are subject to a high degree of uncertainty. This uncertainty is due to a number of factors, including uncertainty regarding future fertility rates, trends in life expectancy (for newborns and for the current population), and net migration flows. These factors depend on preferences and social structures (fertility), technological advances and changing life styles (life expectancy, fertility), and economic, political and social developments in the UK and abroad (net migration)³.

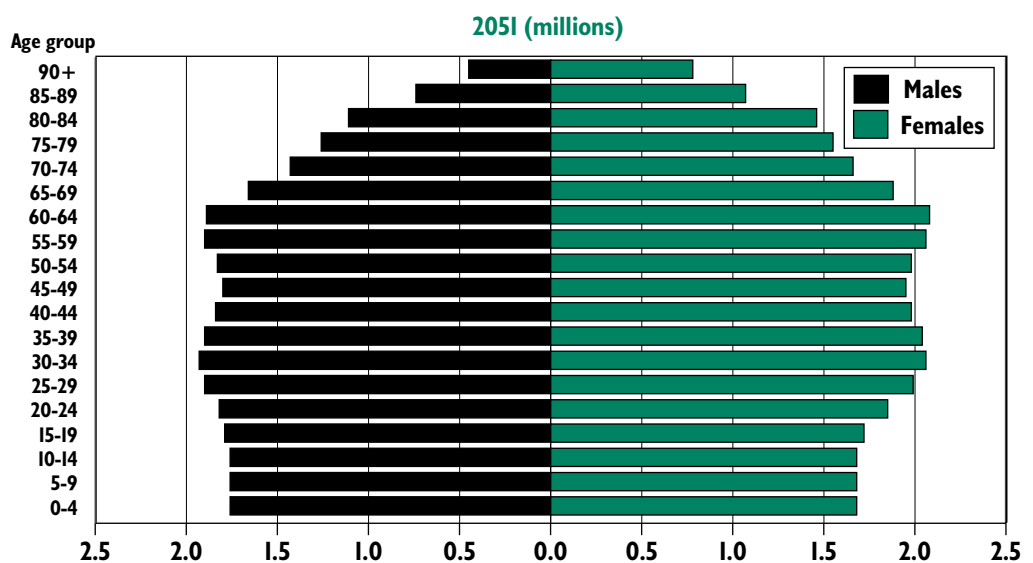
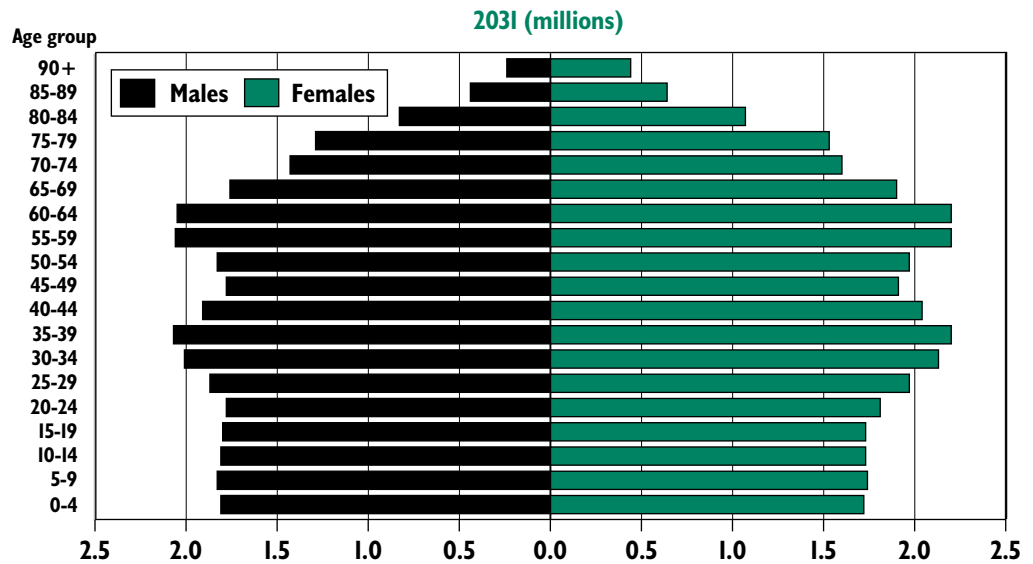
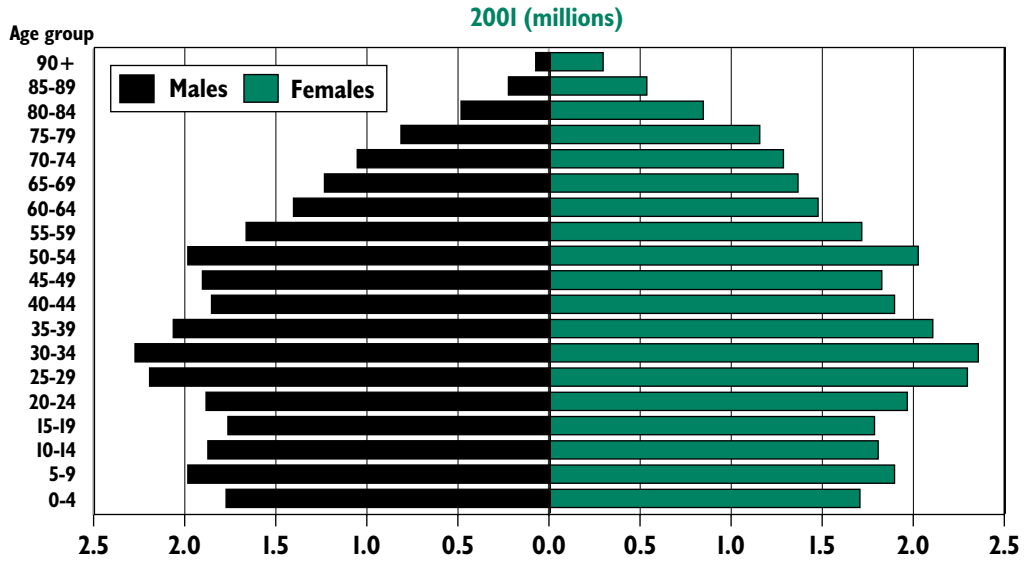
3.6 The UK population is projected to age and its composition to change as a result. According to GAD's 2001-based interim principal projections, the median age will increase from 38 years in 2001 to around 44½ years by 2040 before stabilising. The ageing process will eventually lead to a slight "inversion" of the so-called population pyramid. Chart 3.2 shows the projected evolution of the UK's population.

3.7 As can be seen from Chart 3.2 the number of older people is projected to rise over the coming decades. This is partly due to the post-war baby boom generation reaching retirement age but also to life expectancy for males and females being predicted to edge up from 75.7 years in 2001 to 79.9 years in 2050 for males and from 80.4 years to 84.1 years for females. At the same time the number of younger people is projected to fall slightly⁴.

³ Alongside its principal projections, GAD also generally publishes variant projections which are based on different assumptions. However, GAD has not published any 2001-based interim variant projections. Variant projections based on the findings of the 2001 Census will be published in 2003.

⁴ Chapter 5 (paragraph 5.5) provides more details.

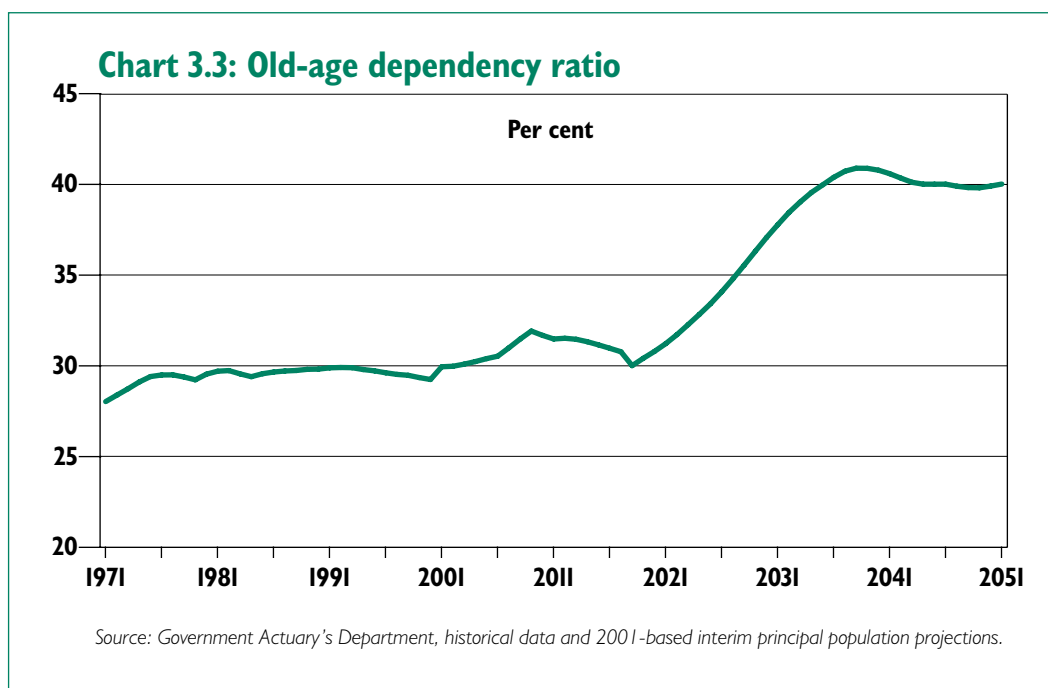
Chart 3.2: UK population by age and sex



Source: Government Actuary's Department, 2001-based interim principal population projections.

Old-age dependency ratio **3.8** The ageing of the UK population can also be illustrated by the evolution of the old-age dependency ratio. This ratio shows the number of people of retirement age relative to the number of people of working age⁵. As can be seen in Chart 3.3 the old-age dependency ratio is projected to rise from 30 per cent in 2002 to 32 per cent in 2010 before falling slightly in the following decade. The fall is due to the fact that the female state pension age will rise from 60 years in 2010 to 65 years in 2020, thereby converging with the male state pension age. Once the effect of this policy-induced change ceases to have an impact, demographic trends drive up the old-age dependency ratio to around 40 per cent by 2040.

3.9 The sharp increase after 2020 can be explained by the rise in the number of people aged 65 and over, and by the fall in the number of people of working age. The number of people of retirement age (taking account of the increase in the female state pension age) is projected to rise from 10.9 million in 2002 to 15.3 million by 2040, mainly reflecting increases in life expectancy and the retirement of the baby-boom generation. This means that there will be around four people of retirement age for every ten people of working age by 2040, compared with around three people of retirement age nowadays.



3.10 The increase in the number of older people is accompanied by a projected slight decline in the number of people under working age; in other words, those aged 15 years or lower (Chapter 5, Chart 5.2). With the fertility rate stable, the decline is due to fewer women of childbearing age in the coming decades.

Other EU countries **3.11** The UK's population is, however, ageing less rapidly than the populations of most EU member states. Everything else equal, population ageing will therefore have a smaller impact on the UK than on many EU member states. Table 3.2 presents old-age dependency ratios for the EU member states (and for some other developed countries) as projected by the United Nations⁶. The table also shows that the ageing trend is not a new phenomenon. Western European and other developed countries have aged since at least the 1950s.

⁵ Working-age population is a statistical concept and comprises everyone aged between 15 years and the state pension age. At present the state pension age for males is 65 years and for females 60 years. However, between 2010 and 2020 the female state pension age will be gradually raised to 65 years.

⁶ Note that the United Nations' figures for the UK are based on different assumptions than those published by GAD in its 2001-based principal population projections.

Table 3.2: Old-age dependency ratios¹ in developed countries

	1950	1975	2000	2025	2050
Austria	15.5	24.0	22.9	37.9	62.5
Belgium	16.2	21.8	25.9	38.0	51.2
Denmark	14.1	20.9	22.5	35.8	43.8
Finland	10.5	15.8	22.3	41.8	48.8
France	17.3	21.5	24.5	36.2	46.7
Germany	14.5	23.3	24.1	39.0	54.7
Greece	10.5	19.1	26.0	38.1	64.6
Ireland	17.7	19.0	16.9	24.5	37.2
Italy	12.6	18.9	26.7	40.6	68.1
Luxembourg	13.9	20.0	21.5	28.5	31.4
Netherlands	12.3	16.9	20.1	34.3	45.0
Portugal	11.0	15.9	23.1	31.7	53.5
Spain	11.1	16.1	24.8	36.1	73.8
Sweden	15.5	23.5	27.1	41.5	54.5
UK	16.0	22.2	24.1	34.8	47.3
Weighted average of EU member states	14.3	20.7	24.5	37.1	54.7
Australia	12.4	13.6	18.2	29.2	37.5
Canada	12.2	12.9	18.5	32.6	40.9
Japan	8.3	11.6	25.2	49.0	71.3
New Zealand	14.5	14.2	17.9	28.9	38.5
USA	12.8	16.3	18.6	29.3	34.9

¹ Those aged 65 years and over as a ratio of those aged between 15 and 64 years.

Source: United Nations, *World population ageing 1950–2050*, (2001).

OTHER LONG-TERM TRENDS

Technological advances

3.12 A further future trend is likely to be the continued rapid advancement of technological knowledge. All aspects of society will be affected as innovations transform the way we travel, purchase, produce and distribute goods and services, and the way we work and spend our leisure time.

3.13 Technological advances are also likely to transform the supply of health care services in the UK, with a potentially major impact on the future cost of health services. As shown in the previous section, life expectancy has risen sharply over the last few decades and is expected to increase further in the decades ahead, partly due to new drugs and forms of treatment. Higher life expectancy, in turn, has encouraged the development of new drugs and forms of treatment, creating pressure to increase spending on further technological advances.

Wanless Review 3.14 A survey of 50 leading health economists in 1995 showed that 81 per cent believed technology was the driving force behind the long-term rise of health care spending⁷. The Wanless Review (2002), commissioned by the Chancellor of the Exchequer in 2001, states that: "...while some technologies will reduce unit costs, overall new technology is likely to continue to put upward pressure on health care spending as it enables more people to be treated and for longer periods of time"⁸.

⁷ *Health care for the elderly: How much? Who will pay for it?*, Victor R. Fuchs, in *Health Affairs*, 1999.

⁸ *Securing our Future Health: Taking a Long-Term View*, Derek Wanless, April 2002, page 52.

3.15 The Wanless Review quantifies the effect of technology on health spending, estimating that technology and medical advances have contributed around 2 percentage points to the annual rate of growth of health spending over the past 20 years. The Wanless Review also states that over the next 20 years, technology spending will need to grow at a faster rate in the UK than over the past 20 years to catch up and keep up with other developed countries.

3.16 The Wanless Review emphasises the high degree of uncertainty involved in projecting medical advances and their likely financial impact on the provision of health services. The Review cites the wide variety of opinions expressed by experts in the field; for example, no consensus has so far emerged regarding the future importance of genetics and stem cell technology. While it is clear that new discoveries will be made in these fields, it is neither known what they will be nor when they will happen. Given that the projections presented in this report cover 50 years (compared with the Wanless Review's 20 years), and the many different possibilities, the results should be interpreted with care.

Compression of morbidity

Healthier, longer lives

3.17 Past experience suggests that the continued rise in life expectancy will be accompanied by an increase in the number of years people enjoy in good health. This trend is generally referred to as compression of morbidity. It is therefore likely that demand for health and long-term care will, everything else equal, be lower for any specific age cohort in the future than it is today. It has been argued that: "...the best evidence we can find about the United Kingdom suggests that the factors, which are causing us to live longer are also resulting in the extra years of life being free from severe disability"⁹. This trend can be expected to have a significant dampening effect on health and long-term care spending increases, at least partially offsetting the impact on the public finances caused by the increase in the number of older people and the above-mentioned technological advances.

3.18 There is an expanding academic literature that analyses the potential effect of the compression of morbidity on the future cost of long-term care provision. For the UK, Wittenberg et al. (2002)¹⁰, for example, find that public long-term care spending will remain more or less stable over the next 50 years, when including compression of morbidity, compared with an increase of around 13 per cent when excluded. There is comparatively less research on the impact of compression of morbidity on health spending.

Changing expectations and preferences

3.19 Expectations and preferences are also likely to change over time. The Wanless Review considered this influence along with demography, technological change and other factors to give a full assessment of the resource requirements for a high quality health service. As society becomes richer and its structure changes, it will demand new goods and services, or more (or less) of existing goods and services. In principle either the public or private sector could provide these goods and services. In the context of projections, the problems are the same as with technological advances: while it is clear that changing expectations and preferences will affect the future, it is not known when or how.

⁹ *With Respect to Old Age: Long-Term Care - Rights and Responsibilities*, The Royal Commission on Long-Term Care, March 1999, paragraph 2.23.

¹⁰ *Demand for long term care in the UK: projections of long-term care finance for older people to 2051*, Raphael Wittenberg, Ruth Hancock, Adelina Comas-Herrera and Linda Pickard, in *A New Contract for Retirement: Modelling Policy Options to 2050*, edited by Richard Brooks, Sue Regan and Peter Robinson, 2002.

3.20 However, a few broad trends can still be predicted from economic theory. As income rises, citizens will spend disproportionately more on some goods and services¹¹. There is some empirical evidence that health care and long-term care are such goods, with individuals spending a larger share of their income on these services the richer they become. Therefore, as societies grow richer, it may be the case that larger shares of GDP will be spent on health care¹².

3.21 There is also empirical evidence that education is such a good¹³. It is possible that demand for education (whether for schooling, higher education or life-long learning) will rise over time and education spending will increase as a share of GDP. The public sector's role in providing and financing this good will determine the impact on the public finances.

Changes in productivity growth

3.22 Another important potential development is the rate of underlying productivity growth. There are likely to be both positive and negative influences of an ageing society on productivity growth. A positive influence could be that a shrinking labour force may have a positive impact on productivity growth through changes in the capital-labour ratio. In addition, labour productivity may rise due to an increase in the average level of work experience, and therefore a higher average skills level of the work force¹⁴. However, it is also possible that the ageing of the population might be accompanied by a loss in productivity performance in the economy, on the basis that older workers are less innovative and less responsive to change¹⁵. Innovation and technical progress could therefore slow as societies age.

CONCLUSIONS

3.23 This chapter identified a number of trends that are likely to occur over the coming decades. These trends are likely to have implications for the public finances. It is important to ascertain the effects of these trends if an appropriate policy response is to be formulated well ahead of time.

3.24 The changing structure of the UK population is one such trend. The ageing of the population will have implications for all spending and revenue items sensitive to demography. The phenomenon of ageing is also occurring in other developed countries, particularly other EU member states.

3.25 Amongst other trends, technological change could also have a potential impact on the public finances. However, given a great deal of uncertainty about the direction and magnitude of the effect(s), these trends are difficult to quantify and model. This Report therefore focuses mainly on modelling the changing of the demographic structure. In the next chapter the approaches used to assess the potential effect on the public finances are examined.

¹¹ These are termed "luxury goods" in the economics literature.

¹² *With Respect to Old Age: Long-Term Care - Rights and Responsibilities*, The Royal Commission on Long-Term Care, March 1999.

¹³ See *Public Finances in EMU 2002*, European Commission, 2002, page 69; and *Fiscal policy and the size of governments*, Carlos Martinez-Mongay, in *The Behaviour of Fiscal Authorities* edited by Marco Buti, Jürgen von Hagen and Carlos Martinez-Mongay, 2002.

¹⁴ For empirical evidence see *An aging society: opportunity or challenge?* David M. Cutler, James M. Poterba, Louise M. Sheiner, and Lawrence H. Summers, in *Brookings Papers on Economic Activity*, 1990, and *Is growth exogenous? Taking Mankiw, Romer and Weil seriously*, Ben Bernanke and Refet Gurkaynak, in *NBER Macroeconomics Annual 2001*, edited by Ben Bernanke and Kenneth Rogoff, 2001.

¹⁵ See, for example, *The Birth Dearth: What Happens When People in Free Countries Don't Have Enough Babies?*, Ben Wattenberg, 1987 and *Capital, labor and productivity*, Paul Romer in *Brookings Papers on Economic Activity*, 1990.

INTRODUCTION

4.1 This chapter sets out the different techniques to assess long-term fiscal sustainability. It shows the methodology used in the illustrative long-term fiscal projections in Annex A of the Economic and Fiscal Strategy Report (EFSR), as well as further approaches that can be used to analyse the long-term fiscal sustainability of current policies. Three different techniques are discussed in detail: fiscal gap modelling, generational accounting and a bottom-up approach, with each approach's strengths and weaknesses highlighted.

LONG-TERM FISCAL SUSTAINABILITY MEASURES

4.2 Governments issue debt (or borrow) to allow the smoothing of expenditure over time. This smoothing takes place so that even if unforeseen changes in tax revenues occur (due to say, fluctuations in the economy), spending programmes do not have to be changed immediately. If borrowing were not possible, then the government would need to either maintain a stock of assets, or tax rates would need to rise and fall each year to meet the cost of existing spending plans. By borrowing, governments are able to help smooth household incomes over the business cycle, and therefore help to stabilise output in the face of economic shocks.

4.3 However, there are limits to how much a government can borrow. Too high a level of public debt may lead to a number of adverse outcomes:

- less favourable combinations of interest rates and economic growth;
- debt servicing requirements may become unsustainable without a tightening in the fiscal position; and
- the long-term credibility of the government (and successive governments) may be damaged. So even if a prudent fiscal policy were announced later, markets may not regard such an announcement as credible. This might hamper growth and stability even after the level of public debt has been brought under control.

4.4 Long-term fiscal sustainability involves the ability of a government to meet its obligations over time¹. It is therefore important that government debt is kept at a sustainable level over time. For this reason the UK operates the sustainable investment rule which requires that public sector net debt as a proportion of GDP is held over the economic cycle at a stable and prudent level.

Updated illustrative long-term fiscal projections

4.5 Within the EFSR, the *Code for Fiscal Stability*² requires that illustrative long-term projections of the outlook for the key fiscal aggregates are presented for a period of no less than 10 years into the future, based on a range of plausible assumptions, so as to shed light on the inter-generational impact and sustainability of fiscal policy.

4.6 These projections are presented in Annex A of the EFSR and have in practice covered a 30-year time horizon. The projections are derived using a top-down approach. One of the main strengths of this approach is that it can be based on the assumption that the fiscal rules

¹ For a more detailed discussion on government solvency and sustainability, see *Reforming Britain's Economic and Financial Policy*, edited by Ed Balls and Gus O'Donnell, HM Treasury, Palgrave, 2002.

² *Code for Fiscal Stability*, HM Treasury, March 1998.

are met. As such, the top-down approach answers the question what resources are available for future spending, assuming that the fiscal rules are always met. In particular, the illustrative long-term fiscal projections presented in Annex A of the EFSR calculate at what rate current consumption (for example current spending on health and education) can grow while allowing the Government to meet its fiscal rules.

Intertemporal budget constraint

4.7 To formalise the assessment of sustainability, the government's obligations over time can be represented in the intertemporal budget constraint (IBC):

$$\sum_{s=t}^{\infty} R_s (1+r)^{-s+t} = \sum_{s=t}^{\infty} S_s (1+r)^{-s+t} + D \quad (1)$$

where R_s is revenue in year s , S_s is spending in year s , r is the discount rate, t is the current year and D is the initial stock of net debt³. The intertemporal budget constraint states that all current and future revenue streams should be sufficient to cover all current and future spending streams, and to pay off current debt. The constraint requires that a government's debt, on average, is not growing at too fast a rate, given the level of interest rates and economic growth rates⁴.

4.8 Spending and revenues are discounted to the current year, time t , using a discount rate, in other words multiplied by a factor of $(1+r)^{-s+t}$ where $(s-t)$ is the number of years into the future. The adjustment reflects that the value society puts on £1 today, may not be the same as £1 in say, ten years time. This can be due to reasons such as preferences over time or future uncertainty.

Fiscal gaps

4.9 There are a number of measures which can be used to assess long-term fiscal sustainability. Under certain assumptions, for example, a constant debt to GDP ratio will meet the IBC (over an infinite time horizon). One measure of sustainability is the difference between the current primary balance and the primary balance needed to achieve a constant debt to GDP ratio. Another measure is the fiscal gap, which uses the IBC to calculate the immediate and permanent change in the primary balance needed to achieve a certain debt target in the future⁵.

4.10 Eliminating, or "closing" the fiscal gap involves changing taxes or spending which affect the primary balance to reach the pre-determined debt target. The required change in the primary balance to GDP ratio, Δpb , can be calculated as follows:

$$\Delta pb = (r-g) \left[d_t + \left(\frac{1}{1+r} \right) \frac{\sum_{s=t}^T -pb_s \left(\frac{1+r}{1+g} \right)^{T-s}}{\left(\frac{1+r}{1+g} \right)^{T-t} - 1} \right] \quad (2)$$

³ Revenue, spending and debt are in real terms.

⁴ For the intertemporal budget constraint to be satisfied, it is required that on average the stock of debt grows at a rate smaller than r , $\lim_{s \rightarrow \infty} \frac{D_s}{(1+r)^s} = 0$, where D_s is the level of (net) debt in year s , and r is the real interest rate in year s .

This condition is also known as a "no Ponzi" finance condition. However, if there exists a rate of economic growth g , which is greater than r , then debt can grow at a faster rate than r and the government can remain solvent. See *Reforming Britain's Economic and Financial Policy*, edited by Ed Balls and Gus O'Donnell, HM Treasury, Palgrave, 2002, page 170 for further details.

⁵ This definition follows *The US fiscal problem: where we are, how we got there, and where we're going*, Alan Auerbach, in *NBER Macroeconomics Annual*, edited by Stanley Fischer and Julio Rotemberg, 1994.

where t is the initial year, T is the target year, r is the interest rate, g is the real growth rate of output, d_t is the initial (and target) debt to GDP ratio and pb_s is the primary balance to GDP ratio in year s . The formula can be modified for a different desired level of debt in target year T to the initial debt level. Various countries, such as the USA and New Zealand⁶ have estimated the magnitude of their fiscal gaps⁷.

Generational accounting

4.11 The technique of generational accounting uses the IBC to calculate whether there is a “gap” in the long-term public finances. If current and future revenues are not sufficient to cover current and future spending and current debt, for a given finite period, then the government will either have to raise revenue or lower spending (or a combination of the two) to close the gap. The extent of the imbalance is called the intertemporal budget gap (IBG), and is based on equation (1):

$$D - \sum_{s=t}^T PB_s (1+r)^{-s+t} \quad (3)$$

where PB_s is the primary balance (revenue R_s less spending S_s) in year s . The key difference between equations (1) and (3) is that the former has an infinite time horizon, while the latter has a finite horizon T by which debt has to be eliminated.

Generational accounting provides a strict measure of sustainability

4.12 The generational accounts provide a too strict measure of long-term fiscal sustainability in that it requires the complete elimination of debt at the end of the chosen time horizon T . For example, Balassonne and Franco have argued that: “...the main problem specific to generational accounting is the upward bias its methodology induces in the assessment of the effort needed to ensure solvency. Given the existence of debt, the imposition of an intertemporal budget constraint implies it will have to be repaid”⁷. However, fiscal sustainability does not require zero debt. The UK Government’s sustainable investment rule requires public sector net debt to remain below 40 per cent of GDP over the economic cycle. Nonetheless, the IBG is useful as a measure to make international comparisons.

4.13 The generational accounting technique calculates the immediate and permanent change in the primary balance that is needed so that the IBG will equal zero for a finite time horizon. The differences between the fiscal gap and generational accounts measures are examined further in the Technical Annex.

4.14 Based on information on demographic developments, generational accounting calculates the effects of a given policy on the revenue and spending of current, as well as future, generations. Using assumptions for the discount rate and the time horizon, the IBG is then calculated using equation (3) above. The IBG can be used to assess the long-term sustainability of the public finances. In this Report the time horizon T is set to 100 years.

⁶ See *The Long-Term Budget Outlook*, Congressional Budget Office, in *Long-term Budgetary Pressures and Policy Options*, 1998 and *The Long-Term Budget Outlook: an Update*, Congressional Budget Office, 1999, and *Long-term fiscal projections and their relationship with the intertemporal budget constraint: an application to New Zealand*, John Janssen, 2002.

⁷ Another related measure is the “tax gap” which calculates the difference between the current tax rate and the tax rate that should prevail so that the debt to GDP ratio remains unchanged over the relevant time horizon. For further details see *The sustainability of fiscal policy: new answers to an old question*, Olivier Blanchard et al, in *OECD Economic Studies*, 1999.

⁸ See *Assessing fiscal sustainability: a review of methods with a view to EMU*, Fabrizio Balassonne and Daniele Franco, in *Paper and Proceedings*, Bank of Italy, 2000.

4.15 To get a feel for the relative magnitude of the imbalance (if any), the intertemporal budget gap is often expressed either as a percentage of GDP or in terms of a specific revenue item. The latter interpretation is that to restore balance the revenue item would have to be raised (or lowered if there is a negative gap) by a certain percentage today, and a proportionate increase (decrease) to be carried forward into the future.

4.16 The concept of the intertemporal budget gap can be illustrated using a simple example, as set out below.

The intertemporal budget gap: a simple example

4.17 Table 4.1 provides a simple illustration of the intertemporal budget gap. Consider a country that has only two spending and two revenue items. In the past it has accumulated debt of 5 units. In the first and second year (which could be called the short to medium term) the country runs a balanced budget, but total spending is assumed to exceed total revenue in years 3 to 6 (the long term). For the illustration, it does not matter why real spending increases more rapidly than revenue in the long term. This could be, for example, due to higher health spending as the population ages.

4.18 Looking only at the budget balance in years 1 and 2 it could be concluded that the country's public finances are sustainable. However, looking further ahead the country faces a substantial fiscal imbalance, with the sum of discounted revenue over the 6 years being lower than the sum of discounted spending.

Table 4.1: Illustrative example of revenue and spending projections

<i>(In real terms)</i>							
Year	1	2	3	4	5	6	Total
Revenue							
Item 1	7.0	8.0	8.0	8.0	8.0	9.0	
Item 2	7.0	9.0	9.0	10.0	12.0	14.0	
Spending							
Item 1	10.0	12.0	13.0	15.0	15.0	17.0	
Item 2	4.0	5.0	6.0	6.0	8.0	9.0	
Budget Balance	0.0	0.0	-2.0	-3.0	-3.0	-3.0	
<i>(In present discounted value terms, with discount rate of 3 per cent)</i>							
Revenue							
Item 1	7.0	7.8	7.5	7.3	7.1	7.8	44.5
Item 2	7.0	8.7	8.5	9.2	10.7	12.1	56.1
Spending							
Item 1	10.0	11.7	12.3	13.7	13.3	14.7	75.6
Item 2	4.0	4.9	5.7	5.5	7.1	7.8	34.9
Total present value of net transfers							-9.9
Outstanding Assets/Debt							-5.0
Intertemporal Budget Imbalance							-14.9
To restore Intertemporal Budget Balance							
In terms of Revenue Item 1 (per cent)							33.5
In terms of Revenue Item 2 (per cent)							26.6

4.19 This is illustrated in the present discounted values. Assuming a discount rate of 3 per cent, the total present value of net transfers is –9.9 units. Adding outstanding debt yields an intertemporal budget imbalance of –14.9 units. To restore intertemporal balance total discounted revenue would therefore have to rise by 14.9 units or spending to fall by the same amount. For example Revenue Item 1 would have to be raised by the factor $(44.5 + 14.9)/44.5$ (in other words $33\frac{1}{2}$ per cent) in every year to close the gap. This percentage is known as the intertemporal budget gap⁹.

4.20 To verify that raising Revenue Item 1 by around a third in every year will establish intertemporal balance, it is possible to rerun the above example with the higher values for Revenue Item 1. This is shown in Table 4.2. Revenue Item 2 and the spending items remain the same as in Table 4.1. If revenue is increased by the percentage stated in the intertemporal budget gap, the budget is balanced over time, or intertemporal budget balance is restored¹⁰.

Table 4.2: Illustrative example of revenue and spending projections with increased revenue

(In real terms, with Revenue Item 1 increased by $33\frac{1}{2}$ per cent)

Year	1	2	3	4	5	6	Total
Revenue							
Item 1	9.3	10.7	10.7	10.7	10.7	12.0	
Budget Balance	2.3	2.7	0.7	–0.3	–0.3	0.0	
<i>(In present discount value terms, with discount rate of 3 per cent)</i>							
Revenue							
Item 1	9.3	10.4	10.1	9.8	9.5	10.4	59.4
Total present value of net transfers							5.0
Outstanding Assets/Debt							–5.0
Intertemporal Budget Imbalance							0.0

**Inter-
generational
balance**

4.21 In addition, generational accounting provides a measure of the degree to which current fiscal policies favour a particular generation. For the UK, it therefore provides an indicator of how far the Government is achieving its fiscal policy objective of ensuring that spending and taxation impact fairly between generations (paragraph 2.5). For example, if current policy means that present revenue levels are insufficient to cover present spending, taxes will have to be raised in the future. This policy would disadvantage future generations and favour current generations.

4.22 The inter-generational balance gap (IGG) gives the amount by which current taxes have to rise (or fall), or spending has to fall (or rise), so that a current newborn and a future newborn are equally well off. The comparison is made with current newborns, rather than all past newborns (existing generations), since although the current Government can affect the lifetime tax burden for current and future newborns, it can only partially affect the lifetime tax burden for existing generations. This is because existing generations have already faced past tax regimes, set by previous governments. An illustrative example is given in Box 4.1 with the technical details for the calculation of the IGG examined in the Technical Annex.

⁹ The required increase of Revenue Item 1 could also be expressed in terms of GDP (not presented in this example). This is the presentation chosen in this Report in Chapter 6.

¹⁰ The example of the intertemporal budget gaps does not take into account any feedbacks between taxation, expenditure and growth. This feedback effect is likely to be small with small changes in taxes and expenditure.

Box 4.1: An illustrative example of generational fairness

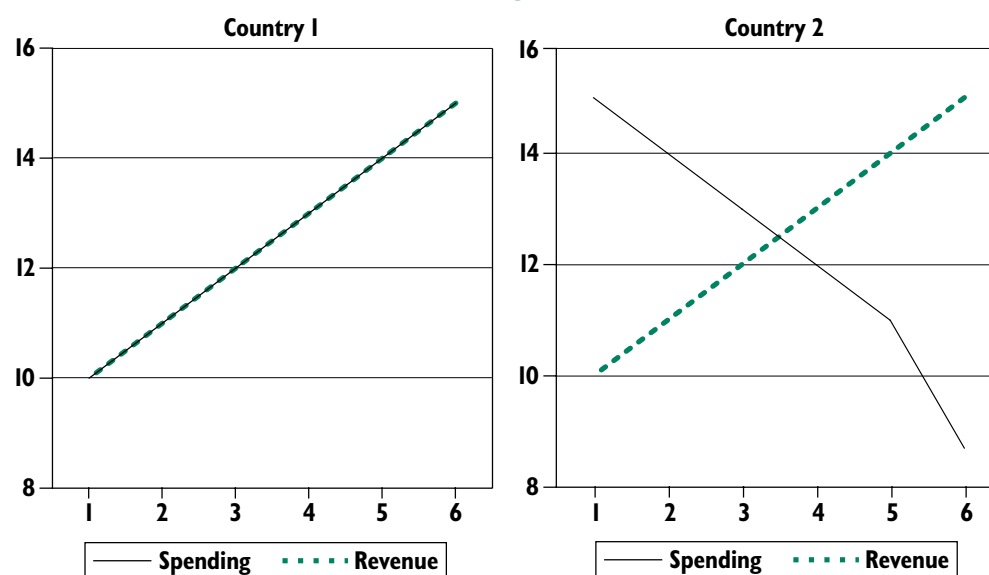
The example in this box illustrates how one might think about inter-generational fairness. The precise measure of inter-generational fairness is not illustrated in Table 4.3 but is discussed in the Technical Annex. Consider two countries, 1 and 2. Both countries have an intertemporal budget gap (IBG) of zero, in other words the present discounted value of all future spending equals that of all future revenue (assume no net assets in period 1). However, while both countries have the same profile of future revenue, the profile of the spending streams is different.

Table 4.3: An example of generational fairness

Year	1	2	3	4	5	6	Total ¹
Country 1							
Revenue	10	11	12	13	14	15	69.3
Spending	10	11	12	13	14	15	69.3
Country 2							
Revenue	10	11	12	13	14	15	69.3
Spending	15	14	13	12	11	8.7	69.3

¹ Total of present discounted values, using a discount rate of 3 per cent.

While in Country 1 spending rises in line with revenue (and hence every generation pays exactly for its own spending), in Country 2 the current generations (those in years 1, 2 and 3) spend considerably more than they raise in revenue. By contrast, future generations spend less than they raise in revenue. Current policy is therefore generationally neutral in Country 1 but not in Country 2, where current policy disadvantages future generations who have to pay off the debts built up by their predecessors. Chart 4.1 illustrates the example.

Chart 4.1: An illustration of inter-generational fairness

Main strength of generational accounts 4.23 The main strength of generational accounts, which are generally based on national accounts classifications, is that they provide a comprehensive and comparable picture of the long-term sustainability of the public finances. In addition, generational accounts provide indicators that can be used alongside more established indicators of sustainability such as the budget balance and the debt to GDP ratio.

Main weaknesses 4.24 There are also a number of drawbacks of the generational accounts methodology. First, due to their degree of aggregation, the generational accounts indicators do not reveal where the imbalance (if any) might arise. However, this information can be derived using the projections incorporated in the generational accounts. Second, as stated above, the indicators are too strict when translated into a finite time horizon. They require that all debt is paid in full at the end of the period T . In practice, fiscal sustainability does not equate to zero debt. Third, generational accounts cannot distinguish between current consumption (which benefits current generations) and investment (which benefits current and future generations). This is discussed in Box 4.2. This could lead to a distorted view of the degree of inter-generational fairness. In the Technical Annex the illustrative example of inter-generational fairness presented in Box 4.1 is extended to show the importance of distinguishing between current consumption and investment. Further, Buiters has argued that the IGG is not a particularly useful indicator of the inter-generational distribution of resources¹¹.

Box 4.2: Generational accounts and the treatment of investment

As generational accounting does not distinguish between current consumption (which benefits current generations) and investment and the assets it creates (which benefit current and future generations) on the spending side, this needs to be taken into account when interpreting the results¹. This distinction is particularly important in the UK for two reasons:

- **The Government has the explicit target to raise public sector net investment to 2 per cent of GDP by 2005-06 to address the historic under-investment in public infrastructure.**
- **Public sector net investment can play an important role in raising the UK's potential long-term growth rate.**

The importance of the distinction between current consumption and investment is reflected in the Government's two fiscal rules, the golden rule and the sustainable investment rule (see paragraph 2.7).

In interpreting the results in this Report on the intertemporal budget gap and inter-generational balance gap, it is therefore important to keep in mind that the results may give too unfavourable impression of the position of future generations. Regarding the intertemporal balance, public sector investment may have a positive effect on long-term economic growth, making it easier for the government to finance future spending plans. Even if this is not the case and there is no effect on the intertemporal balance, the inter-generational balance is biased by not distinguishing between current consumption and investment. Other things equal, an inter-generational imbalance that favours current generations will overstate the degree of imbalance.

¹ See *Should generational accounts replace budget deficits?* Robert Haveman, *Journal of Economic Perspectives*, 1994 for further details.

¹¹ See *Generational accounts, aggregate saving and intergenerational distribution*, Willem H. Buiters, *Economica*, 1997 for further details. For example, Buiters also argues that the generational accounts are only useful if the strict life-cycle model of household consumption holds. A further drawback is that the generational accounts do not handle general equilibrium repercussions.

4.25 For these reasons, and because the IGG proves to be very sensitive to small changes in the underlying assumptions, this Report does not put much weight on this indicator. In addition, there are alternative ways to think about inter-generational fairness. The Government's golden rule and sustainable investment rule are just two (interlinked) examples.

Generational accounts and public policy

4.26 Generational accounting was developed in the mid 1980s to early 1990s as a more comprehensive public finance indicator than existing measures such as the budget balance and the debt to GDP ratio¹². The technique of generational accounting has been used by a number of countries and international organisations to inform public policy decisions. International organisations have included the International Monetary Fund (IMF), Organisation for Economic Co-operation and Development (OECD), European Commission and the World Bank. In addition, the Congressional Budget Office and the Office of Management and Budget in the U.S., the New Zealand Treasury, the Norwegian Ministry of Finance, and the Bank of Japan have used generational accounts in their analysis. A study by the National Bureau of Economic Research (NBER) in 1999 published generational accounts for 17 countries¹³.

NIESR 4.27 The first set of generational accounts for the UK was published in 1998. These were produced by the National Institute of Economic and Social Research (NIESR) with partial funding from HM Treasury. The accounts were then updated by NIESR prior to Budget 2002. Both sets of accounts suggest that the UK's public finances are broadly sustainable in the long term and that any generational imbalance is relatively modest when compared with other leading developed countries¹⁵.

Bottom-up approach

4.28 The bottom-up approach is a popular technique that has been used to project the path of individual revenue and spending items as a share of GDP into the future. Like generational accounts, bottom-up projections can be constructed using demographic developments, cost and demand drivers, and investment requirements. These projections can then be used to identify future fiscal pressures, and various "what if" scenarios can be simulated.

4.29 Unlike generational accounts, bottom-up projections are not generally used to examine whether the intertemporal budget constraint is satisfied. This is because bottom-up projections often do not consider all spending and revenue items, instead focusing on a smaller number of items, and are for a shorter time horizon than generational accounts.

Main strength of bottom-up approach

4.30 Bottom-up projections are nevertheless valuable in showing how different spending and revenue items might evolve over time, either in absolute terms or relative to GDP. In doing this, the projected primary balance, or the "fiscal pressure" over the long term can be examined. Countries such as Australia have used this technique¹⁴ in evaluating the outlook for the long term. The change in projected expenditure on the programmes studied can provide an indication of what might need to happen to spending or taxation to reduce or even eliminate any existing fiscal imbalance. In addition, bottom-up projections are a useful input

¹² *Generational accounts: a meaningful alternative to deficit accounting*, Alan Auerbach, Jagadeesh Gokhale, and Laurence J. Kotlikoff, in *Tax Policy and the Economy*, edited by David Bradford, 1991.

¹³ *Generational Accounting Around the World*, edited by Alan Auerbach, Laurence Kotlikoff and Willi Leibfritz, 1999.

¹⁴ *Generational accounting in the UK*, Roberto Cardarelli, James Sefton, and Laurence J. Kotlikoff, NIESR, 1998 and NIESR press release 15 April 2002.

¹⁵ *Intergenerational Report 2002-03*, Commonwealth of Australia, May 2002.

in calculating sustainability measures such as the tax gap, or fiscal gap¹⁶. As such the bottom-up approach is well-suited to alert policy makers to potential future spending pressures (or revenue shortfalls) and as such provides useful insights into the long-term sustainability of the public finances.

CONCLUSIONS

4.3I In addition to the top-down approach used in the illustrative long-term fiscal projections presented in Annex A of the EFSR, this chapter presented the various other approaches used in this Report to assess the long-term sustainability of the public finances. The main characteristics of these are given below:

Fiscal gaps:

- show by how much the primary balance needs to be raised or lowered as a percentage of GDP to achieve a pre-determined debt to GDP ratio at some specific point in the future;
- can be derived using underlying cost and demand drivers, and demographic projections;
- have as key variables the primary balance and the debt to GDP ratio at the initial point and the debt to GDP target at some specific point in the future; and
- are widely used to analyse long-term sustainability of the public finances.

Generational Accounts:

- show whether the government balances its budget over time, and whether current policies are inter-generationally fair;
- are mainly derived from demographic projections and cohort-related revenue and spending profiles;
- do not model debt interest payments explicitly, (in other words focus on the primary balance) and hence do not project the debt to GDP ratio;
- have as key variables the intertemporal budget gap and inter-generational balance gap;
- provide, in the form of the intertemporal budget gap, a strict measure of long-term sustainability in that they require the elimination of debt within a finite time horizon;
- present a potentially misleading picture of inter-generational fairness as they do not distinguish between current consumption and investment in their present form; and
- have been applied mostly by academic researchers to date.

¹⁶ The Technical Annex provides further details.

Bottom-up projections:

- show the evolution of individual spending and revenue items over the long term;
- can be derived from underlying cost and demand drivers, and demographic projections, but are often less detailed than generational accounts;
- have as key variables spending and revenue items as percentages of GDP;
- have been widely used, including by governments, to examine long-term spending pressures; and
- provide another indicator of long-term sustainability by providing information on the evolution of total spending as a share of GDP.

INTRODUCTION

5.1 This chapter presents and discusses the main underlying assumptions used in this Report.

ASSUMPTIONS

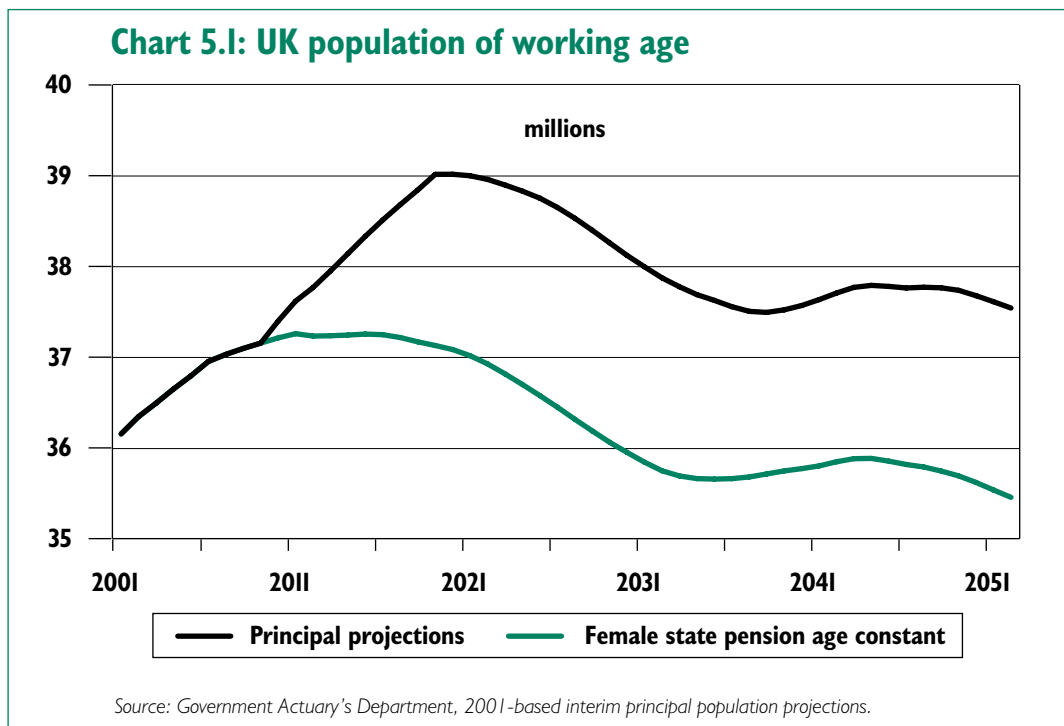
Demography

2001-based interim population projections are used

5.2 As discussed in Chapter 3, one of the main trends in the coming decades will be the changing structure of the UK population, in particular the ageing of the 1960s baby-boom generation. The projections in this Report are based on the Government Actuary's Department's 2001-based interim UK population projections¹.

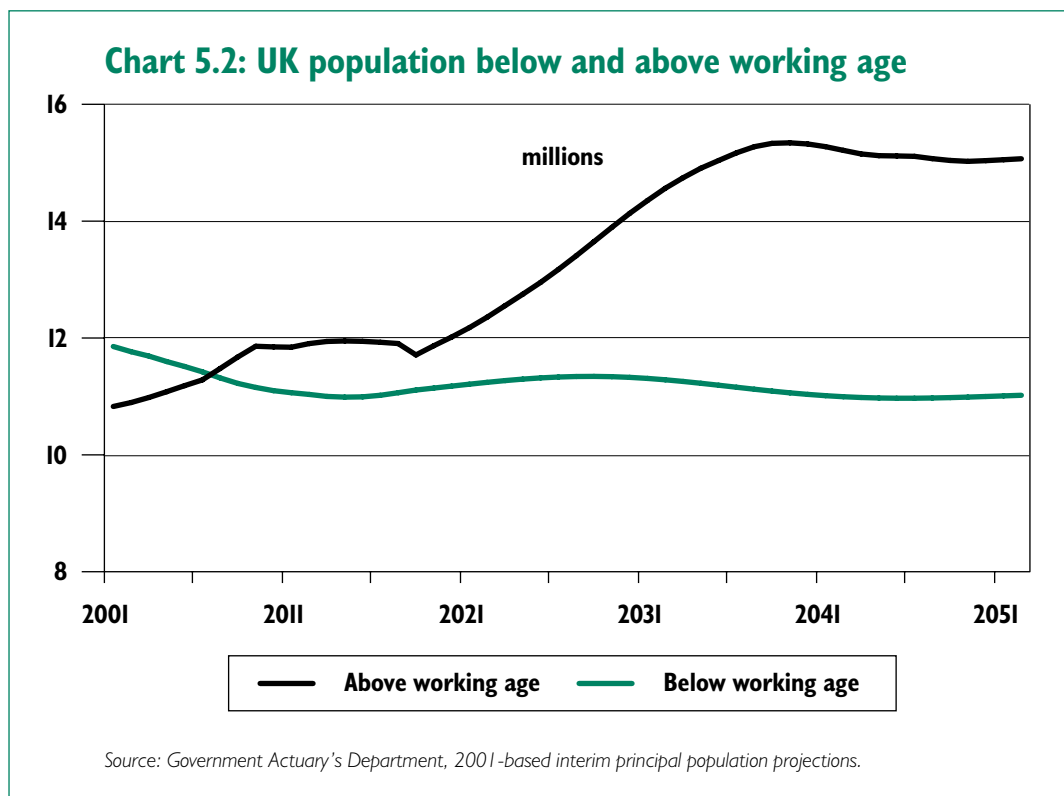
5.3 Chart 5.1 shows the likely evolution of the number of people of working age over the coming decades. A statistical concept of working age is used in that it includes all males between 16 and 65 years and all females between 16 and 60 years (rising to 65 years by 2020). The continued rise between 2010-11 and 2020-21 is entirely due to the increase of the female state pension age from 60 years in 2010 to 65 years by 2020. The number of people of working age will reach its peak in 2021-22 at around 39 million. Once this policy-induced change ends, working-age population is projected to decrease until the mid 2030s, before stabilising around 37½ million thereafter.

5.4 For illustrative purposes Chart 5.1 also shows how the working-age population would most likely evolve if the female state pension age were to remain constant at 60 years in the decades ahead. As can be seen the working-age population would increase to around 37.3 million in 2012-13, remain stable until 2021-22 and then fall until 2031-32. After that it would remain relatively stable at below 36 million.



¹ http://www.gad.gov.uk/Population_Projections/Population_projections_background.htm.

5.5 Chart 5.2 shows the evolution of the number of people above and below working age over the same time horizon. As can be seen the number of people above working age is expected to rise from around 10.8 million in 2001 to nearly 12 million within a decade and then remain stable until around 2020-21. The relative stability over that decade is due to the fact that the state pension age for females rises from 60 to 65 years between 2010 and 2020. This gradual reclassification of females aged between 60 and 65 years from being “above working age” to “of working age” offsets the underlying ageing process. The real magnitude of the ageing process becomes apparent only after 2020 when the policy-induced dampening effect ceases. The number of people above working age is set to rise to 15.3 million by 2040. By contrast, the number of people aged between 0 and 15 years is projected to decline by nearly 1 million from 11.9 million in 2001 to 11 million by 2015-16 and then to fluctuate around that level.



Labour-market assumptions

5.6 The Report requires assumptions on the labour-market participation rates and the unemployment rate. These are needed for a number of reasons:

- social transfers such as unemployment benefits are a function of unemployment rates;
- future public pension expenditure depends on entitlements². For example, the gradual rise in the female participation rate will, everything else equal, lead to higher pension spending in the future as these women enter retirement age; and

² To be entitled to the full basic state pension, individuals must have reached state retirement age, 65 years for males and 60 years for females (the latter will be raised to 65 years between 2010 and 2020). In addition, individuals are generally required to have paid, and/or have been credited as having paid, National Insurance Contributions for about 90 per cent of their working life in order to receive the full basic State Pension.

- assumptions on working-age population, and labour-market participation and unemployment rates (and hence the employment rate) are needed to derive employment levels. These in turn are necessary (alongside productivity assumptions, see below) to derive future GDP levels.

Employment rate is held constant 5.7 For simplicity it is assumed that the overall employment rate remains unchanged from 2007-08 onwards, the end of the medium-term forecast period. Up to 2007-08, the projections are consistent with the medium-term projections in the *2002 Pre-Budget Report*³. This means that changes in employment levels are entirely due to changes in the working-age population.

5.8 The above assumption ignores the potential effect of the increase of the state pension age for females from 60 to 65 years between 2010 and 2020 on the employment rate of the working-age population. This is because it is difficult to predict the participation rate of females aged between 60 and 65 years in the future. Under the reasonable assumption that the participation rate of females aged 60 to 65 years will be similar to that of females aged 55 to 59 years, the employment rate of the working-age population might be expected to fall. However, as older females present only a small fraction of the working-age population, the impact is likely to be small.

5.9 Focusing only on the working-age population, the above assumption also ignores any potential future trends in the number of people employed above state pension age. With life expectancy continuing to rise and the number of years that can be enjoyed in good health likely to increase as well, it is possible that the number of older people that work beyond state pension age will rise. This potential positive effect on employment growth is excluded from the projections.

Productivity

5.10 The productivity growth assumption used in the baseline scenario is 2 per cent per year. This is the average long-term productivity growth rate for the UK since the mid 1950s. It is also the neutral productivity assumption used in the Government's medium-term forecast as derived and discussed in the Budget 2002 publication on trend growth⁴.

5.11 However, lower and higher productivity growth assumptions of 1³/₄ per cent and 2¹/₄ per cent per year respectively are also used to provide some sensitivity analysis. Annex A of the Economic and Fiscal Strategy Report (EFSR) stresses that the lower productivity growth assumption is cautious. The higher productivity growth assumption is included as there is some potential upward pressure to productivity growth in the medium term⁵.

Gross Domestic Product (GDP)

5.12 Given assumptions regarding employment and productivity growth, it is possible to derive projected GDP growth beyond the end of the medium-term forecast period. Table 5.1 shows average real GDP growth in the coming decades for the baseline scenario.

³ *2002 Pre-Budget Report*, HM Treasury, November 2002.

⁴ *Trend Growth: Recent Developments and Prospects*, HM Treasury, April 2002.

⁵ *Trend Growth: Recent Developments and Prospects*, HM Treasury, April 2002.

Table 5.1: Real GDP growth and its components in the baseline scenario (per cent)¹

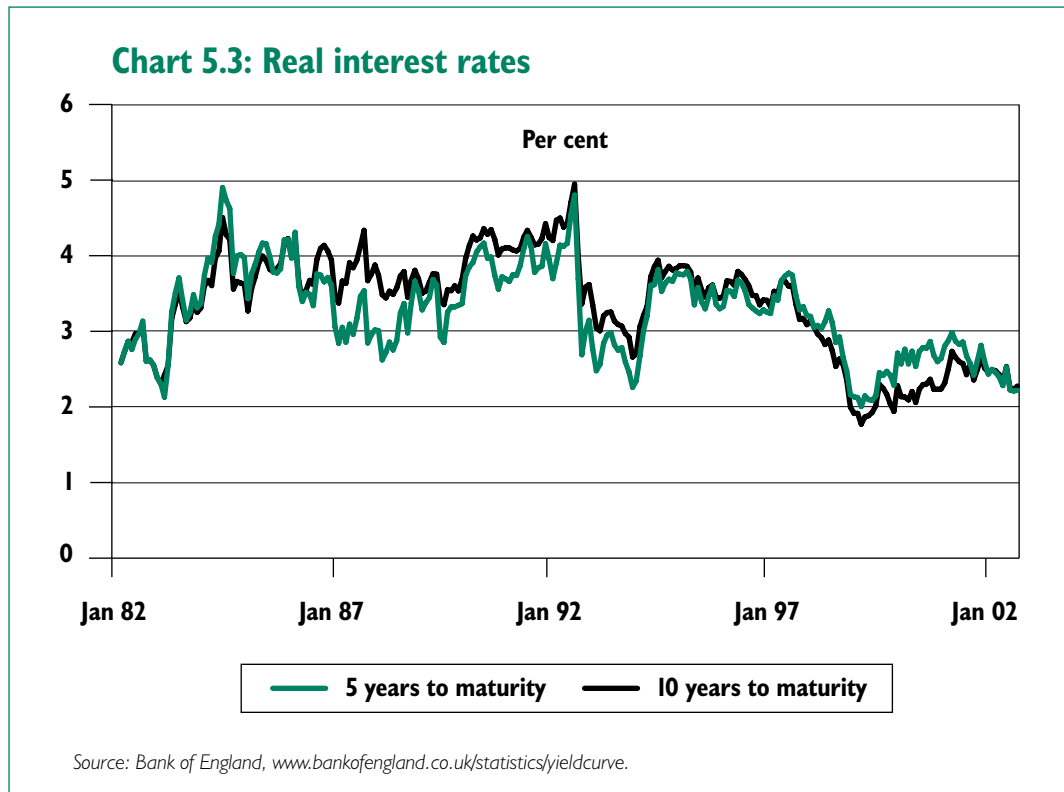
Year	2011-12	2021-22	2031-32	2041-42	2051-52
	to 2020-21	to 2030-31	to 2040-41	to 2050-51	to 2060-61
Productivity	2	2	2	2	2
Employment	1/4	-1/4	0	0	-1/4
Real GDP	2 1/4	1 3/4	2	2	1 3/4

¹Productivity growth per year of 1 3/4 per cent and 2 1/4 per cent is assumed in the two alternative scenarios.

Discount/ debt interest rate

5.13 The fiscal gap and generational accounts approaches described in Chapter 4 require a discount/debt interest rate assumption. Everything else equal, a higher discount rate means less importance is attached to distant future developments relative to the present and the near future. The discount rate therefore represents the social time preference rate, in other words the rate that reflects the value society places on consumption of goods and services now, compared with consumption in the future.

5.14 A discount rate can be derived from data on long-term real interest rates based on index-linked gilts. As Chart 5.3 shows, real interest rates have varied between 2 per cent and 5 per cent since 1982, and have remained between 2 per cent and 3 per cent since 1997, averaging less than 2 1/2 per cent since 2000. The Report presents results based on discount rate assumptions of 2 1/2 per cent, 3 per cent and 3 1/2 per cent⁶.



⁶ Cardarelli et al. assume discount rates of 3, 5 (as their central case) and 7 per cent. See *Generational accounting in the UK*, Roberto Cardarelli, James Sefton, and Laurence J. Kotlikoff, *Economic Journal*, 2000.

5.15 The discount rate assumptions are in line with the recommendations of the Green Book⁷. The Green Book is a best practice guide for all central government departments and executive agencies on the process of project appraisal and evaluation. The Green Book recommends a discount rate of 3½ per cent but also states that there are a number of circumstances (for example, when the impacts occur over the long term, as in these calculations of long-term fiscal sustainability) in which a lower discount rate may be appropriate.

Spending and revenue assumptions

Current policies are assumed

5.16 The long-term projections are based on the assumption of current policy; in other words, it is assumed that the Government will leave current policy unchanged in the future. This should not be interpreted as meaning that policy will *not* change over time, but it is used so that the long-term projections do not prejudice future Government policy. This assumption is frequently used in long-term projections; for example, in the illustrative long-term fiscal projections in Annex A of the EFSR and by the European Union's Economic Policy Committee⁸.

5.17 Current policy has been interpreted as all policy already in place or announced in this year's *Pre-Budget Report*. As such, spending and revenue forecasts up to 2007-08 are included, using the departmental breakdown as presented in the *2002 Spending Review* as a reference on the spending side⁹. For 2006-07 and 2007-08 stylised assumptions regarding growth of education and other spending apart from health are made. Current policy thereafter refers to the level of per-capita revenue and spending in 2007-08 rather than the real growth rate.

Revenue and spending items have specific age profiles

5.18 The spending and revenue projections are based on separate spending and revenue profiles for males and females. These profiles have been calculated by the National Institute of Economic and Social Research (NIESR), and used before in the context of generational accounts for the UK, derived from household or individual micro-data¹⁰. The same profiles are used to derive bottom-up projections of key spending programmes.

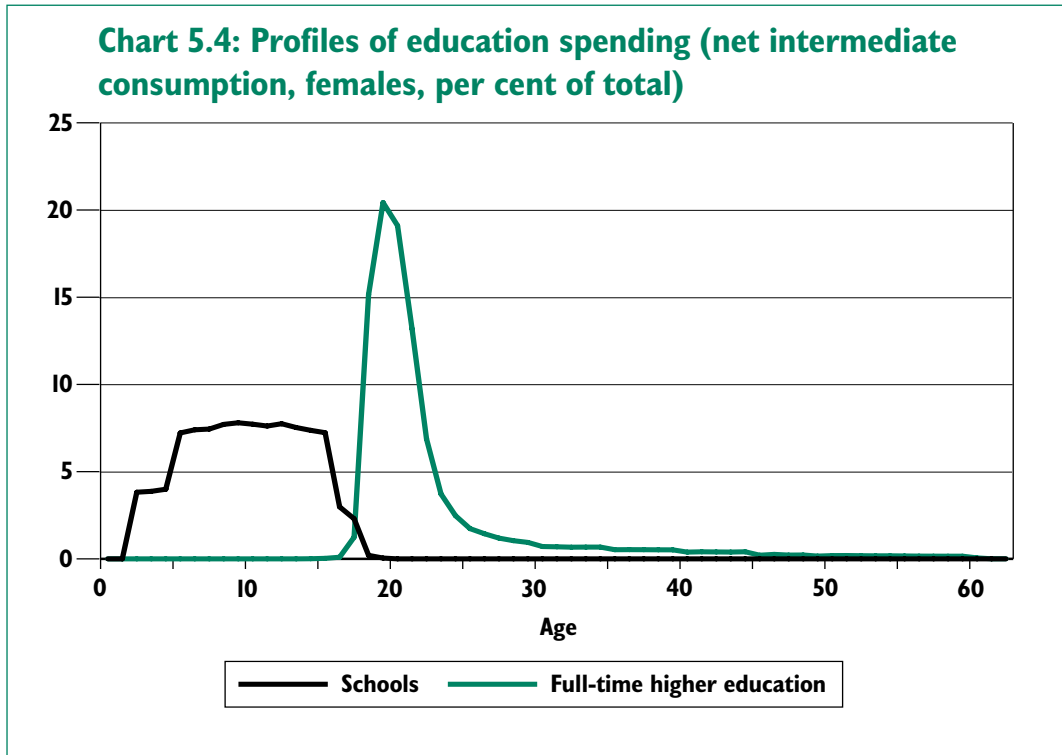
5.19 The profiles show the distribution of total spending and total revenue across age cohorts, and vary according to sex. The age aspect of the profiles allows the inter-generational aspects of the public finances to be examined. The profiles are best explained with the help of illustrative examples. The first example is given in Chart 5.4 which shows how education spending for females on schools and full-time higher education is allocated across the different age groups.

⁷ *The Green Book Draft under consultation Annex 7*, HM Treasury, July 2002.

⁸ *Budgetary Challenges Posed by Ageing Populations*, EPC Working Group on Ageing, October 2001.

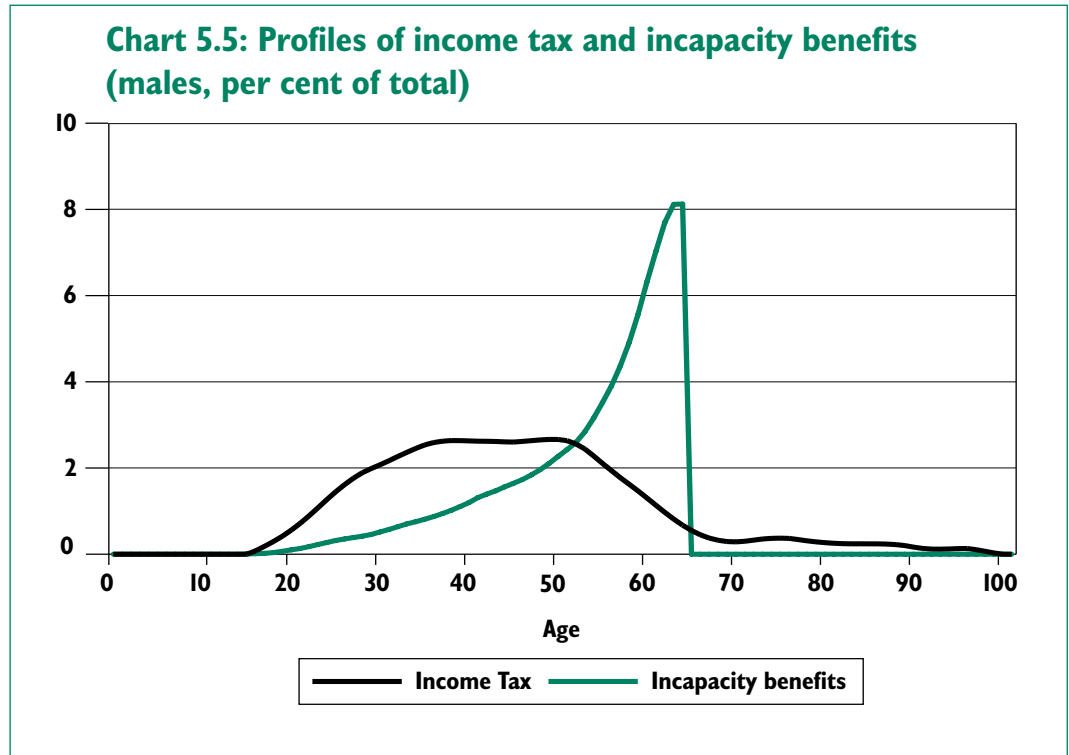
⁹ *2002 Spending Review: Opportunity and security for all: investing in an enterprising fairer Britain*, HM Treasury, July 2002.

¹⁰ For more details on how the specific profiles have been derived see *Generational accounting in the UK*, Roberto Cardarelli, James Sefton, and Laurence J. Kotlikoff, *Economic Journal*, 2000. The profiles presented here are updated versions of those available at <http://www.ms.ic.ac.uk/sefton>.



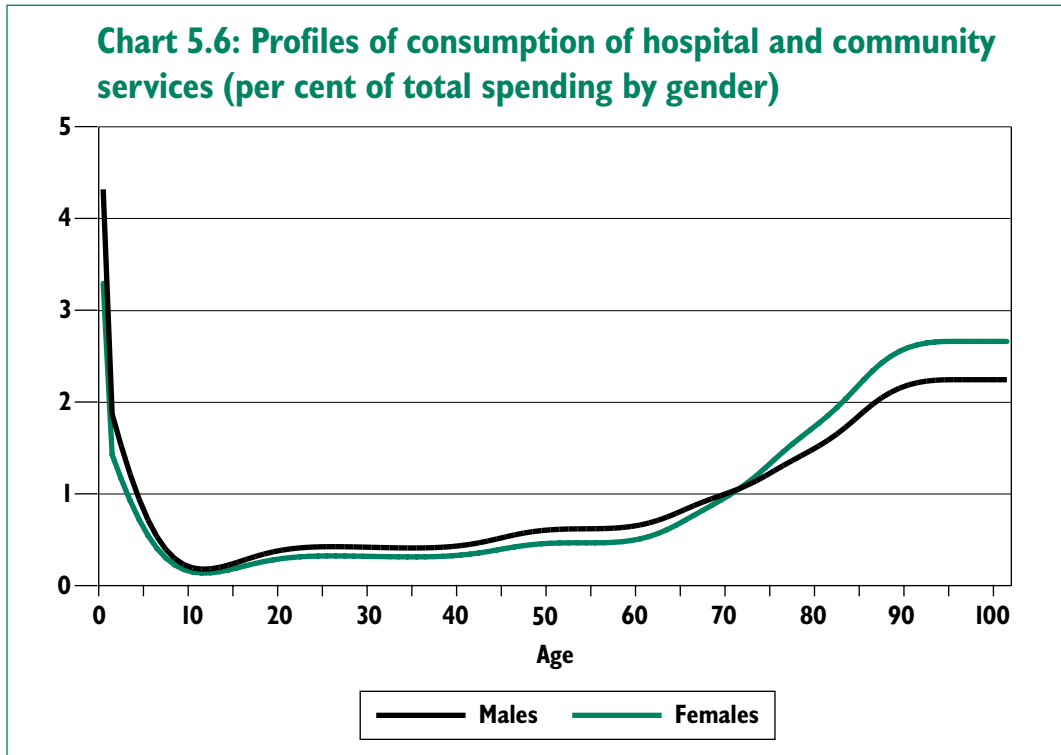
5.20 As expected, most of the spending on schools occurs on those between the ages of five and 16, with females in each cohort within this age band receiving around 8 per cent of total spending on schools (on females). Spending on higher education is concentrated on a higher age group than spending on schools and is allocated over fewer years. This reflects the fact that higher education degrees generally take between three and four years. It can be seen from the chart that females aged 20 receive around a fifth of total higher education spending (on females). The age cohorts of 30 years and over receive relatively small shares of higher education spending as only few women of those ages are in full-time higher education.

5.21 The second example considers income tax and incapacity benefits for males. As can be seen from Chart 5.5, males aged 17 years or less do not contribute to the Government's overall income tax revenue, and males of 65 years and older only contribute a small proportion. The former observation is explained by the fact that younger males are generally in education and do not earn income on which they have to pay income tax. The second observation is explained by the fact that males reach retirement age at 65 years, with labour-market participation rates falling rapidly from then on. Males between 30 years and 50 years contribute the most to overall income tax revenue. The gradual decline between 50 and 65 years is due to the fact that labour-market participation rates for males of these age groups fall.



5.22 The distribution of incapacity benefits across the age cohorts reflects to a large extent increasing incapacity with age. Older males leave the labour force, many of whom claim an incapacity benefit. An average male aged 64 receives 8 per cent of the total incapacity benefits paid out to males. The drop at 65 years to zero is due to the fact that males reach the state pension age at 65 years and move from receiving an incapacity benefit to receiving the basic state pension.

5.23 Chart 5.6 shows the consumption of hospital and community health services for males and females. This example illustrates the different profiles for males and females related to their different life expectancies. In the case of males around 4½ per cent of total hospital and community health services spending (on males) is spent on births. The respective share for females is slightly lower at 3½ per cent. This is not because the average birth is more costly for males than for females, but because females have a higher life expectancy than males (and the absolute number of females therefore exceeds that of males at higher ages) so that older female cohorts absorb a larger share of total health spending on females than male cohorts of total health spending on males. For example, males aged 90 consume around 2 per cent of total health spending on males. For females this share is around 2½ per cent. This means that there are relatively (but not necessarily absolutely) fewer resources available for females of young to middle age compared with males.



Deriving per capita contributions and allocations

5.24 With these profiles it is possible to derive the per capita contribution or allocation as a share of total revenue or total spending on the different revenue and spending items (as taken from the *2002 Pre-Budget Report*), and to transform this into money terms.

5.25 For this, information is required on the number of males and females in every cohort, and the total money amount for the revenue or spending item. Take the case of income tax presented above. In 2001-02 income tax amounted to around £108 billion. Around three-quarters of this was paid by males. Income tax paid by males was therefore around £80 billion. As can be seen from Chart 5.5, males aged between 30 years and 50 years paid most of the income tax paid by males, with every cohort contributing around 2½ per cent of income tax paid by males. This means that males aged 40 years, for example, paid around £2 billion in income tax. GAD's 2001-based interim population projections show that there were roughly 450,000 males aged 40 in 2001. This means that every male aged 40 paid – on average – roughly £4,500 of income tax in 2001.

5.26 The generational accounts method calculates per capita contributions and allocations for all of the different spending and revenue items, using the spending and revenue profiles and information on total spending and revenue from HM Treasury's medium-term forecasts. Where appropriate, the generational accounts raise the per capita contributions and allocations in line with productivity gains over the projection horizon. These per capita contributions are then combined with detailed population projections (as for example illustrated by Chart 5.2) to generate spending and revenue projections. These projections can then be used to calculate the indicators discussed in Chapter 4.

Exceptions 5.27 However, there are a number of spending and revenue items that will be affected not only by demographic changes in the future, but also the long-term consequences of current policies and other factors. The basic state pension is one example, with rising female participation rates, everything else equal, leading to higher pension spending in the future. Just taking account of the demographic effects would not pick up these developments. Social security spending is most affected by these other factors and has therefore been projected separately by the Department for Work and Pensions, and the Government Actuary's Department. Their social security projections feed straight into the projections used here.

5.28 The second exception is that of long-term care spending. As argued in Chapter 3 (paragraphs 3.17 and 3.18), compression of morbidity is likely to dampen the impact of ageing on long-term care expenditure. This Report assumes that long-term care spending remains constant as a share of GDP from 2007-08 onwards (Chapter 6, Chart 6.8). Although a compression of morbidity effect might also be expected to moderate health spending, no assumption for this is allowed for in these projections, in part because this issue is less well-researched.

CONCLUSIONS

5.29 This chapter presented the assumptions used in the Report's assessment of long-term fiscal sustainability. They are for:

- **demography:** GAD's 2001-based interim principal population projections for the UK;
- **employment:** the employment rate is held constant after the medium-term forecast;
- **productivity:** 2 per cent per year as the baseline case, with $1\frac{3}{4}$ per cent per year and $2\frac{1}{4}$ per cent per year as alternative scenarios;
- **GDP:** assumed to grow in line with projected employment and productivity growth rates;
- **discount rate:** assumed to be $2\frac{1}{2}$ per cent, 3 per cent and $3\frac{1}{2}$ per cent; and
- **spending and revenue:** are consistent with HM Treasury's medium-term forecast and are assumed to follow the age profiles calculated by the NIESR unless explicitly stated otherwise.

INTRODUCTION

6.1 This chapter presents the results of the *Long-Term Public Finance Report*. Following the different approaches outlined in Chapter 4 the results are presented in terms of: bottom-up projections; updated illustrative long-term fiscal projections as in Annex A of the Economic and Fiscal Strategy Report (EFSR); fiscal gaps; and generational accounting. The bottom-up projections highlight spending on education, pensions, and health and long-term care, which account for around half of total public spending.

6.2 The results illustrate the impact of making different assumptions about productivity growth and discount/interest rates. Limitations of the projections are also discussed, including the treatment of government investment, the likely positive impact of funded pensions on projected tax receipts, and the possibility of a moderating effect on health spending arising from a compression of morbidity¹.

6.3 Finally the results are compared with those of other long-term studies in the UK and other developed countries.

6.4 The analysis in this Report assumes, for modelling purposes, that taxation and spending policies at the end of the medium-term forecast are continued into the future. This does not mean that changes to future Budgets are fixed. Instead, changes are dependent on the results of future spending reviews.

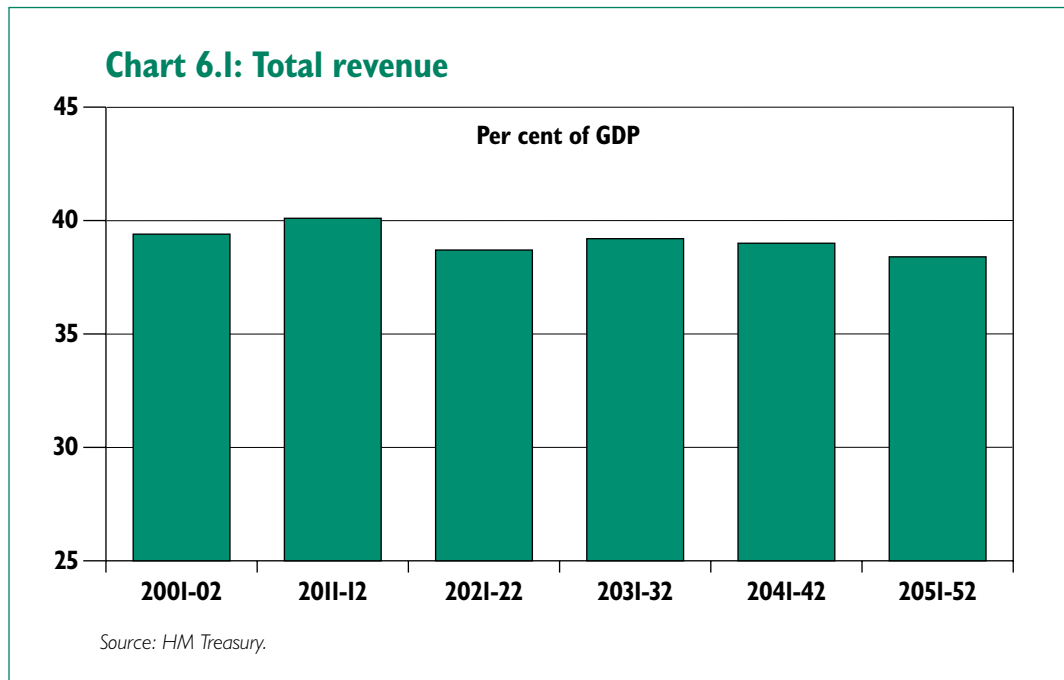
ANALYSIS OF REVENUES AND SPENDING

6.5 This section presents the results of the revenue and spending projections on the baseline assumption of 2 per cent productivity growth per year.

Revenue projections

6.6 Chart 6.1 shows that total revenue is projected to fall marginally as a share of GDP over the next 50 years. However, the projections presented here do not pick up all the potential developments on the revenue side that can be expected. In fact, there are several reasons why total revenue may rise as a share of GDP without a change in policy. First, the number of pensioners with significant pension entitlements is expected to increase over the coming decades. While contributions to pension schemes are tax exempt (up to generous limits), the future income stream that a funded pension generates is taxed. There is evidence that such policy could have a significant upward effect on revenue in countries with well-established funded pension systems.

¹ The increase in the number of years people enjoy in good health that accompanies a continued rise in life expectancy. See Chapter 3 for more details.



6.7 A study by the Netherlands Bureau for Economic Policy Analysis, for example, projects that total tax revenue from pension income will rise by around 5 percentage points between 2001 and 2040 in the Netherlands². The same study argues that: “An important factor that alleviates the burden of ageing is the pension system, which features a large funded second pillar of occupational pensions. The Netherlands (together with the UK) has by far the largest amount of pension fund assets in EU countries. The fiscal treatment of retirement savings in the Netherlands turns out to be highly favourable for future public finances...”³. The UK treatment of retirement savings is in principle similar to that in the Netherlands and a similar upward tendency of receipts relative to the projections presented here might be expected on the assumption of an unchanged tax system.

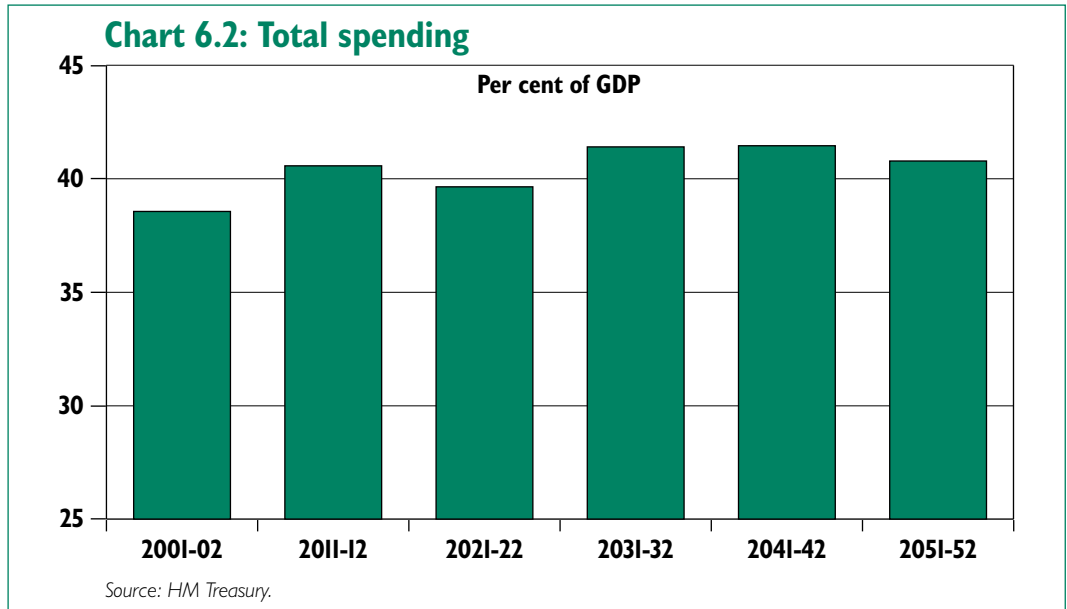
6.8 Second, even with unchanged indirect and direct tax rates, and tax allowances/thresholds indexed for inflation, real fiscal drag will tend to push up revenue due to economic growth. For example, a reasonable long-term assumption is that real earnings will increase in line with productivity growth. The revenue projections presented here are therefore probably on the low side or at least should be interpreted as assuming a comprehensive form of ‘real indexation’.

² *Ageing in the Netherlands: a manageable problem*, Harry ter Rele, et al, 2000.

³ *Ageing in the Netherlands: a manageable problem*, Harry ter Rele, et al, 2000, page 21.

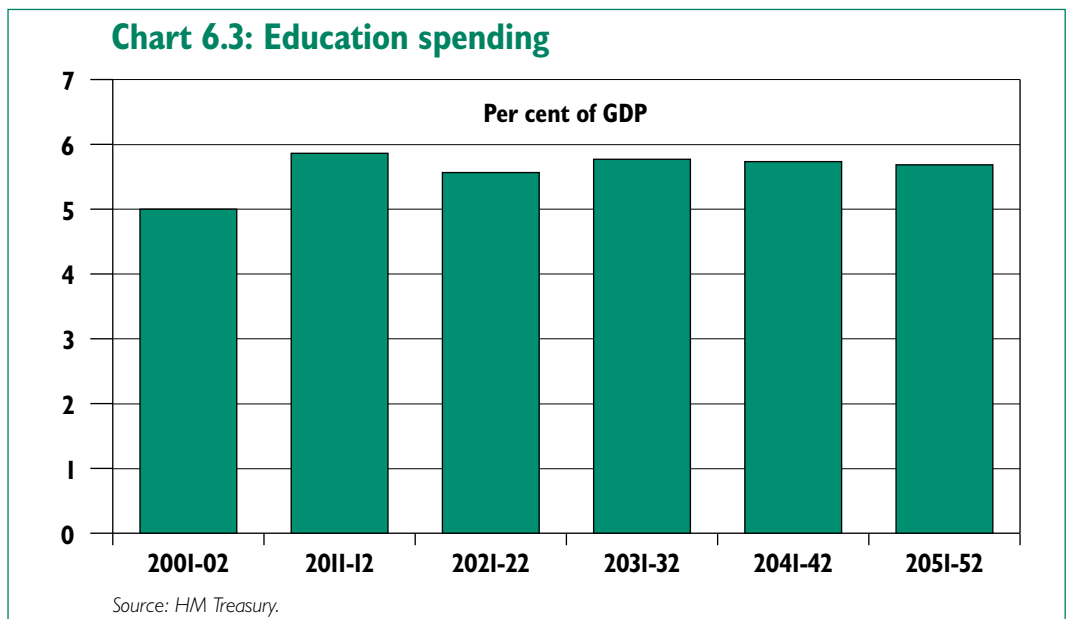
Spending projections

6.9 Total spending (including gross investment) is projected to rise slightly from 38½ per cent of GDP in 2001-02 to around 40½ per cent by 2011-12, then drop marginally before stabilising around 40¾ per cent of GDP in later decades. As such, total spending is projected to be very similar in 2051-52 as in 2007-08. The evolution of total spending as a share of GDP is shown in Chart 6.2.

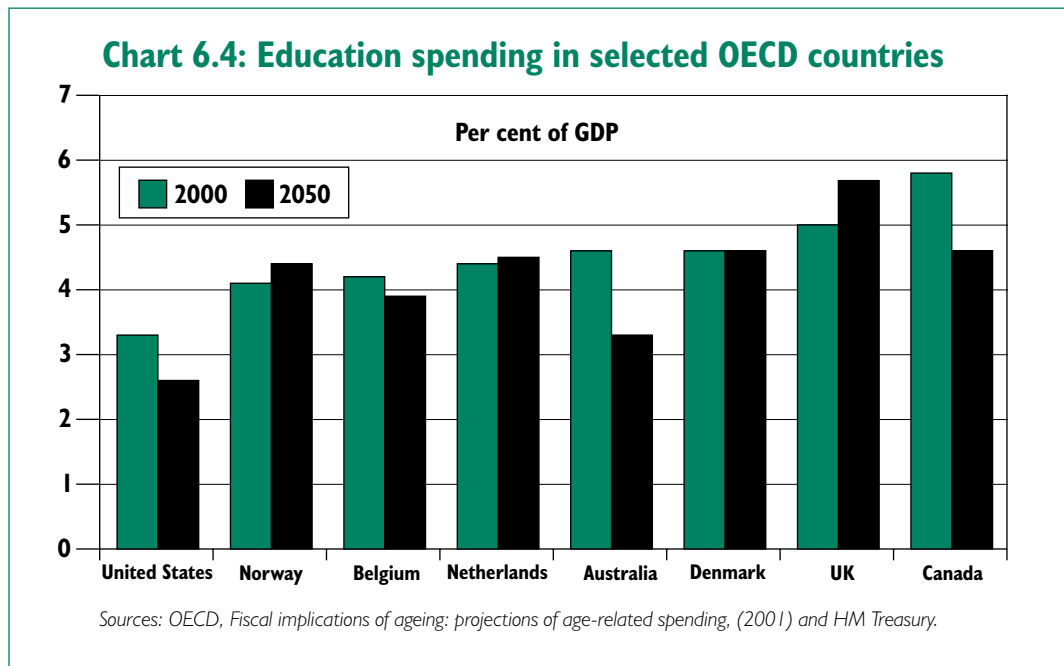


Individual spending projections

Education 6.10 Chart 6.3 shows that education spending is projected to remain relatively stable over the coming decades, fluctuating around 5½ per cent of GDP. This reflects the fact that the number of people of education age (either in schools, higher education or further education) is projected to vary only slightly. As stated in Chapter 5, these projections take no account of policy developments or other changes in the future, such as potential future changes in participation rates in higher and further education. The increase between 2001-02 and 2011-12 reflects the substantial increase in education spending announced in the *2002 Spending Review* up to 2005-06.



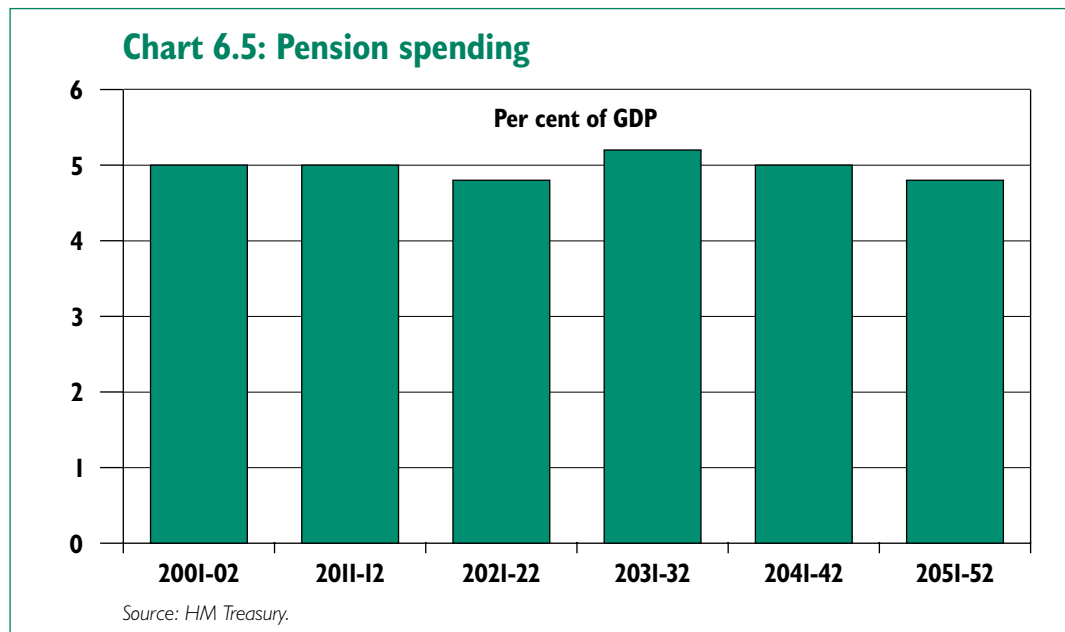
6.11 Chart 6.4 compares projected education spending in the UK with a number of OECD countries.



Pensions 6.12 Chart 6.5 shows that public pension spending⁴ is likely to remain relatively stable over the next 50 years, fluctuating around 5 per cent of GDP. As a share of GDP, pension spending is projected to be highest around 2031-32, when the number of pensioners is projected to be increasing at its fastest rate as the 1960s baby-boom generation enters retirement age. The projection results, therefore, confirm earlier findings, for example by the Department for Work and Pensions⁵.

⁴ Public pension spending is defined as the sum of the Retirement pension, including the Second State Pension, Minimum Income Guarantee and Pension Credit, Winter Fuel Payments, Over 75 TV licenses, and Christmas Bonus.

⁵ *The Pension Credit: long-term projections*, Department for Work and Pensions, 2002.

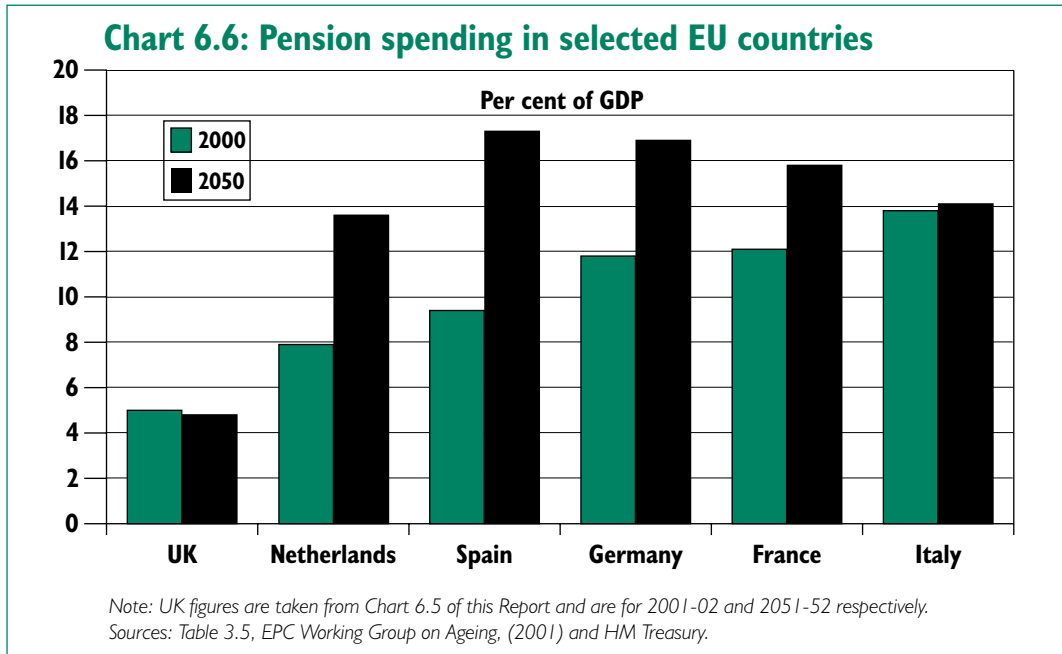


6.13 The pension projections differ in a number of ways from earlier long-term pension projections for the UK. The main differences relative to the most recent UK pension projections, produced by HM Treasury in the context of the European Union's Economic Policy Committee (EPC), are that slightly different employment rate and productivity growth assumptions are used, and demographic trends are based on GAD's latest 2001-interim principal population projections rather than on earlier population projections provided by Eurostat.

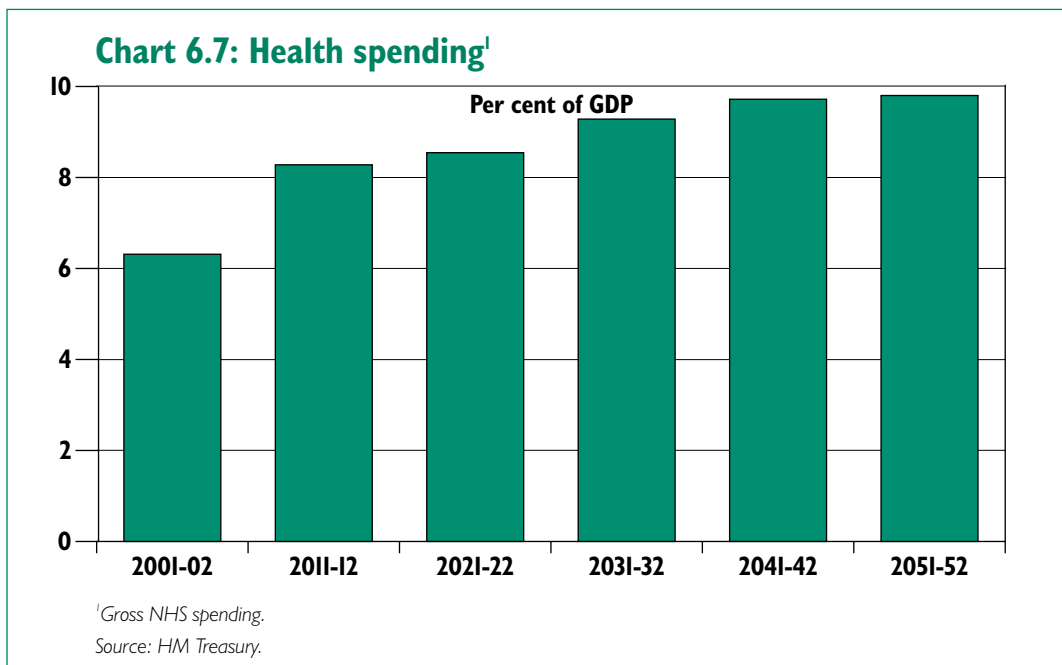
6.14 In addition, HM Treasury's projections conducted for the EPC exercise were on a definition of public pensions comprising the National Insurance Fund and the Minimum Income Guarantee, whereas the projections presented in this Report are based on a narrower definition of public spending on pensions and so the projections – in terms of GDP – are correspondingly lower⁶.

6.15 Despite these differences the broad conclusions remain unchanged: public spending on pensions, as a share of GDP, is projected to remain fairly constant in the face of an ageing population. Chart 6.6 shows that this contrasts with the substantial increases expected in many other EU countries on the assumption of unchanged policies.

⁶ For the different definitions, see Footnote 4 and, for the HM Treasury's EPC projections, http://www.hm-treasury.gov.UK/Documents/UK_Economy/Fiscal_Policy.



Health 6.16 The health projections build in the substantial medium-term increases in health spending announced in Budget 2002 in response to the Wanless Review. Health spending as a proportion of GDP is projected to rise from around 6½ per cent in 2001-02 to around 9¾ per cent by 2051-52 as shown in Chart 6.7. Of this, an increase of roughly 1½ percentage points of GDP by 2007-08 reflects the substantial increase in NHS spending announced in Budget 2002 in response to the Wanless Review. The further increase from 2008-09 is driven by demographic changes.



Compression of morbidity 6.17 However, the pure demographic effect on health spending is likely to be less marked than shown in these projections. This is because higher life expectancy generally goes hand in hand with a rise in the number of years enjoyed in good health. This trend, which is described in more detail in Chapter 3, is called compression of morbidity⁷.

⁷ See also *Demand for long-term care in the UK: projections of long-term care finance for older people to 2051*, Raphael Wittenberg, Ruth Hancock, Adelina Comas-Herrera and Linda Pickard, in *A New Contract for Retirement: Modelling Policy Options to 2050*, edited by Richard Brooks, Sue Regan and Peter Robinson, 2002.

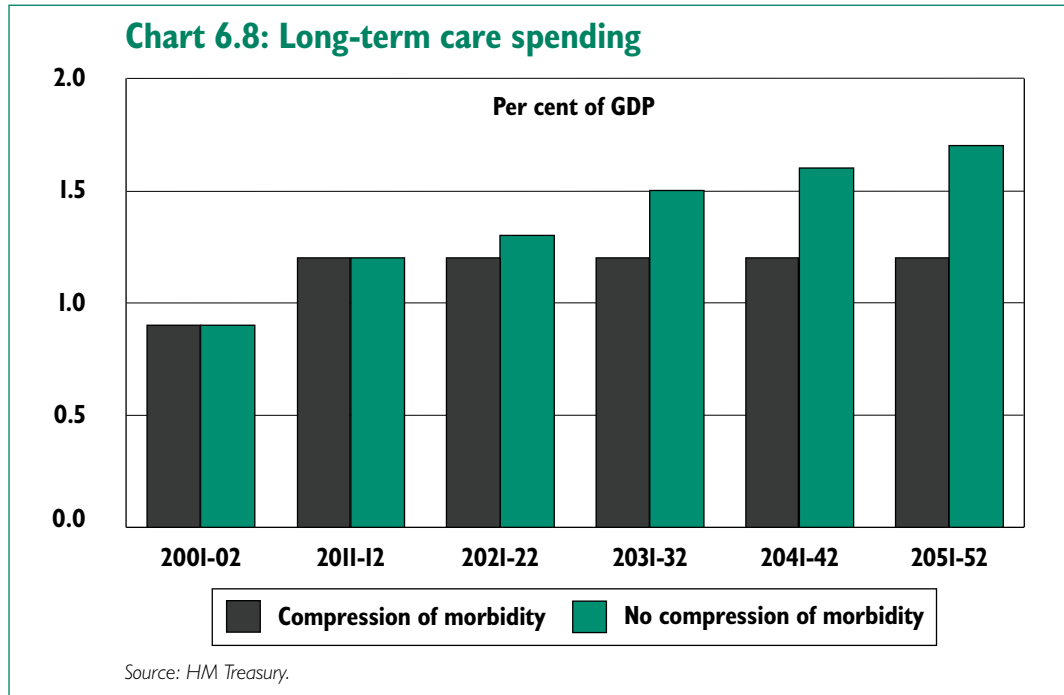
6.18 This trend is likely to have a marked dampening effect on health spending growth. The Wanless Review, for example, assumed in two of its three scenarios that the compression of morbidity would lead to a fall in demand for health services and products of between 5 and 10 per cent between now and 2022 for those aged 65 years and over. Alongside the compression of morbidity, the Wanless Review also modelled changes in preferences and expectations, and technological advances. Future decisions on implementing the Wanless recommendations after 2008 are a matter for future spending reviews.

6.19 Compared with HM Treasury's health projections produced for the EPC⁸, the projections presented here show a more pronounced increase in health spending as a share of GDP over the next 50 years. While the underlying economic and demographic assumptions are different (see above in the context of pension spending), the difference mainly reflects the substantial increase in funding to the NHS announced in Budget 2002 up to 2007-08. The EPC projections did not include these increases and therefore started from a lower initial point at the end of the medium-term forecast period.

Long-term care 6.20 The EPC report also presented long-term care spending allowing for the effect of compression of morbidity. A gradual increase in healthy life was modelled in a variant scenario by assuming someone, say, aged 75 would require the same amount of long-term care in 2050 as someone five years younger nowadays. This assumption made a marked difference to the results, with long-term care spending projected to remain more or less stable over the next 50 years in the UK. By comparison, in the unchanged healthy-life scenario, long-term care spending was projected to rise by nearly 50 per cent by 2050. This finding is confirmed by other research⁹. As stated in Chapter 5, the projections in this Report assume a similar compression of morbidity effect for long-term care (while no allowance for this effect is made for health spending). This means that long-term care spending is held at around 1¹/₄ per cent of GDP (the 2007-08 level) rather than rising to 1³/₄ per cent by 2051-52 as it would if compression of morbidity were not allowed for. Chart 6.8 shows the evolution of long-term care spending as a share of GDP with or without assuming the effect of compression of morbidity.

⁸ *Budgetary Challenges Posed by an Ageing Population*, EPC Working Group on Ageing, November 2001.

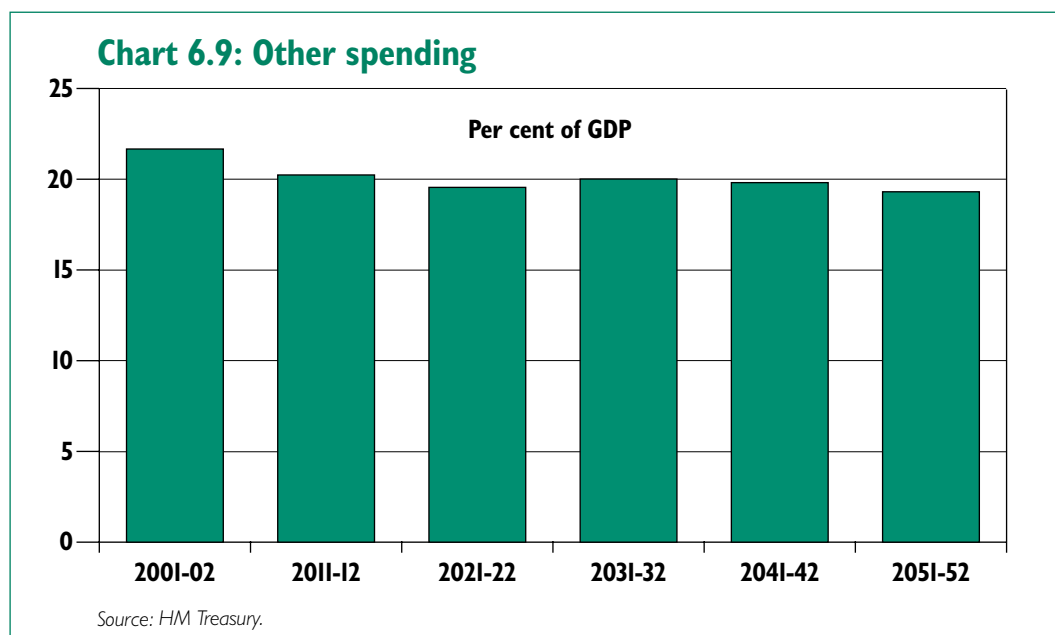
⁹ *Demand for long-term care in the UK: projections of long-term care finance for older people to 2051*, Raphael Wittenberg, Ruth Hancock, Adelina Comas-Herrera and Linda Pickard, in *A New Contract for Retirement: Modelling Policy Options to 2050*, edited by Richard Brooks, Sue Regan and Peter Robinson, 2002.



6.21 Compared with the long-term care projections produced by HM Treasury for the EPC, these results are slightly lower. This is because part of long-term care is under health spending in this Report where no compression of morbidity is assumed. In the EPC projections, long-term care spending was defined as the sum of NHS spending on long-term care and spending on personal social services¹⁰.

Other spending 6.22 Spending on education, pensions, and health and long-term care amounted to roughly 45 per cent of total government spending in 2001-02. This share is projected to rise to around 50 per cent by 2051-52. In terms of GDP, the total of education, pension, and health and long-term care spending is projected to be around 21½ per cent by 2051-52. The evolution of other spending is shown in Chart 6.9. The gradual decline between 2001-02 and 2021-22 largely reflects the assumption that most non-pension social transfers (which represent nearly a third of other spending) will rise in line with prices after 2007-08, reducing their share in GDP. Other spending also includes public sector occupational pensions, which remains small as a share of GDP in the projections.

¹⁰ The health projections in this Report are therefore correspondingly higher than in the exercise coordinated by the EPC.



Spending summary 6.23 Table 6.1 shows that the changing demographic structure of the UK's population – and especially the ageing aspect – is expected to have only a limited impact on the public finances over the coming decades. This contrasts with the findings in many other developed countries, where the spending pressures are much greater. Spending on education and pensions is projected to remain more or less stable as a share of GDP after the end of the medium-term forecast. The most marked increase is projected in health spending. Health spending is projected, based on the assumptions in this report, to rise from 8¹/₄ per cent of GDP in 2007-08 to 9³/₄ per cent by 2051-52. Overall spending is projected to increase slightly, as a share of GDP, over the next 30 years and then fall back. So total spending, as a share of GDP, is projected to be very similar in 2051-52 as in 2007-08. The substantial increase in spending between 2001-02 and 2007-08 largely reflects the Government's increased spending on public services, in particular, on health and education.

Table 6.1: Spending projections

per cent of GDP						
Year	2001-02	2011-12	2021-22	2031-32	2041-42	2051-52
Pensions ¹	5.0	5.0	4.8	5.2	5.0	4.8
Health ²	6.3	8.2	8.5	9.3	9.7	9.8
Education	4.6	5.9	5.6	5.8	5.7	5.7
Long-term care ^{3,4}	0.9	1.2	1.2	1.2	1.2	1.2
Total age-related spending	16.9	20.3	21.1	21.4	21.7	21.5
Other spending	21.7	20.3	19.6	20.0	19.8	19.3
Total spending⁵	38.6	40.6	39.6	41.4	41.5	40.8

¹ Defined as the sum of the Retirement pension, including the State Second Pension, Minimum Income Guarantee and Pension Credit, over 75 TV licences, and Christmas Bonus.

² Gross NHS spending.

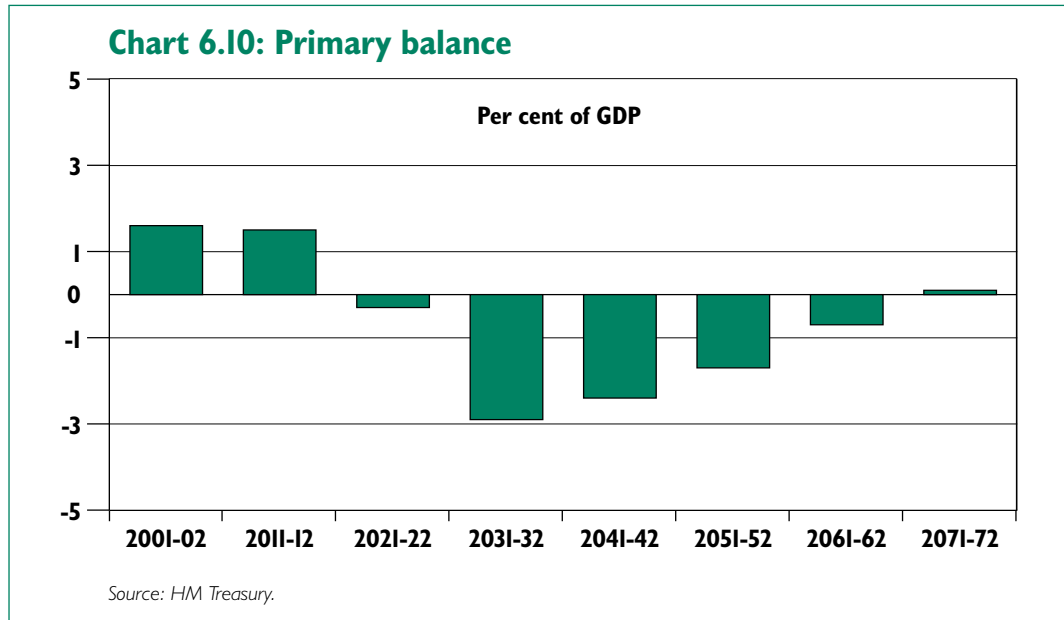
³ Compression of morbidity assumed.

⁴ Excluding long-term care provided within the NHS which is accounted for under Health (for which no compression of morbidity is assumed).

⁵ Total spending including gross investment.

ANALYSIS OF THE LONG-TERM FISCAL POSITION

6.24 As discussed above, total revenue is projected to fall marginally as a share of GDP, while spending is projected to rise slightly over the next few decades and then fall back again as a result of demographic changes. Chart 6.10 shows that, as a result, the primary balance moves from surplus to deficit and then back to surplus again over the next 70 years.



Long-term sustainability and the fiscal rules

6.25 As discussed in Chapter 4, there are a variety of approaches to assessing long-term fiscal sustainability. What matters from the Government's perspective is keeping within the fiscal rules as discussed in Chapter 2. However, it is worth emphasising that the Government aims to meet the fiscal rules over the cycle. It does not make sense to try to set fiscal policy now to meet the fiscal rules exactly over the next 50-100 years – the uncertainties are simply too great. The purpose of this Report is to look ahead beyond the normal medium-term horizon to ensure that current Government policies remain sustainable in the long run.

6.26 A common starting point for thinking about long-term fiscal sustainability is to consider a sustainable debt to GDP ratio. Indeed, the Government's sustainable investment rule is based on this idea. The sustainable investment rule states that public sector net debt will be held at a stable and prudent level over the cycle, and that, other things equal, net debt will be maintained below 40 per cent of GDP over the economic cycle.

Updated illustrative long-term fiscal projections

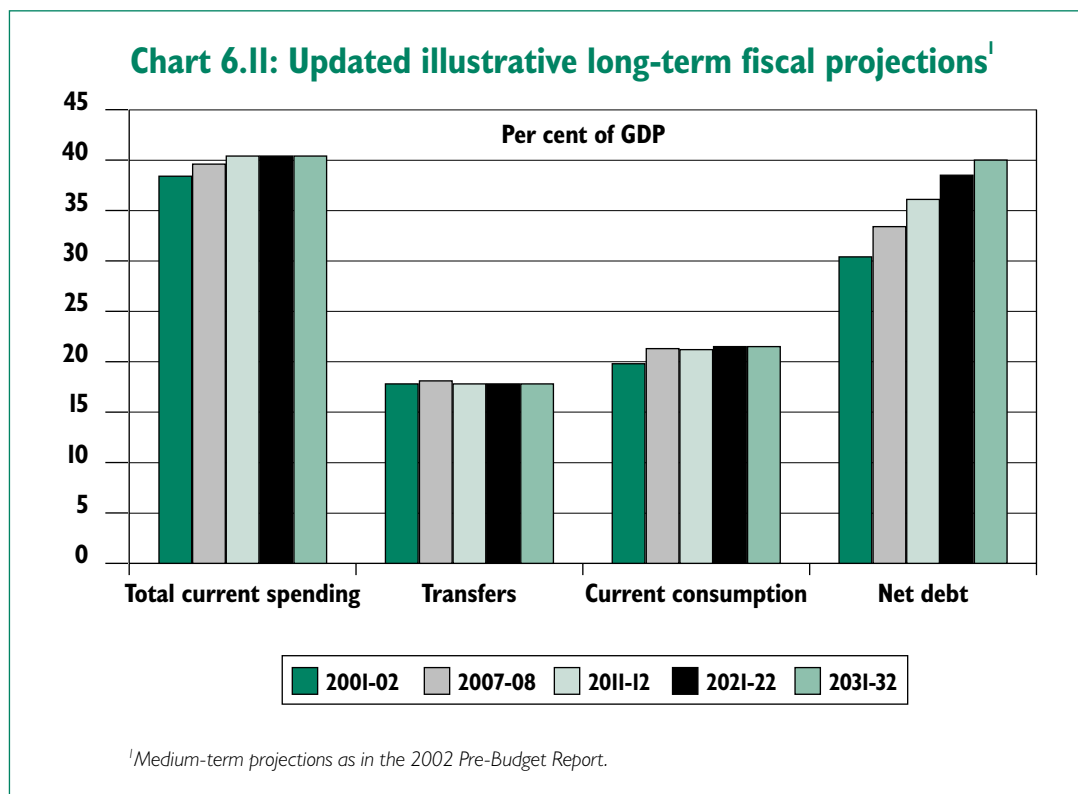
6.27 Annex A of the 2002 EFSR, published in Budget 2002, showed that the UK's public finances are broadly sustainable in the long term. Moreover, Annex A of the 2002 EFSR showed that:

- current public consumption can grow slightly faster than GDP growth in the long run, while meeting the Government's golden rule;
- public sector net investment can grow close to the economy's growth rate over the projection period, without jeopardising the sustainable investment rule; and
- the net debt to GDP ratio is projected to remain below 40 per cent in the long run.

6.28 These conclusions are firmly supported by updated illustrative the long-term fiscal projections, which are based on the medium-term forecast as presented in *2002 Pre-Budget Report*. Except for the updated medium-term forecast, the same assumptions as for the baseline projections in Annex A of Budget 2002 are used¹¹. The main assumptions are:

- productivity growth of 2 per cent per year between 2007-08 and 2011-12, and of 1³/₄ per cent per year from 2012-13 onwards;
- employment growth of 1/4 per cent per year between 2007-08 and 2011-12, and of 0 per cent per year from 2012-13 onwards; and
- public sector net investment equivalent to 2¹/₄ per cent of GDP up to 2011-12 and then 1.8 per cent of GDP; and
- tax revenues and current spending grow in line with GDP from 2008-09 onwards and are the same, in other words the current budget is in balance (and hence the golden rule is met).

6.29 The updated illustrative long-term fiscal projections based on the medium-term forecast presented in the, *2002 Pre-Budget Report* are shown in Chart 6.11. They show a very similar picture of overall long-term fiscal sustainability.



¹¹ See *Budget 2002 The strength to make long-term decisions: Investing in an enterprising, fairer Britain*, HM Treasury, April 2002, page 147.

6.30 Transfers as a share of GDP are projected to remain relatively stable between 2007-08 and 2031-32 as the increase in debt interest payments is more or less offset by relatively lower other transfers such as non-pension social benefits.

Current consumption can grow slightly faster than GDP

6.31 Current consumption is projected to rise from 19.8 per cent of GDP in 2001-02 to just above 21 per cent of GDP by 2007-08 and to rise marginally further thereafter. This relative expansion reflects the fact that current consumption can grow at a slightly faster average annual rate than GDP while still meeting the fiscal rules.

6.32 Using the stated assumptions and modelling approach, the net debt to GDP ratio remains below 40 per cent over the entire projection horizon, implying that the sustainable investment rule is met. The projected changes in net debt mainly reflect the higher ratio of public investment to GDP up to 2011-12.

6.33 With the results of the updated illustrative long-term fiscal projections only marginally different from those presented in Annex A of Budget 2002, the conclusions drawn earlier remain valid: the UK's public finances are broadly sustainable over the long term. Consistent with meeting the golden rule, current consumption can grow slightly faster than GDP in the projections, providing the resources to meet future spending needs; for example, to meet the health care needs of an ageing population. Furthermore, public sector net investment can grow more or less in line with the economy without jeopardising the sustainable investment rule. Net debt is projected to remain below 40 per cent of GDP in the long run.

Fiscal gaps

6.34 The fiscal gap concept introduced in Chapter 4 also takes a sustainable debt to GDP ratio as a starting point for thinking about long-term fiscal sustainability. The fiscal gap measure represents the change in the primary balance needed to attain a particular debt target at a particular point in time. A negative fiscal gap, for example, implies that the Government could loosen fiscal policy while still attaining a particular debt level in the future. Taking the 40 per cent net debt to GDP level from the sustainable investment rule as the target, it is therefore possible to use the fiscal gap concept to estimate the primary balance that is consistent with the sustainable investment rule, over different time horizons¹².

6.35 Tables 6.2 to 6.4 show the fiscal gaps under a variety of scenarios, where the change in the primary balance is assumed to occur from 2008-09 on, that is beyond the medium-term horizon for fiscal policy¹³. Table 6.2 shows the baseline projections under a variety of assumptions about the real interest rate on debt interest. As discussed in Chapter 5, there is currently quite a difference between the discount rate assumed in the Green Book, 3½ per cent, and the real interest rate on long-term UK government debt, which is currently closer to 2¼ per cent. Given that long-term real interest rates have averaged less than 2½ per cent since 2000, there is a strong case for using the lower rates. Table 6.2 illustrates the sensitivity of the results to changes in the interest rate assumption.

¹² It should be noted that this Report focuses on the general government rather than on the public sector, while the Government's fiscal rules apply to the public sector. However, the difference is small.

¹³ Obviously if the change in the primary balance were assumed to be in 2003-04 instead of 2008-09 then the implied increases or reductions in the primary balance would be smaller.

Table 6.2: Fiscal gaps¹ in baseline scenario with 2 per cent productivity growth (per cent of GDP)

Interest rate (per cent)	2½	3	3½
Year			
2016–17 ²	–1¼	–1	–¾
2021–22	–¾	–½	–½
2031–32	0	¼	¼
2041–42	½	½	¾
2051–52	¾	¾	1

¹ Change to primary balance needed to attain a net debt target of 40 per cent of GDP in the year shown. Rounded to the nearest quarter percentage point.

² Net debt target is reached at end of the year specified.

6.36 The results show that the UK public finances are in a strong long-term position. Table 6.2 shows that the Government could reduce its primary balance if it aimed for a net debt to GDP ratio of 40 per cent by 2021–22 in the baseline case. If the horizon is extended, the Government would have to tighten fiscal policy only slightly to ensure that net debt stays at 40 per cent of GDP. Table 6.2 also shows that the Government could loosen fiscal policy by slightly more (or tighten by slightly less) the lower the assumed interest rate. It should also be emphasised that all the numbers in Table 6.2 are small (representing around 1 percentage point of GDP or less). This needs to be seen in the context of an average absolute forecasting error on the year-ahead forecast on public sector net borrowing of 1 per cent of GDP since 1989–90¹⁴.

6.37 Tables 6.3 and 6.4 illustrate the effect of assuming lower and higher productivity growth respectively than in the baseline scenario. In this context it should be noted that HM Treasury recently found that there were clear upside risks to productivity growth in the medium term¹⁵, indeed on current estimates, output per hour has averaged around 2¼ per cent between the on-trend points in 1997 and 2001¹⁶. Tables 6.3 and 6.4 show that the Government needs to change the primary balance only slightly (if at all) to ensure that net debt would stay at 40 per cent of GDP in the future. In the higher productivity growth scenario with a 3 per cent interest rate, for example, the Government could loosen fiscal policy if it aimed for a net debt to GDP ratio of 40 per cent by 2021–22, leave policy unchanged for 2031–32 and tighten only slightly for longer time horizons. The main impact of making different productivity assumptions is to change the rate at which most non-pension social transfers (uprated in line with prices) move in relation to earnings. A faster rate of productivity growth implies that price-indexed benefits grow more slowly relative to GDP and hence suggest an even stronger fiscal position.

Table 6.3: Fiscal gaps¹ in lower productivity scenario with 1¾ per cent productivity growth (per cent of GDP)

Interest rate (per cent)	2½	3	3½
Year			
2016–17 ²	–1	–1	–¾
2021–22	–¾	–½	–¼
2031–32	0	¼	½
2041–42	½	¾	1
2051–52	1	1	1¼

¹ Change to primary balance needed to attain a net debt target of 40 per cent of GDP in the year shown. Rounded to the nearest quarter percentage point.

² Net debt target is reached at end of the year specified.

¹⁴ *End of Year Fiscal Report*, HM Treasury, November 2002.

¹⁵ See *Trend Growth: Recent Developments and Prospects*, HM Treasury, April 2002.

¹⁶ See *2002 Pre-Budget Report*, HM Treasury, November 2002.

Table 6.4: Fiscal gaps¹ in higher productivity scenario with 2¼ per cent productivity growth (per cent of GDP)

Interest rate (per cent)	2½	3	3½
Year			
2016–17 ²	-1¼	-1¼	-1
2021–22	-1	-¾	-½
2031–32	-¼	0	¼
2041–42	¼	½	½
2051–52	½	¾	¾

¹ Change to primary balance needed to attain a net debt target of 40 per cent of GDP in the year shown. Rounded to the nearest quarter percentage point.

² Net debt target is reached at end of the year specified.

6.38 It is worth pointing out that lower long-term interest rates are likely to be associated with a low growth rather than high growth rate. Correspondingly, it is also likely that higher interest rates will prevail in a high growth economic environment.

Generational Accounts

Intertemporal balance

6.39 Chapter 4 also introduced the concepts of intertemporal and inter-generational balances. Table 6.5 presents estimates of the intertemporal budget gap under a range of assumptions about the discount rate, that is the increase/reduction in tax revenues as share of GDP in 2001-02 (and a proportionate increase/reduction thereafter) to meet the intertemporal balance condition. A positive gap means that the Government would have to raise taxes (or lower spending) to establish intertemporal balance. As for the fiscal gap calculations, these numbers need to be interpreted carefully. As noted in Chapter 4 (paragraph 4.12) the intertemporal balance concept is an overly-stringent condition for long-term sustainability in the sense that at the end of the assumed projection horizon (100 years here) all government debt is repaid. However, fiscal sustainability does not require zero debt. Indeed, the sustainable investment rule states that public sector net debt should be maintained below 40 per cent of GDP over the economic cycle. Nevertheless, it is a useful indicator that can be monitored over time and can be compared with previous international studies and those by the National Institute of Economic and Social Research (NIESR) for the UK¹⁷.

6.40 The NIESR calculated the UK's generational accounts for 1998 and 2001. Both studies concluded that the UK faced only a modest generational imbalance and that the public finances were broadly sustainable in the long run. The results presented in this report are qualitatively similar to those calculated earlier even though slightly different assumptions are used.

6.41 Table 6.5 presents the same variants as Tables 6.2 to 6.4 for the intertemporal balance. The results show that whether revenues/spending need to change at all to maintain intertemporal balance depends entirely on the discount rate assumption. If a low discount rate is used, as could be justified by the low real interest rate on long-term UK government bonds, the condition for intertemporal balance is met or exceeded in each case regardless of the productivity assumption.

Table 6.5: Intertemporal budget gaps¹ (per cent of GDP)

Discount rate (per cent)	2½	3	3½
Scenario			
Lower productivity (1¾ per cent)	0	1	¾
Baseline (2 per cent)	-1	½	¼
Higher productivity (2¼ per cent)	-2	-¼	¾

¹ Tax increase (or decrease) in 2001-02 and a permanent, proportionate tax increase (or decrease) thereafter needed to ensure intertemporal balance.

Rounded to the nearest quarter percentage point.

¹⁷ See *Generational accounting in the UK*, Roberto Cardarelli, James Sefton, and Laurence J. Kotlikoff, NIESR, 1998 and NIESR press release 15 April 2002.

Box 6.2: Inter-generational balance

The generational accounting framework also provides a measure of inter-generational equity, the inter-generational balance gap (IGG). There is no unique measure of inter-generational fairness, however. For example, debt sustainability with a constant tax burden is another useful indicator. Another way of thinking about inter-generational fairness is in terms of the golden rule which ensures that over the cycle the Government only borrows to invest and not to fund current spending.

By comparison with the golden rule, the IGG probably understates the degree of generational fairness as it does not distinguish between current consumption and investment in that investment is allocated to the generation in which the spending takes place. Clearly government investment can provide a flow of services for a very long period of time benefiting not just this generation but also future generations. Buildings and infrastructures are obvious examples^{1,2}. This suggests that firm conclusions on inter-generational balance should not be drawn from the IGG measure presented in Table 6.6, especially not from the absolute values. The concept does, however, provide a benchmark that can be assessed over time and between countries. It may also serve as a basis for improved measures in the future.

Table 6.6: Inter-generational balance gap in baseline scenario' (per cent of GDP)

Discount rate (per cent)	2½	3	3½
Scenario			
Baseline (2 per cent)	2	2¼	2½

¹ Tax increase (or decrease) in 2001-02 and a permanent, proportionate tax increase (or decrease) thereafter to ensure the net lifetime tax burden on current newborns is equal to that of future newborns.

Table 6.6 shows that the Government would have to raise taxes (or lower spending) only slightly to close the inter-generational balance gap. These results must be seen in the context of an average absolute forecasting error of 1 per cent since 1989-90 on the year-ahead forecast of public sector net borrowing.

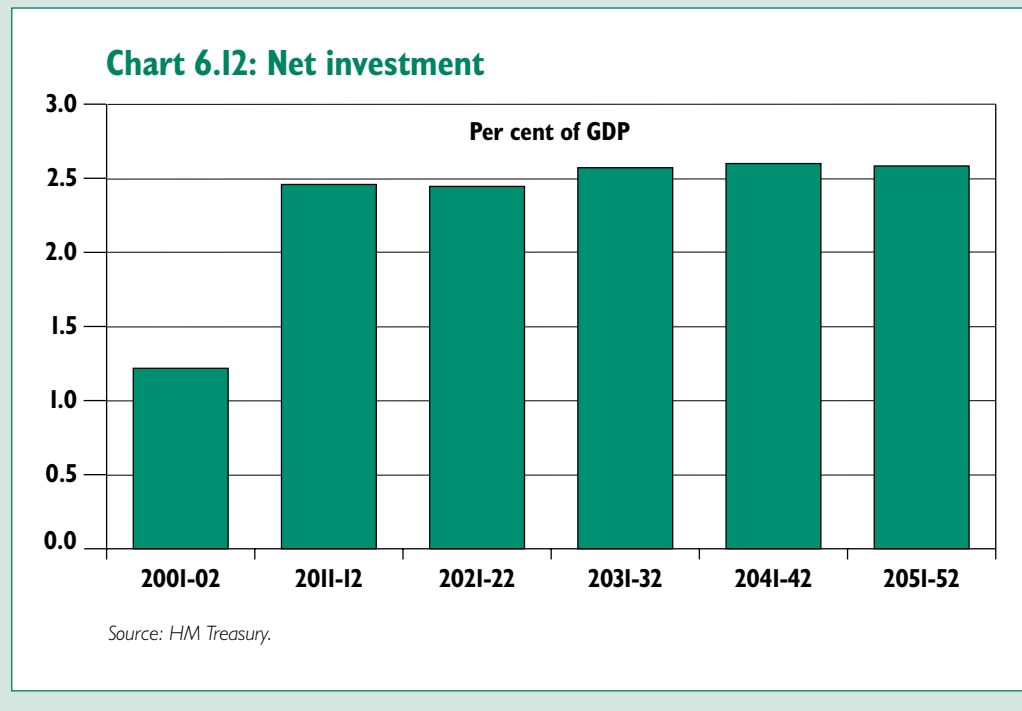
The results confirm earlier studies and other indicators which suggest that there is a high degree of inter-generational fairness with respect to future generations. However, the results were found to be very sensitive to the assumptions about productivity growth and the discount rate, and only the baseline scenario is presented in Table 6.6.

As noted, one drawback of the inter-generational gap measure is that it takes no account of the benefits of government investment to future generations. Chart 6.12 below illustrates the projected evolution of general government net investment as a share of GDP in the coming decades³. As can be seen net investment as a share of GDP is projected to rise substantially between 2001-02 and 2011-12. This is mainly the result of the substantial increases in investment spending announced in Budget 2002 and earlier budgets. These investments will benefit the current and future generations. From the end of the medium-term forecast period, net investment is projected to remain relatively stable as a share of GDP at around 2½ per cent.

¹ The intertemporal balance concept is not affected by this distinction, although in principle sustainability could be affected by the mix of spending, for instance where the mix affects the economy's productivity growth rate. Chapter 4, Box 4.2 provides more details.

² To obtain a more realistic assessment of the degree of generational fairness of current policy, the generational accounts should treat current consumption and investment differently. HM Treasury is currently studying ways to modify the existing generational accounts framework to allow for this, Box 4.2 in Chapter 4 illustrates some of the issues involved.

³ As stated earlier, this refers to the general government and not the public sector. Net investment of the generational government generally exceeds that of the public sector by a small margin.

Box 6.2: Inter-generational balance (continued)

**Summary on
sustainability and
inter-
generational
fairness**

6.42 The results demonstrate that the UK public finances are sustainable in the long term and that the UK is in a strong position to face the fiscal challenges of an ageing population. They confirm earlier findings as presented in Annex A of the EFSR and also those of NIESR¹⁸. The projections in this report by no means represent what the Government intends to do over the next 50 to 100 years, rather they illustrate the long-term implications of continuing with current policies. Nevertheless, the indicators show that, on a range of cautious and plausible assumptions, the UK public finances are sustainable. Even in the variants where some adjustment is implied, it is small and well within the margins of error of such projections.

6.43 The sustainability indicators also suggest a high degree of inter-generational fairness in the sense that spending trends can be sustained with a roughly constant tax burden without increasing the debt burden relative to GDP over time. This finding is also supported by the inter-generational balance indicators (Box 6.2), although this measure is found to be sensitive to the precise assumptions used, and important deficiencies in its treatment of investment were noted.

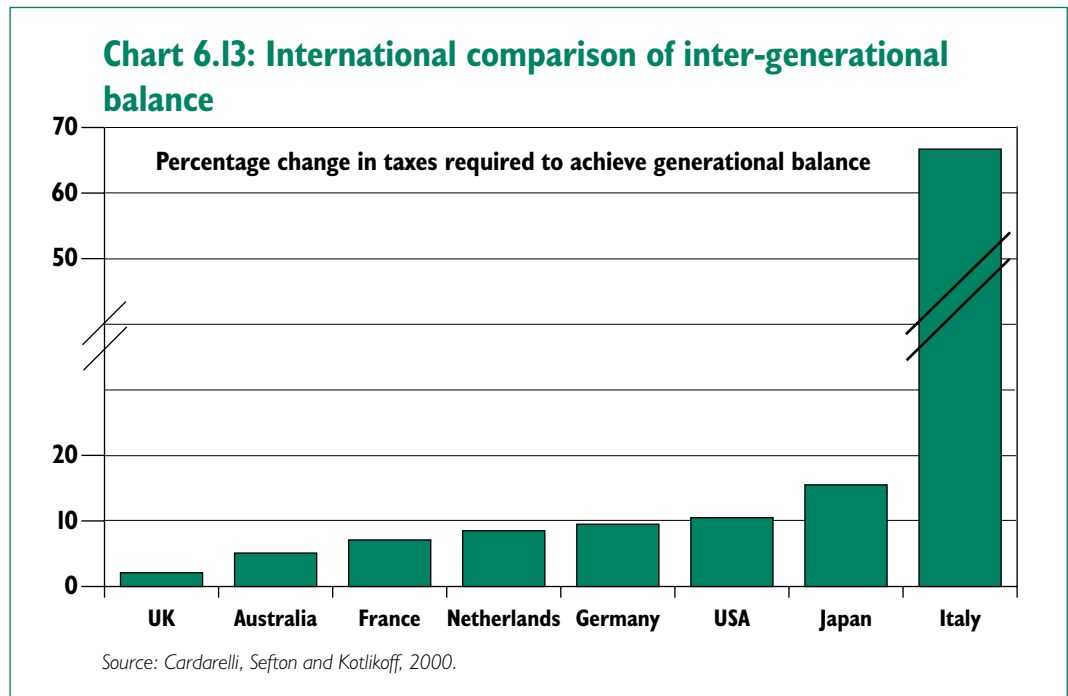
6.44 To obtain a better perspective of just how sustainable the UK position, is it is instructive to compare the results for the UK with studies for other developed countries. This is considered in the next section.

¹⁸ *Generational accounting in the UK*, Roberto Cardarelli, James Sefton, and Laurence J. Kotlikoff, NIESR, 1998 and NIESR press release 15 April 2002.

INTERNATIONAL COMPARISONS

UK fiscal position is strong internationally

6.45 International comparisons show that the UK's fiscal position is also relatively strong compared with other developed countries facing similar challenges from ageing populations. Table 6.13 shows the percentage change in taxes required to establish inter-generational balance in a number of developed countries¹⁹. While not directly comparable with the results presented in this report, it shows that current policy in the UK has a substantially higher degree of inter-generational fairness than many other developed countries. The UK also compares favourably to the United States. The authors conclude that: "It is evident that if the government is able to keep to these tight fiscal constraints, then the UK fiscal position is considerably brighter than most other developed nations'"²⁰.



6.46 The OECD have also projected that the overall increase in age-related spending (such as education, pensions and health care) in the UK is likely to be moderate compared with those expected in other developed countries. In 2001 the OECD published a detailed study on the fiscal implications of ageing in OECD member states²¹. Under the assumption of unchanged policies, the OECD projected that public pension spending as a share of GDP for all OECD countries will rise by an average of nearly 4 percentage points between 2000 and 2050. In a number of countries, the projected increase is even greater, reaching 8 percentage points.

6.47 The same study showed that total age-related spending (which the OECD defines as the sum of old-age and early retirement pensions, health and long-term care, and child/family benefits and education) would increase by nearly 6 percentage points on average in OECD member states over the next 50 years. Alongside old-age pensions, the main upward pressure was projected to come from health and long-term care spending. This Report shows that health spending is likely to put the most pressure on the public finances in the UK, with public pension spending projected to remain relatively stable as a share of GDP. Overall spending is projected to remain very stable as a share of GDP from 2007-08 onwards.

¹⁹ *Generational accounting in the UK*, Roberto Cardarelli, James Sefton, and Laurence J. Kotlikoff, *Economic Journal*, 2000.

²⁰ *Generational accounting in the UK*, Roberto Cardarelli, James Sefton, and Laurence J. Kotlikoff, *Economic Journal*, 2000, page F570.

²¹ *Fiscal implications of ageing: Projections of age-related spending*, in *OECD Economic Outlook*, OECD, June 2001.

6.48 The EPC's Working Group on Ageing (see paragraph 2.17) was closely involved in the OECD exercise. The EPC's own projections on pensions, and health and long-term care costs were based on different assumptions and definitions, but present a similar picture. Based on policy in place or legislated for at the time of the exercise in mid-2000, public pension spending in EU member states was projected to rise from an average of 10.4 per cent of GDP in 2000 to 13.6 per cent by 2040 – the decade in which the ageing process is likely to put the most pressure on the public finances in European countries. The UK was one of a few countries for which public pension spending as a share of GDP was not projected to rise markedly over that time (Chart 6.6). The working group's projections on health and long-term care were also qualitatively similar to those published by the OECD.

6.49 As a result of the ageing process, the primary balance is predicted to deteriorate in most OECD member states. In the above-mentioned study, the OECD projected that the deterioration will average 6.8 percentage points between 2000 and 2050, with the range varying from an increase of 1 percentage point in Poland to a deterioration of 17 percentage points in Norway. In an international context the projected deterioration of the primary balance in the UK up to 2031-32 is therefore extremely modest. Furthermore, as stated above, the trend is also projected to be reversed by around 2031-32.

CONCLUSIONS

6.50 The Report updates the illustrative long-term fiscal projections presented in Annex A of the EFSR and confirms the results given in Budget 2002. Given the projected profile for tax revenue and transfers, current consumption can grow slightly faster than GDP growth in the long run while meeting the Government's golden rule. In addition, public sector net investment can grow close to the economy's growth rate over the projection period without jeopardising the sustainable investment rule and the net debt to GDP ratio is projected to remain below 40 per cent in the long run.

6.51 The Report also presents a series of additional indicators, including measures of: bottom-up projections, fiscal gaps and generational accounting. These confirm the results of the Annex A-style projections and of earlier studies that the UK fiscal position is sustainable in the long term on the basis of current policies and that the UK is in a strong position relative to many other developed countries. The Report also finds that there is a high degree of inter-generational fairness; particularly so when account is taken of the increase in public investment that has been announced and which will provide benefits for both current and future generations.

6.52 The indicators used in this Report do not supplant the fiscal rules which govern the Government's fiscal policy. What the Report does show, using a range of established indicators, is that on plausible assumptions the UK public finances are sustainable in the longer term.

6.53 The uncertainties involved in projecting so far ahead are enormous. Besides the sensitivity to discount/interest rates and productivity growth, which are illustrated, the Report notes a number of important qualifications including the uncertainty about long-term trends in: health spending, tax revenues, and employment.

6.54 The *Long-Term Public Finance Report* along with the *End of Year Fiscal Report* mark a major development of the UK's fiscal framework. In particular, they provide substantially more transparency and detailed analysis on both the distant future and the recent past. Both are intended to provide further reassurance that the tough decisions made in the past have put the UK in a secure position to face the challenges of the future without resorting to sudden and unexpected changes in policy.

INTERTEMPORAL BUDGET CONSTRAINT AND FISCAL SUSTAINABILITY

A.1 The intertemporal budget constraint (IBC) was described in Chapter 4 as

$$\sum_{s=t}^{\infty} R_s (1+r)^{-s+t} = \sum_{s=t}^{\infty} S_s (1+r)^{-s+t} + D \quad (1)$$

where R_s is revenue in year s , S_s is spending in year s , r is the discount rate, t is the current year and D is the initial stock of net debt.

A.2 We can also define the level of primary balance in year s PB_s to equal $R_s - S_s$ so that the IBC can be rewritten as:

$$D - \sum_{s=t}^{\infty} PB_s (1+r)^{-s+t} = 0 \quad (2)$$

By substituting into the left hand side the current level of debt, and current and (discounted) projected primary surpluses, the sum is equal to zero if the IBC is satisfied.

A.3 The IBC, in a variety of forms, has been used widely in the analysis of the sustainability of fiscal policy. For example, it is possible to rewrite equation (2) as ratios to GDP. This yields:

$$d - \sum_{s=t}^{\infty} pb_s \left[\frac{(1+g)}{(1+r)} \right]^{s-t} = 0 \quad (3)$$

where d is the initial debt to GDP ratio, pb_s is the primary balance as a share of GDP in year s , g is the real growth rate of GDP, and r is the discount rate.

A.4 This formulation of the IBC has been used to analyse the level of primary balances needed to achieve a certain debt target in the future, such as in fiscal gap analysis¹. The fiscal gap is the immediate and permanent change in the primary balance that is needed in order that the debt to GDP ratio at time T in the future returns to the level that prevails at the current time².

A.5 The alternative technique of generational accounting looks at the absolute levels of the primary balance and debt rather than ratios to GDP, that is, equation (2) rather than equation (3). Equation (2) can be used to calculate whether there is a “gap” in the long-term public finances. If current and future revenues are not sufficient to cover current and future spending and current debt, for a finite period the right hand side of equation (2) will not equal zero, but be a positive number. The extent of the imbalance is called the intertemporal budget gap (IBG):

$$D - \sum_{s=t}^T PB_s (1+r)^{-s+t} \quad (4)$$

A.6 The generational accounting technique calculates the immediate and permanent change in the primary balance that is needed in order that the IBG will equal zero.

¹ For more details, see *The US fiscal problem: where we are, how we got there, and where we're going*, Alan Auerbach, 1994.

² As stated in Chapter 4, the formula can be modified so that any debt to GDP ratio can be targeted at time T .

A.7 As discussed in Chapter 4, the inter-generational balance gap (IGG) can be used as a measure of the extent of fiscal adjustment needed to achieve generational balance. The IGG imposes an additional constraint over and above the intertemporal budget constraint, as the following discussion will show.

DERIVING THE INTER-GENERATIONAL BALANCE GAP

A.8 The following discussion (and notation) is drawn from *Generational accounting in the UK*, Roberto Cardarelli, James Sefton, and Laurence J. Kotlikoff, *Economic Journal*, 2000.

A.9 Using $PB_s = R_s - S_s$ in equation (4) yields:

$$D - \sum_{s=t}^{\infty} R_s (1+r)^{-s+t} + \sum_{s=t}^{\infty} S_s (1+r)^{-s+t} \quad (5)$$

A.10 The term $\sum_{s=t}^{\infty} R_s (1+r)^{-s+t}$ can be looked at in more detail. The tax revenues to be collected by the Government can be broken down into two parts: the burden on generations that are already born, and the burden on future generations.

A.11 Tax revenues to be collected (defined as net of transfers) can be expressed as:

$$\sum_{s=0}^M N_{t,t-s} P_{t,t-s} + \sum_{s=1}^{\infty} N_{t,t+s} P_{t,t+s} (1+r)^{-s} \quad (6)$$

with the first term the burden on current generations, and the second term the burden on future generations.

A.12 First, the burden on current generations.

$N_{t,t-s}$ is the present value of the average remaining lifetime net tax (taxes less transfers) payment of the person born in year $t-s$, or is aged s years old, at time t . M is the maximum length of life.

$P_{t,t-s}$ is the population of the generation born in year $t-s$ at time t .

Therefore, $N_{t,t-s} P_{t,t-s}$ represents the future tax burden of the generation born in year $t-s$, at time t . Summing across from $s=0$ to M , the maximum length of life, adds together the tax burdens of different generations that have already been born.

A.13 Secondly, the burden on future generations.

$N_{t,t+s}$ is the present value (*to the year of birth*) of the average lifetime net tax payment of the person to be born in year $t+s$, or in s years time.

Because this is only discounted to the year of birth, we need to discount this value s years back to time t , hence the inclusion of $(1+r)^{-s}$.

$P_{t,t+s}$ is the population of the generation born in year $t+s$, determined in the year of birth.

Therefore, $N_{t,t+s} P_{t,t+s} (1+r)^{-s}$ represents the tax burden of a generation to be born in s years time, at time t . Summing across from $s=1$ to infinity, adds together the tax burdens of the generations born every year from now into the infinite future.

A.14 Using equations (5) and (6), the intertemporal budget gap can be represented by:

$$IBG = D_t - \sum_{s=0}^M N_{t,t-s} P_{t,t-s} - \sum_{s=1}^{\infty} N_{t,t+s} P_{t,t+s} (1+r)^{-s} + \sum_{s=0}^{\infty} S_{t+s} (1+r)^{-s} \quad (7)$$

where spending S now only includes government purchases (i.e. transfers are not included).

A.15 If the intertemporal budget gap is equal to zero, this means that future tax collections will be sufficient to meet future spending and to pay off current debt. This does not mean, however, that the tax collections will be distributed equally across time. A country that raises taxes in the future to pay off past debt may still attain an IBG of zero. However, this policy makes future newborns relatively worse off than current newborns. Similarly, a country that runs large surpluses today while reducing taxes in the future may still attain an IBG of zero, but this policy makes current newborns worse off relative to future newborns.

Defining inter-generational fairness

A.16 Inter-generational fairness as defined by the IGG is achieved when current policy treats current newborns and future newborns equally. The basis for comparison for future newborns is current newborns, rather than all past newborns. This is because while the Government today can affect the lifetime tax burden for current newborns and future newborns, it can only partially affect the lifetime tax burden for past newborns or existing generations. Those who are already born have faced tax regimes in the past, set by past governments. It would be very difficult for a current Government to change its policies to offset the effects of policies of past Governments.

A.17 If current and future newborns are to be treated the same, then the present value (discounted to their year of birth) of their average lifetime net tax payments should be the same, regardless of the year of birth. In the notation introduced above, this means that $N_{t,t}$, the present value of the average lifetime net tax payment of the person born in year t , at time t , should equal $N_{t,t+s}$, the present value of the average lifetime net tax payment of the person born s years from time t , for all s .

A.18 Therefore the IGG modifies the IBG in equation (7) by restricting $N_{t,t+s} = N_{t,t}$ to yield:

$$IGG = D_t - \sum_{s=0}^M N_{t,t-s} P_{t,t-s} - \sum_{s=1}^{\infty} N_{t,t} P_{t,t+s} (1+r)^{-s} + \sum_{s=0}^{\infty} S_{t+s} (1+r)^{-s} \quad (8)$$

A.19 Thus equation (8) measures the extent of fiscal adjustment needed today, in order for future flows of spending and current debt to be financed by tax flows that do not favour one generation over the other.

A.20 The IGG is defined above in terms of the inter-generational fairness of tax flows, rather than spending flows, in that lifetime net tax payments are equalised between current newborns and future newborns. On the spending side (excluding transfers) it is already assumed that current newborns and future newborns have the same lifetime spending flow (not including transfers). That is, both current and future newborns are assumed to face the same (current) spending policies.

DISTINGUISHING BETWEEN CURRENT CONSUMPTION AND INVESTMENT

A.21 As discussed in Chapter 4, Box 4.2 generational accounting does not distinguish between current consumption and investment. A result that shows an inter-generational imbalance that favours current generations at the cost of future generations is therefore likely to overstate the degree of imbalance.

A.22 To illustrate the above statement it is possible to modify the example of inter-generational fairness presented in Chapter 4. Consider Country 2. In Chapter 4 it was argued that policy was generationally unfair as generations 1, 2 and 3 spent more than they raised in revenue. Policy in Country 2 is generationally unfair as long as spending is entirely in the form of current consumption.

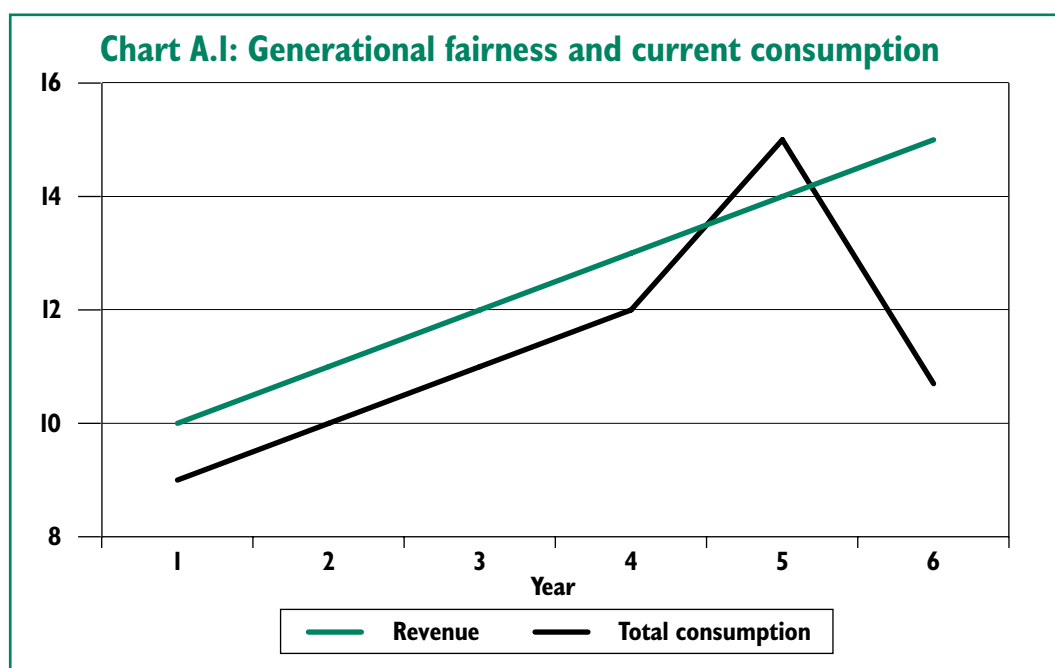
A.23 By distinguishing between current consumption and investment, the result can be changed. Imagine that spending is either in the form of current consumption or investment, and that investment today has a positive impact on current consumption in the future. Specifically, assume that investment today has the same positive impact on the next three generations (ignore depreciation). For example, if the generation in year 1 invested 3 units, then the generations in years 2, 3 and 4 would receive a boost to current consumption by one unit each. By contrast, generation 1 would not receive any boost to its consumption from its own investment.

Table A.1: Illustrative example of generational fairness and current consumption

Year	1	2	3	4	5	6
Country 2						
Revenue	10	11	12	13	14	15
Spending	15	14	13	12	11	8.7
Investment	6	6	6	6	0	0
Current consumption	9	8	7	6	11	8.7
Total consumption¹	9	10	11	12	15	10.7

¹Sum of current consumption and consumption gained from previous generations' investment.

A.24 In the above example it is assumed that the generation in year 1 invests 6 units, leaving 9 units for total consumption. The generation in year 2 spends 14 units but 6 units is on investment as well. Hence the second generation consumes 8 units out of its own spending. In addition it benefits from the first generation's investment which boosts current consumption by 2 units. Hence the second generation has total consumption of 10 units. The third generation benefits from investment made by generations 1 and 2 which boosts its consumption by 4 units in total, and so on. Chart A.1 shows inter-generational fairness when looking at consumption rather than spending. It can be seen that the above example yields a higher degree of inter-generational fairness than previously for Country 2.



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LIST OF ABBREVIATIONS

EFSR	Economic and Fiscal Strategy Report
EMU	Economic and Monetary Union
EPC	Economic Policy Committee
EU	European Union
EYFR	End of year fiscal report
IBC	Intertemporal budget constraint
IBG	Intertemporal budget gap
IGG	Inter-generational balance gap
IMF	International Monetary Fund
GAD	Government Actuary's Department
GDP	Gross Domestic Product
MIT	Massachusetts Institute of Technology
NBER	National Bureau of Economic Research
NHS	National Health Service
NIESR	National Institute for Economic and Social Research
OECD	Organisation for Economic Cooperation and Development
ONS	Office for National Statistics
PDV	Present Discounted Value
WGA	Whole of Government Accounts

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