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AGEING POPULATIONS, PENSION SYSTEMS AND GOVERNMENT BUDGETS: HOW DO THEY AFFECT SAVING?

by
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AGEING POPULATIONS, PENSION SYSTEMS AND GOVERNMENT BUDGETS: HOW DO THEY AFFECT SAVING?

The paper examines the effects of demographic changes on government budgets and national savings. Most OECD countries will experience a rapid ageing of the population in the future and this development will put public pensions, health care systems and government budgets in general under increasing pressure. It could also have adverse effects on national saving. In order to provide some idea of the scale and magnitude of potential future problems the paper presents a quantitative analysis of the effects of ageing populations on government budgets, on inter-generational equity and on national saving and it also discusses policy options to cope with these problems. The paper finds that getting general government fiscal positions into better shape over the next few years would enable governments to better cope with the demographic change that will occur in the first decades of the next century. Furthermore, it stresses that further increases in retirement ages could make a major contribution to balancing pension systems.

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Ce document examine l'incidence de l'évolution démographique sur les budgets publics et l'épargne nationale. Dans un future proche, la plupart des pays de l'OCDE vont être confrontés à un vieillissement rapide de leur population et cette évolution se traduira par des pressions accrues sur les systèmes publics de pension et de santé et plus largement sur les budgets publics. Elle pourrait aussi avoir des effets négatifs sur l'épargne nationale. Afin de donner une idée de l'échelle et de l'importance des problèmes potentiels à venir, cette étude présente une analyse quantitative des effets du vieillissement des populations sur les budgets publics, sur l'équité entre générations et sur l'épargne nationale. Elle analyse aussi les différentes options de politique économique qui pourraient permettre de faire face à ces problèmes. Il en ressort qu'améliorer les positions budgétaires au cours des prochaines années permettraient aux gouvernements de mieux faire face aux changements démographiques qui vont se produire au cours des premières décennies du siècle à venir. En outre cette étude fait ressortir qu'un nouveau relèvement de l'âge de la retraite pourrait contribuer de façon sensible au rééquilibrage des systèmes de pension.

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AGEING POPULATIONS, PENSION SYSTEMS AND GOVERNMENT BUDGETS: HOW DO THEY AFFECT SAVING?

Willi Leibfritz, Deborah Roseveare, Douglas Fore and Eckhard Wurzel[1]

I. Introduction and Summary

1. Demographic patterns in OECD countries indicate that most OECD countries will experience a rapid ageing of the population in the near future. A sharply increasing proportion of the population will be older than current retirement age, potentially placing stress on pensions and health care systems. Ageing populations will also have implications for overall national savings, as both the demand and supply of savings in aggregate is likely to be affected by the demographic mix. The rest of this paper is divided into two chapters. The fiscal implications of ageing populations are considered (Chapter II) and then the impact of ageing on national savings is examined (Chapter III).

2. The evolution of fiscal positions in response to ageing populations depends crucially on the starting point for fiscal positions before the pressure from ageing populations begins to mount. The OECD Secretariat's Medium-Term Reference Scenario (MTRS) provides a scenario until 2000, incorporating the budget plans and targets of member governments. Member countries' likely fiscal positions until 2000 are briefly reviewed in Section II.1 and demographic projections are summarised in Section II.2. Beyond 2000, it is possible to construct scenarios that separate out the main demographically sensitive public expenditures -- primarily pensions, health and education -- and explore how these might evolve over the following 30 years, assuming no changes in policies, and taking into account the overall fiscal positions in 2000 and debt dynamics. This is done for the major seven countries in Section II.3. Such an exercise is obviously highly speculative and relies on fairly heroic assumptions; the main point of these calculations is to provide some idea of the scale and magnitude of future problems.

3. This quantitative analysis suggests that ageing may have a major impact on government budgets in most of the countries considered, although the consequences differ depending on: the starting position; the nature of demographic changes; and the exposure of government budgets to the effects of ageing, in particular through public pension systems and public health spending. The Secretariat's work suggests that the U.S. pension system is in a reasonably good position, but the United States is likely to face major pressures from health care spending and these come on top of a relatively weak starting position (with only

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1. The authors would like to acknowledge the useful comments and contributions received from many members of the Economics Department and, in particular, Mike Feiner, Constantino Lluch, Bob Ford and Paul Van den Noord. Debra Bloch, Anick Lotrous, Chantal Nicq, Jackie Gardel and Tara Gleeson provided invaluable technical assistance.

a small surplus in the primary balance in 2000). Japan starts with a deficit in the primary balance in 2000, and the effect of rapid ageing on pensions from 2005 onwards leads to a sharp deterioration in the overall budget position and a rapid accumulation of net debt. France and Germany are relatively well placed until around 2010 and 2020, respectively, when the costs of the pension schemes are set to rise sharply and in both countries adverse debt dynamics lead to a significantly higher net debt by 2030. Italy also starts in 2000 with a strong primary surplus that is rapidly eroded by the pension system and debt starts to increase sharply from around 2015 onwards. The United Kingdom would experience falling net debt, reflecting the advantages of a good starting position, a less marked ageing effect, and a pension system that is close to balance. Canada, with relatively favourable demographics and pension schemes that run in surplus until 2020, also experiences a fall in net debt, despite health-care expenditures rising more quickly than elsewhere.

4. There are a number of possible policy responses to these developments; some are considered in Section II.4. These include options for:

i) redressing the demographic trends (through raising participation rates, increasing immigration and extending the working lifetime);

ii) making more progress on fiscal consolidation over the next few years to generate a better starting position; and

iii) changing policy settings on health and pensions.

For pension schemes that are in deficit, policy changes must have the effect of raising contributions or reducing pension payments or the deficit must be absorbed within the overall fiscal position. The option that would make the biggest contribution to redressing imbalances would be further increases in retirement ages.

5. In Section II.5, a different perspective on the impact of demographics is taken, making use of generational accounting. This technique is a relatively new approach for examining questions of inter-generational redistribution and the balance between the present generation and future generations. Generational accounts are, so far, only available on a comparable basis for the United States, Germany, Italy, Norway and Sweden, but for all these countries they indicate that the present generation is benefiting at the expense of future generations, and in general by large amounts. In order to restore inter-generational balance (and to ensure very long-term fiscal sustainability) significant policy changes would be needed. For example, to restore generational balance exclusively by spending cuts (across-the-board, immediate and permanent) would require cuts (as a percentage of GDP) of: about 12 per cent for Italy; about 4 to 5 per cent for the United States; about 3 per cent for Norway; about 2 per cent for Sweden; and 1½ to 2 per cent for Germany.

6. In Chapter III, attention shifts to the impact of ageing populations on aggregate private savings and national savings. In a life-cycle framework, households save during their working years and dissave during retirement. This would imply that as the elderly share of the population rises (and working-age populations fall) aggregate private savings would also fall. However, empirical evidence of the effect of demographic factors on private saving in the past is inconclusive.

7. To examine the possible effects of demographics on the evolution of private savings, the Secretariat has constructed simulations from 2000 to 2030 incorporating three alternative assumptions about the saving behaviour of the elderly:

i) that the elderly continue to save so that they can make bequests to their children (dynasty model);

ii) that the elderly dissave, as the life-cycle framework would imply; and

iii) that the elderly shift gradually from saving to dissaving over time, as demographic pressures mount.

These simulations indicate that the demographic impact on private savings is likely to be relatively small in the first two cases and somewhat larger in the third case.

8. These results suggest that government savings are a major determinant of national savings, which are therefore likely to decline as the population ages. However, to the extent that households take into account the future tax implications of current government dissaving and adjust private savings to compensate (as Ricardian equivalence would imply), the impact of demographics on national savings would be attenuated. Empirical evidence suggests that full Ricardian equivalence does not hold, although it might be reasonable to expect that as public debt rises, households are more likely to adjust their private savings. The Secretariat's illustrations suggest that even if half the projected fall in government savings were offset by increases in private savings, national savings would still decline significantly in the coming decades. To the extent that the demographic effects on national saving can or should be offset, the adjustment would need to come mainly from reducing government dissaving. Other (model-based) studies suggest that weaker private saving may play a more important role in the future decline in national saving. Given these inconclusive results, the effects of ageing on private and national saving and on economic growth should be examined further in a global framework, including the demographic and economic developments in non-OECD countries.

II. Impact of Ageing on Budget Balances

1. The starting point: fiscal positions in 2000

9. The Medium-Term Reference Scenario (MTRS) to 2000 (see *OECD Economic Outlook 57*) provides a starting point for longer-term scenarios. In the MTRS, fiscal projections to 2000 assume a significant fall in public-sector deficits: general government financial deficits for the OECD area are projected to fall from their peak of 4.5 per cent in 1993 and 3.4 per cent in 1995 to 1.9 per cent by 2000 (Table 1). However, this is only just sufficient to stabilise gross debt at slightly under 75 per cent of GDP, compared with less than 60 per cent in 1990.

10. The assumptions underlying the Medium-Term Reference Scenario are relatively optimistic. They are based on continued favourable economic conditions and are therefore highly dependent on the realisation of the growth and interest-rate projections embodied in the Medium-Term Reference Scenario (see Leibfritz *et al.*, 1994). They incorporate a favourable interpretation of governments' fiscal plans and

of the ability to realise these plans. The announced plans are generally quite ambitious[2] and indicate a clear intention to reduce public deficits. The United States is an exception in this regard: while the projections reflect fiscal constraint, entitlement spending (especially health care) pressures are expected to emerge later in this decade and -- if no further measures are taken -- the deficit may start to rise again. In addition, the fiscal deficit includes the surplus in the social security sector, which is currently running at around 1 per cent of GDP.

11. Following the fiscal stimulus of the past five years, the Japanese Government is now seeking to consolidate its budgetary position, but is facing the additional fiscal burden of the recent programme to deal with the Kobe earthquake. Though the budget is projected to improve towards the end of the decade, it will still show a deficit of around 2 per cent of GDP by 2000. It should be noted that this position includes the social security surplus, which amounted to 3.5 per cent of GDP in 1994. Although the Japanese Government does not have particular fiscal targets, the concerns about ageing populations are often in the forefront of any discussion of fiscal policy, and there is general concern to ensure that the current social security surplus does not obscure the consequences of other budget policies. A major part of the prospective fiscal consolidation is expected to come from the consumption tax increases that come into effect from 1997. Current spending is also expected to be trimmed, although spending on public works is likely to be maintained as a priority, particularly following the recent earthquake.

12. Within the European Community, the convergence criteria under Maastricht play a major role in guiding fiscal policy. By the year 2000, only Italy and Greece are projected to be running deficits larger than the Maastricht reference value of 3 per cent of GDP, although these countries are projected to make considerable progress in reducing their budget deficits between now and 2000. Consolidation in Europe is likely to result from efforts to control expenditure across a broad range of measures, rather than through major shifts in policy. In some countries, efforts to improve the tax collection system are expected to contribute significantly to higher government revenue. The Maastricht reference value for gross debt of 60 per cent of GDP will be hard to achieve and only Germany, France, the United Kingdom and Luxembourg are projected to have gross debt of less than 60 per cent of GDP by 2000[3].

13. With high debt levels in many OECD countries, debt dynamics play a significant role in the evolution of fiscal positions. For example, in Europe net interest payments already amount to around 5 per cent of GDP. Those countries with high debt levels are particularly vulnerable to adverse movements in interest rates. Given that implicit real interest rates on government debt are currently higher than growth rates, and may well remain so (although the differential is expected to narrow), debt dynamics are unstable and a vicious spiral of debt would ensue unless primary surpluses are large enough to offset the increase in interest payments. Among the major seven countries, only Japan is projected to run a primary deficit in 2000. In the other major countries, primary surpluses in 2000 are projected to range from 0.1 per cent for the United States through to 4.5 per cent for Italy, with sufficient fiscal consolidation during 1995 to 2000 for the debt/GDP ratio to fall in these countries, except for the United States and France.

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2. For example, for France, Italy, the United Kingdom and Canada, the improvement projected in fiscal balances from 1993 to 2000 is generally around 2.5 percentage points of GDP (or more) larger than the improvements in balances achieved during the late 1980s, despite slower growth projected for the 1990s.

3. Luxembourg is not, in fact, included in the Medium-Term Reference Scenario; a separate Secretariat estimate has been made for that country.

14. In short, these scenarios embody the view that by 2000 most OECD countries will have mastered the immediate priority of stemming the increase in debt, but that debt ratios and the associated interest payment burden will remain high. Any slippage would risk a debt-interest payment vicious circle. In addition, most OECD countries will be facing the demographic pressures of ageing populations in the early part of the next century. These will add to the pressure on fiscal positions and reinforce the need to avoid slippage in these fiscal plans.

2. Lower population growth and declining workforce[4]

15. Demographic trends in OECD countries reflect considerable changes taking place. Population growth of OECD Member countries has been slowing in recent decades, from 1.1 per cent per year in the 1960s to 0.8 per cent per year in the 1980s and -- despite considerable uncertainty about the long-term evolution of birth rates, mortality rates and immigration -- the demographic patterns for the next few decades are, to a large extent, already determined. It is generally accepted that industrial countries can expect a considerable degree of ageing during the first half of the next century as illustrated by the World Bank's population projections (Bos *et al.*, 1994) used in the analysis in this paper[5]. For the major seven countries, the demographic developments are illustrated in Figure 1, and some clear differences can be seen. In the United States and Canada -- and also, to a lesser extent, in France and the United Kingdom -- the overall population is projected to grow until around 2030 and then to stabilise. But in Japan, Germany and Italy significant falls in overall population are projected. In the United States, the working-age population (adjusted for scheduled increases in retirement ages[6]) is projected to increase until 2020 and to decline slightly between 2020 and 2035 before starting to grow modestly again, while sharp falls are projected in the course of the next three decades in Japan, Germany and Italy, and moderate falls in France, the United Kingdom and Canada.

16. In all major seven countries except the United Kingdom, elderly dependency ratios (the ratio of elderly to the "adjusted" working-age population) are projected almost to double by around 2030 to 2040 before stabilising or falling slightly. In Japan, Germany and France, elderly dependency ratios are projected to peak at around 0.6 and in Italy, at over 0.7, while the peak for the United States, the United Kingdom and Canada is likely to be around 0.4 to 0.5.

3. Ageing and fiscal pressures: scenarios for the major seven countries

17. Ageing populations are likely to put significant pressure on public spending programmes, especially those linked to life-cycle developments, such as health care and pensions. Moreover, potential GDP growth is projected to slow down as a result of demographic changes, making these pressures harder to bear for the economy as a whole. Furthermore, projected high debt levels over the medium term and associated debt interest payments will exacerbate these fiscal pressures. This section builds on the medium-

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4. See Annex 1 for a more complete description of demographic trends and projections.

5. Except in the calculation of generational accounts, where national sources were used in most cases.

6. These are described in detail in Section II.3.1.

term scenario presented above to construct an illustrative long-term scenario of how the main demographically sensitive public expenditures -- pensions, health and education -- might evolve. Such an exercise is obviously highly speculative and relies on fairly heroic assumptions; the main point of these calculations is to provide some idea of the scale and magnitude of potential future problems.

3.1 Public pensions

18. All major seven OECD countries have multiple *public pension schemes,* either with different schemes covering different segments of the working population, or different schemes funding different components of the overall pension received (usually where benefits combine flat-rate and earnings-related components) (see Annex 2 for further description of public pension schemes in OECD countries). Countries typically also provide a flat-rate pension to those elderly who do not qualify for a pension on the basis of their earnings and contributions history and these benefits are usually financed from general taxation receipts. Public servants often have separate pensions schemes that are funded largely from general taxation, although some contributions may be levied on employees.

19. Payroll taxes are generally levied as "contributions" and the pension benefit entitlements are usually based on a formula incorporating the previous earnings and the number of years of contributions made. Once a pension has been calculated, it is thereafter more or less indexed to inflation, except in Germany where it is linked to net wage growth. However, the formulae for calculating contributions and pension payments are generally not actuarially "fair"[7]. In the past, more favourable demographics and, in some cases, the immaturity of schemes[8] have generally resulted in contributions equal to or exceeding pension payments in any one year.

20. A key distinguishing feature between schemes in different countries is the age of retirement. When most pension schemes were instituted, they were generally designed to cover a relatively short number of years between work and death. As life expectancy has risen and is expected to rise further, a number of countries have scheduled increases in retirement ages. Changes in the retirement age are already legislated to take place in the United States, Japan, Germany, Italy and the United Kingdom. In the United States, the retirement age will increase gradually from 65 to 67 by 2022. In Japan, the retirement age for men will increase gradually from 60 to 65 by 2014 and for women from 60 to 65 by 2019. In Germany, the retirement age is currently 63 for men and 60 for women and from 2001 it will be raised gradually to 65 by 2009 for men and by 2018 for women. In Italy, the retirement age of 60 for men and 55 for women is being raised rapidly to 65 for men and 60 for women: the increases will be fully phased in by 2001. In 1995, the retirement ages were raised to 62 for men and 57 for women. In the United Kingdom the retirement age of 60 for women will be raised to the male retirement age of 65 between 2010 and 2020. France, however, has no plans to raise the current retirement age of 60 (although the number of years of contributions required to qualify for a full pension will be raised) and Canada plans to keep its retirement age at 65.

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7. An actuarially fair pension would equate the net present value of contributions made with the net present value of pension payments paid for the expected duration of retirement.

8. An immature scheme is one which is younger than the working life of those currently retiring, so that the participants retiring have not contributed for their entire working life and do not qualify for full pensions; for example, a scheme started in 1960 and requiring 40 years of contributions for a full pension would mature in 2000.

21. Simulations illustrating the possible evolution of public pension schemes until 2070 have been run for the major seven countries. Despite efforts to capture as fully as possible the institutional arrangements in each country, simplifying assumptions have been necessary and the scenarios should be viewed as broadly indicative only. Further description of the methodology underpinning these simulations is presented in Annex 2. The simulations follow the path of the OECD's Medium-Term Reference Scenario until 2000, so that output gaps close and unemployment is close to the natural rate. After 2000, the ratio of employed to the working-age population is assumed to remain constant[9]. GDP growth rates are determined by the growth in labour productivity and changes in the working-age population. Three alternative labour productivity growth-rate assumptions have been used: 1 per cent, 1½ per cent and 2 per cent.

22. The projected pension flows -- contributions and pension payments -- assuming a productivity growth rate of 1½ per cent are shown in Figure 2. Three key features emerge. First, there is a marked difference in the magnitude of pension payments: in the United States, the United Kingdom and Canada, pension expenditure peaks at between 5 and 8 per cent of GDP, compared with pension expenditure peaks of between 15 and 20 per cent of GDP for Japan, Germany, France and Italy. This reflects both the relative generosity of pensions and the elderly dependency ratios. Second, in Japan, Germany, Italy and the United Kingdom, pension payments peak and then fall once the baby-boom generation has passed (around 2035-2050). In contrast, in the United States, France and Canada, pension expenditures reach a plateau in the second half of the period covered by the scenario. Third, despite higher contribution rates, the gap between contributions and pension payments is much larger in Japan, Germany, France and Italy than in the other three countries.

23. The gap between the flows of contributions (including other revenues of the pension systems) and pension payments can also be expressed in net present value terms incorporating the assets of the public pension schemes where they exist (the United States, Japan and Canada). The main advantage of summarising net pension flows in net present value form is that it allows for easier comparison between different simulations, but the same pension flows can produce quite different net present values depending on the discount rate used (see Box A). The pension flows, converted to net present values using discount rates of 3, 5 and 7 per cent, are shown in Table 2. The alternative productivity growth assumptions used to estimate pension flows (1, 1½ and 2 per cent per year) have much less impact on the results than the discount rates used. Although a 1 percentage point difference in discount rates and in productivity growth rates would yield similar changes in net present values, the plausible range of productivity growth rates is much narrower than the plausible range of discount rates.

24. Earlier Secretariat work, using a stylised model of public pension systems, produced estimates of net pension liabilities that are significantly different for some countries than those reported here (Van den Noord and Herd, 1994). The two sets of simulations are not directly comparable, however, for several reasons. The previous analysis used a generic model designed to capture the main institutional characteristics of a "typical" public pension system, whereas for this study a different simulation model has been constructed for each country, incorporating the differing structures of national public pension schemes. The simulations here also include recent reforms which have been legislated to take effect in coming years. Additionally, the stylised model used different discount rates and a different forecast time horizon. The

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9. This assumption implies that the ageing population does not affect structural unemployment, or participation rates.

BOX: Discount Rates

Discount rates have been applied both in the analysis of pensions and in the inter-generational accounting analysis to convert projected annual flows into net present values. A higher discount rate would reduce the net present value of future flows compared with a lower discount rate, and the longer the time period under consideration, the greater the sensitivity of the results to the choice of discount rate.

However, there are differing views about how to choose an appropriate discount rate for this analysis. One option would be to use the real interest rate on government bonds, since this rate reflects the standard way of evaluating the trade-off between taxation in two different periods and recording it in the government's balance-sheet. In effect, future deficits should be discounted by the cost of additional debt servicing and similarly future net tax payments should be discounted by the savings in debt servicing costs (through repayment of outstanding debt). However, to the extent that there are uncertainties and risks of future fiscal flows which are not covered by the government bond rate, the discount rate should be higher to account for such risks.

An alternative option would be to use a discount rate based on the average real rate of return that could be earned by a private investor. But if the higher real return on capital reflects in part its particularly high volatility or risk, it may be inappropriate to discount these flows using such a high rate.

A third option is to derive the discount rate from the rate of time preference. However, this value is not observable.

Given the range of views about appropriate discount rates and the wide range of rates used in previous studies (from 2½ per cent to 10 per cent), the calculations use three different discount rate assumptions: 3 per cent, 5 per cent and 7 per cent. This range encompasses differing interpretations of the appropriate choice of discount rate and allows for sensitivity analysis of the discount rate assumption.

simulations presented here give broadly similar results to those found in national studies of actuarial soundness of pension systems.

3.2 Public expenditure on health

25. The pattern of health care costs at different stages in the average life-cycle has been established in a number of studies: costs are relatively high in the first year of life, but they fall to low levels throughout childhood and adolescence. There is a small rise in early adulthood, especially for young men, reflecting injuries in particular, and an increase for women during their child-bearing years. Costs rise mildly but progressively after the mid-forties and then very steeply in the late seventies. This life-cycle implies that as the numbers of elderly increase, total health care costs are also likely to rise.

26. The effect of increased life expectancy on health costs is more difficult to establish because it depends, in part, on the physical dimensions of the ageing process. It has been argued that the major increase in health costs in later life is actually determined by the lifetime remaining before death occurs. On this basis, increased life expectancy would not increase health costs per person significantly. But the alternative case is also made that as life expectancy rises, people experience more episodes of major medical intervention. On this basis, an increase in life expectancy would lead to an increase in costs per person. The physical aspects of ageing (generally referred to in the scientific debate as the "compression of morbidity" thesis) and their impact on health care costs remain a matter of on-going debate elsewhere (OECD, 1994*a*) and are not taken further in this paper.

27. As the starting point for the estimates presented here, a baseline scenario of health spending has been derived by separating public expenditures on health care into two parts: spending on under 65 year olds and spending on those 65 years and older. Relative proportions of public health spending for these two age groups were taken from OECD (1987) and updated from other sources where possible. The resulting per capita ratios for each of the major seven countries vary quite significantly. The United States in particular shows a very high ratio, because a high proportion of health spending on the over 65 year olds is covered through public expenditure (Medicare and Medicaid[10]), whereas the rest of the population is covered mainly by private health care schemes.

28. In order to isolate and examine the effects of demographics on health spending, per capita health spending (broken down by age group) is assumed to grow in line with productivity growth[11]. Experience during the 1980s indicates that, in fact, per capita real public expenditures on health care have risen faster than this assumption would suggest, except in Japan and Germany. This assumption could be interpreted as implying that the increases in health costs faster than the rate of inflation that have occurred in the past (see Oxley and MacFarlan, 1994) are brought under control and the per capita increase reflects only technological advances and/or more interventions as people live longer. The expenditures derived for each of the age groups, adjusted for productivity, were then projected forward by the growth in their corresponding projected population age groups.

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10. The elderly receive the bulk of their health care from Medicare, which is often supplemented by private insurance. In addition, the poor elderly receive coverage from Medicaid for care not covered by Medicare, particularly nursing homes.

11. In these scenarios productivity growth is assumed to be 1 1/2 per cent per year.

29. The results of this procedure should be regarded as indicative only -- they are simply an attempt to illustrate the effects of demographics and should not be interpreted as projections of public health care spending which would require taking other factors into account. The results are summarised in Table 3 and they illustrate significant variations between countries. In the United States and Canada, whose populations are growing as well as ageing, public spending on health care as a per cent of GDP would rise significantly. In the United States, the effects of ageing are exacerbated by the particularly high share of public health spending which is spent on the over 65 year olds compared with the under 65 year olds. The other five major countries would experience more modest increases in public health expenditures as a per cent of GDP. In these countries, the falling population of under 65 year olds offsets the higher costs due to the effects of ageing and of per capita health care expenditures rising faster than GDP.

30. Sensitivity analyses have been carried out on the two key assumptions underpinning these scenarios. The first examines what increases would arise if all countries had the estimated average ratio of public health spending on the old versus the young of 4.2:1, instead of the estimated ratios for each individual country. Changing this assumption has the most effect for the United States, where it reduces the increase by around 1 percentage point of GDP, and for Germany, France and Italy, where health expenditures would rise more rapidly. The significance of the second key assumption is tested by examining what would happen if per capita health expenditures grew 1 percentage point slower than productivity growth each year. For the United States and Canada, health expenditures as a per cent of GDP would then increase by only ½ percentage point of GDP between 2000 and 2030 and for the other countries, health expenditures would fall by around ½ percentage point of GDP.

3.3 Public expenditure on education

31. It might be expected that demographics would also affect public spending on education, generating some savings in those countries where school-age populations are projected to fall, notwithstanding the assumption made in the demographic projections that countries where fertility is currently below replacement rates will return to replacement rates by 2030[12]. To examine the possible impact of demographics on education, a scenario has been constructed by calculating per pupil public expenditures on education for different age groups, based on data on public spending by type of education -- from pre-school to post-graduate -- and participation in schooling by age group for 1991 (OECD, 1994*b*). As with health spending, it has been assumed that education spending per pupil would grow in line with productivity. This assumption would imply an increase in quality of spending per head, if productivity increases in education were able to keep pace with the overall productivity rate, leading to a fall in education costs over time for a given quality of education. (It is assumed, however, that this productivity gain would not change the length of time spent in education -- any change in the time spent in education before entering the workforce would also have an impact on GDP growth through the working-age population).

32. This scenario indicates that education spending will change very little -- at most, 0.3 per cent of GDP between 2000 and 2030 as shown in Table 4. This is despite significant falls in the school-age population everywhere except in the United States and Canada where the school-age population rises. The fall in school-age populations is, to a large extent, offset by the effect of GDP growing slower than productivity when the working-age population is falling, which results in per pupil education expenditures

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12. Projections of the number of children are considerably less certain than the numbers of elderly in the future, since the latter can be readily extrapolated from the present age structure.

rising faster than GDP. Italy, which has the strongest fall in school-age population, also experiences a shrinking working-age population for 2005 onward. However, if per capita public spending on education were to grow at 1 percentage point slower than productivity, the education spending as a per cent of GDP would fall in all countries. In the United States and Canada, spending could decline by 1½ percentage points of GDP.

3.4 Primary balances, debt dynamics, financial balances and net debt accumulation

33. In an attempt to estimate the combined effect of demographics on budget positions and to allow the calculation of related debt dynamics, the evolution of primary balances on the basis of the effects calculated above on pensions, health and education expenditures and revenues has been estimated until 2030. The starting point of these simulations is the Secretariat's Medium-Term Reference Scenario for 2000, summarised above. Revenues and expenditures on all items in the primary balance other than pensions, health and education have been assumed to remain constant as a percentage of GDP.

34. The primary balances that result from these simulations are shown in Figure 3. In 2000 all major seven countries except Japan are projected to have a positive primary balance. However, these primary balance positions are subsequently eroded, and by 2030, they range from approximate balance for the United Kingdom to a deficit of 8 per cent for Japan. The components of expenditure that contribute to the primary balance are shown in Figure 4 along with primary revenues and there are considerable variations between countries. Pensions expenditures play a major role in the deterioration of primary balances in Japan, Germany, France, Italy and Canada, rising by almost 4 to 7 percentage points of GDP between 2000 and 2030. In the United States and the United Kingdom, pension outlays play a much smaller role, and in Canada rising outlays are partially offset by increases in contributions. However, health care expenditures rise more sharply in both the United States and Canada than in other countries[13].

35. Overall fiscal positions are determined not only by the primary balance but also by the cost of servicing debt. Where growth rates are lower than interest rates (expressed in nominal or real terms) a vicious circle of rising debt as a per cent of GDP will follow, unless the primary balance is sufficiently in surplus to offset increases in debt interest payments, which in turn depend on the initial stock of debt.

36. The combined effects on public finances of the factors listed above are presented in Table 5. Primary balances, interest payments, financial balances and net financial liabilities are presented separately to show the evolution of debt dynamics. Debt dynamics depend on the path of future real market interest rates as compared to economic growth, which is highly uncertain. It is also not clear if, and to what extent, the implicit net interest rate of the stock of "old debt" (net interest payments as a percentage of net debt) will move towards the market rate. For illustrative purposes, four alternative scenarios have been calculated. The first assumes that the real interest rates (derived from net interest payments and net debt in 2000) stay constant from 2000 onwards at levels which are country-specific for debt accumulated up until 2000, while for new debt accumulated from 2001 onwards a real interest rate averaged over the major seven countries was applied. Because GDP growth rates (derived from growth in the working-age population and an assumed annual rate of productivity growth of 1½ per cent) fall between 2000 and 2030, the positive interest rate/growth rate differential widens. The second scenario assumes that the real interest rate/growth rate differentials stay constant, which implies that real interest rates (on old debt and new debt) fall between 2000 and 2030. In the third and fourth scenario, the (implicit) interest rates on old debt are

13. For the United States see also Auerbach, 1994.

assumed to approach market interest rates so that (after a five-year adjustment period) there is no difference between interest rates on old debt and new debt. In contrast to the first three scenarios, which apply an average real market interest rate on new debt, the fourth scenario applies country-specific real market interest rates (derived from the MTRS in 2000). None of these assumptions attempt to take into account the impact that fiscal positions and public debt levels might have on interest rates and, as might be expected given the long simulation period, the alternative interest-rate assumptions introduce a considerable degree of variability into the projected outcomes.

37. The combined effects of developments in primary balances and the debt dynamics give the following results:

- In the United States, net public debt levels may remain stable until around 2010 at around 40 per cent of GDP but then they would start rising to around 105 to 120 per cent of GDP by 2030 (depending on the interest-rate assumptions) despite relatively favourable demographics and a public pension scheme that is generally well financed. The increase largely reflects significant increases in public expenditures on health care.

- In Japan the primary balance, while improving over the medium term, remains in deficit and deteriorates rapidly after 2000 due to the sharp increase in pension expenditures. Adverse debt dynamics result in net debt rising from about 25 per cent in 2000 to around 255 to 315 per cent of GDP by 2030.

- Germany is relatively well placed until around 2020, largely because of its comfortable primary surplus in 2000 and the relatively small deficits of the pension scheme until around 2020. While the age structure of the population deteriorates earlier, the dependency ratio does not increase significantly because the retirement age is increasing. But after 2020, the pension deficit deteriorates sharply and by 2030 net debt is around 80 to 105 per cent of GDP, as compared with around 45 per cent in 2000.

- France also has a reasonably good primary balance position in 2000, but after 2010 pension expenditures rise significantly, rapidly eroding the primary surplus. Adverse debt dynamics result in net debt rising steeply from 40 per cent in 2000 to around 75 to 105 per cent of GDP by 2030.

- Italy is projected to generate a primary surplus sufficiently large to produce a virtuous circle of debt reduction from 120 per cent in 1995 to between 80 and 100 per cent in 2015, despite its current very high debt/GDP ratio. But the rapid increase in pension expenditures leads to a deterioration in the primary balance of around 9 percentage points of GDP between 2000 and 2030. Adverse debt dynamics start to come back into play around 2015 and by 2030 net debt is 125 to 175 per cent of GDP.

- In the United Kingdom, with the advantages of a good starting position and a public pension scheme that runs only a small deficit, net debt as a per cent of GDP falls to very low levels and by 2030 in two of the scenarios it even turns into a small net asset position. However, in these circumstances, the assumptions of unchanged policies for other spending and taxes may well be not realistic; policies might tend to become less restrictive with the evolution of debt thus being less favourable.

-- Canada, under the assumption that announced medium-term consolidation targets are fully met, is projected to run a comfortable primary surplus by 2000. With announced pension policies including significant increases in social security contributions, the surplus will remain high until around 2020. But, thereafter, it will decline due to the continued increase in health-care and pension outlays. Nevertheless, Canada's net debt falls sharply and turns to a small net asset position by 2030. As with the United Kingdom, in these circumstances the assumptions of unchanged policies may not be realistic.

3.5 The pure ageing effect on debt accumulation

38. The evolution of overall net debt depends on the starting levels of net debt and primary balances in 2000. Another set of simulations examines the accumulation of debt due solely to the change in demographics -- the pure ageing effect. To do this, the debt accumulation resulting from servicing existing debt and primary balances in 2000 is eliminated and the remaining debt accumulation, resulting only from the change in primary balances from 2001 onwards, captures the pure ageing effect. The interest-rate assumptions correspond to those made above[14]. As shown in Table 6, by 2030 the deterioration in primary balances would produce significant debt/GDP ratios for all countries, ranging from about 27 per cent for the United Kingdom to as much as 180 per cent or more for Japan.

39. These results, compared with the overall debt accumulation, reinforce the importance of the initial starting position. In the United States, Japan, Germany, France and Italy, the pure ageing effect and the initial starting position both lead to debt accumulations, whereas in the United Kingdom and Canada, the debt accumulation due to the pure ageing effect is offset by the debt decumulation due to favourable initial starting positions.

3.6 Impact of productivity

40. This analysis is clearly dependent on the assumptions made about productivity growth, not only in calculating primary balances, but also in the debt dynamics. To examine what difference higher or lower productivity would make, the simulations were re-worked, assuming productivity growth rates of 1 and 2 per cent per year instead of 1½ per cent. Higher productivity growth would increase both spending that is linked to productivity growth and the rate of GDP growth itself. On balance, higher productivity growth would slow down the rate of debt accumulation in all countries, as shown in Figure 5.

4. Policy options

41. Where major fiscal pressures have been identified above, it is clear that some policy action will be needed to redress imbalances. Without such action, government dissaving could also lead to significant reductions in national savings in some countries, as shown in Chapter III. In this section, three broad types of policy responses are considered: i) policies that would increase the workforce; ii) improving overall budget positions; and iii) modifying health and pension programmes to reduce their net fiscal costs. Given the size of the problem in some countries, a mix of policies would probably be required as no single policy may be sufficient to redress the imbalances completely.

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14. There are only three interest-rate assumptions as there is no "old debt".

4.1 Increasing the workforce

42. Since the pressures on government budgets originate from the demographic projections, one possible response would be to attempt to increase the workforce. This would both raise potential output[15] and temper the increase in the effective dependency ratio[16], thereby reducing public expenditures on the elderly as a per cent of GDP. The three main options are to raise the participation rate, increase immigration and increase working lifetimes.

Raising participation rates

43. Perhaps the two most notable features of current participation rates are the differences between rates for men and women, and the drop in participation rates after the 45 to 54 age bracket. For the OECD as a whole, participation rates for men are currently around 20 percentage points higher than for women, with marked differences across countries -- France and Canada showing differences of around 15 per cent, while Japan and Italy are around twice that. In some cases, the gap in part reflects differences in retirement ages for men and women (see Section II.3.1 above). However, participation rates for women are lower than those for men in all age groups. It is also significant that participation rates fall sharply in most countries well before the formal retirement age. In part, this reflects reliance on "early retirement" policies as a response to high unemployment (see OECD, 1992). This is especially evident in France where participation rates for the 55-59 age bracket fall by 25 percentage points from the rates for the age bracket 45-54. But raising the overall participation rate would only affect GDP growth rates in the period when raised, although GDP levels would be higher in subsequent years. Policies aimed at increasing participation rates *per se* may be difficult to design[17], but at least policies which discourage participation could be avoided, especially those policies that discourage part-time working arrangements (OECD, 1994*c*).

Increasing immigration

44. Increasing immigration from countries outside the OECD area could provide a means of increasing the workforce and, to some extent, offset the fall in working-age populations that is projected to occur in some countries[18] (although such a policy may be viewed negatively by the migrants' home country as encouraging a "brain drain"). Programmes tailored towards attracting immigrants chosen for their capacity to contribute to the economy, taking into account the age and skill level of potential migrants, are already in place in Canada, Australia and New Zealand, although the number of immigrants entering under these

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15. It is assumed that from 2000 onwards, potential output and actual output are the same.

16. The ratio of non-workers (including children and the elderly) to workers. This differs from the standard definition of the dependency ratio which show the ratio of the non-working-age population to the working-age population.

17. Policies would need to be based on a more specific analysis of the reasons why participation rates show the pattern that they do, which is beyond the scope of this paper.

18. It should be noted that the population projections used in this document assume that no net migration flows take place by 2030, compared with positive net inflows in almost all OECD countries during the period 1990 to 1995 (see Annex 1). In this respect, the population projections are thus relatively pessimistic.

programmes remains small relative to overall immigration flows in those countries. However, the interaction between immigration and economic performance may be quite complex and, in any case, there are likely to be practical limits on the extent to which immigration can be increased, depending on how easily immigrants can be absorbed in different countries and the age and family structure of immigrants. But for those countries where the working-age population falls most sharply (Japan, Germany and Italy), it is difficult to see how these countries could absorb the cumulative number of immigrants that would be necessary to keep the working-age population from falling[19].

Increasing working lifetimes

45. For the major seven countries, life expectancy at 60 has increased by roughly four to six years for men and seven to nine years for women during the course of this century, although Canada is an exception with significantly lower improvements (United Nations, 1993). World Bank projections for life expectancy (at age 15) imply further increases of four to five years between now and 2030. At the same time, the age of entry into the workforce has become progressively later during the past century (as the number of years of schooling have increased). In addition, the shift of work activity from manual to more sedentary jobs brought about by technological development and the shift towards services, suggests that jobs have become less physically demanding over time. These three factors together suggest there may be more scope[20] for lengthening the working lifetime (beyond already scheduled increases), especially in those countries with low retirement ages, and facing the biggest falls in working population -- France and Italy. France, in fact, lowered its retirement age from 65 to 60 in 1982. This option, recast as an increase in retirement ages, would have an impact not only on GDP growth, but also on elderly dependency ratios, as illustrated in Figure 6. The implications for public pension schemes are considered further below.

4.2 Improving overall budget positions

46. Given the demographic pressures building up, there may be scope for reducing the budgetary pressures either by building up a better starting position before demographic pressures mount or by raising taxes or cutting other expenditures in the longer term.

A better starting point

47. A better starting point -- a lower net debt/GDP ratio and a higher primary surplus in 2000 -- would generate significantly more favourable debt dynamics. In the long-term baseline scenarios as described above, for the United Kingdom and Canada, net debt is already projected to fall over the period to 2030, and in Germany, France and Italy, it remains flat, or even decreases, until around 2015 to 2020, when it starts to rise. The effects of starting with primary surpluses 1 percentage point of GDP higher in 2000 are shown in Figure 7. In the United States, this would result in debt in 2030 being around 40 per cent of GDP lower at around 65 per cent of GDP and for Japan, France and Italy, it would lead to debt positions in 2030 being around 50 percentage points of GDP lower than otherwise.

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19. The number of working-age immigrants that would be needed in 2050 to fully offset the fall in working-age population between 2000 and 2050 (when the working population stabilises at a lower level) would be around 13 to 15 million in each case for Japan, Germany and Italy, or between 20 to 40 per cent of the working-age population.

20. That is, the average 65 year old may be in increasingly better health as a result of these factors.

Raising taxes or cutting other primary expenditures in the longer-term

48. Keeping debt ratios constant at their levels in 2000 would require improvements in primary balances amounting to around 5 to 9 per cent of GDP by 2030, except for the United Kingdom (around ½ to 1 per cent), and Canada (around 2½ to 3½ per cent), as shown in Table 7. On the expenditure side, the scope for leaving health, education and pensions untouched and finding sufficient savings elsewhere, would seem to be very limited. For example, for the United States such an approach would be equivalent to eliminating all defence spending; for Japan, it would be equivalent to cutting out twice all spending on general public services and defence; for Germany, all general public services plus around a third of defence. Given concerns about existing overall tax burdens, the option of raising taxes is not considered further in this paper.

4.3 Reforming public pension and health programmes

49. Given the large impact of ageing populations on health and pensions and the large impact these will have on total public outlays, changing the parameters of policies governing these two sectors may provide the most direct scope for controlling fiscal pressures.

Pensions

50. It is clear that if present pension payments are left untouched, the pension schemes in some countries would impose major burdens on their societies in the next century, either through requiring higher taxation or other spending cuts, or by rapidly increasing public debt burdens resulting from high primary deficits, compounded by explosive debt dynamics. It is unlikely that the working population in the early to middle part of the next century would be willing to sustain the magnitude of inter-generational transfers that these burdens imply. Early announcement of reforms would allow people the longest possible period to adjust their behaviour to pension reforms (and what these might imply for their preferred consumption and savings patterns), would minimise the adjustment cost associated with any change and spread the burden more evenly between the present workforce and the workforce in the next century. Phasing-in some reforms might also be necessary to allow people reasonable time to adjust their behaviour. The age cohort just about to retire, for example, would have little time to adjust their savings behaviour to lower public pension payments than they would have expected.

51. One radical reform option that has been mooted would be to move to a "defined benefit" basis for calculating public pensions. Under such a scheme, those already retired would receive pensions equivalent to the contributions that they have paid (employer and employee contributions paid as payroll taxes) adjusted to net present value as if their pensions had been paid into a fully funded pension scheme and earned interest[21]. For those currently in the workforce, their past contributions could be calculated as quasi-contributions on the same basis as the present retired, and their future contributions could actually be paid into a separate public fund and earn interest. For someone commencing work today, their

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21. But estimating the net present value of contributions, as if they had been invested in a fund, would almost certainly prove contentious, given the need to estimate what an investment earnings stream over the past 40 years might have been.

contributions could be paid entirely into a fund[22]. Although such an approach would be actuarially fair, it makes no allowance for differences in personal circumstances, whereas a major objective in the design of public pensions is the alleviation of old-age poverty, which would seem to imply that some redistribution of income would need to be funded through general taxation. During the transition period until the fully funded scheme covers all of the workforce and the retired, some funding through general taxation would be necessary.

52. In addition, payment of contributions into a separate fund would not, in itself, change the fiscal arithmetic, although it might make it easier to persuade the electorate to accept other pension changes, and it would make the scheme resemble more closely what many people believe it to be -- an insurance scheme that pays pensioners back what they have contributed. Whether or not a separate fund was established, it would still be necessary to raise additional tax revenue or lower expenditures in order to reduce overall fiscal pressures. This would be achieved if additional tax revenue were raised to cover the existing and future pensions until the "fund" was fully operational and in effect "replace" the current and future contributions that would henceforth be paid into the fund. And where overall pension payments under existing rules are higher than they would be under a "defined benefit" scheme (combined with measures to avoid old-age poverty), moving to defined benefits would generate savings in overall expenditure. However, if this implied significant cuts in pension payments, then a phasing-in period would be necessary to give those retired or close to retirement time to adjust.

53. An alternative radical reform would be to reorient pension schemes towards the more limited objective of ensuring only that old-age poverty is avoided, leaving people free to manage their additional savings as they wish through private pension schemes[23]. This would argue for paying flat-rate pensions without income-related supplements[24]. Most countries already have either a flat-rate component, or provide a minimum pension regardless of contributions made. If pensions were reduced to modest flat-rate levels (such as 25 per cent of average wages), this could achieve significant savings, as illustrated in Table 8 (except for the United Kingdom, where future replacement rates on public pensions are even lower in the base case). However, such a proposal would be likely to meet major resistance from pensioners and those close to retirement.

54. Other options would preserve the current nature of the payroll tax contributions and income-related pensions of current schemes, but would change some of the parameters that determine revenue and/or expenditure. Three possibilities have been considered here: raising contribution rates, lowering pension payments and raising the retirement age. The combination of falling working populations and rising numbers of pensioners, mean that even quite major increases in contribution rates or reductions in pension payments would be insufficient to balance those schemes that face the greatest problems, as the sensitivity analysis in Table 9 shows. Raising retirement ages (beyond changes already scheduled) provides greater

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22. Moving to a fully funded public scheme, whether or not it was strictly actuarially fair, would also raise a number of issues about risk exposure and how investment funds should be monitored, which are beyond the scope of this paper.

23. In principle, this could also include means-testing pensions, but any attempt to do this would need to be very carefully designed to avoid adverse incentives.

24. This could be managed either directly or indirectly through tax claw-backs that achieve the same result.

scope for rebalancing schemes, with the advantage of a two-fold impact: through increasing the working-age population and therefore both GDP itself and the contributions paid, and decreasing the number of pensioners in any one year. Those countries with the lowest retirement ages, after current reforms are implemented, France and Italy, are also those facing the largest pension pressures and the policy option of raising retirement ages significantly would seem to offer the most scope for easing the pressure, especially as experience elsewhere indicates that raising retirement ages is a practical and feasible policy option.

Health

55. Containing the growth of public health expenditures as populations age depends, in significant part, on controlling the growth of per capita public health expenditures, which are likely to depend on better design of health care systems and policies to achieve greater micro-efficiency (Oxley and MacFarlan, 1994). These policy options would be very specific to each country, but it is perhaps worth noting that it would only be necessary to hold growth in per capita real public health spending to around ½ to 1 per cent lower than productivity growth in order to offset the impact of ageing on health spending.

56. One area that is beginning to receive more attention, and where there may be scope for policy, is long-term nursing care of the frail elderly. The provision and financing of long-term care varies from country to country (both home care and institutional care), but all are funded on a pay-as-you-go basis. Some of the impact of demographic pressures on long-term care may be tempered by better case management designed to ensure that the frail elderly are well cared for in the most cost-effective manner (OECD, 1994*d*). To the extent that current public policy settings work against this, either through the regulatory structure, through lack of co-ordinated structures, or through the incentives built into the structure of payments for care, there may be scope for improvement. Another issue that could be examined further is the scope for further use of means-testing for publicly financed long-term care, including housing assets[25]. It should be noted, however, that means-testing can lead to some perverse incentive structures for those around the means-test threshold. One option that has been suggested is to require current workers to make contributions to a new "fund" from which they could draw in future years to cover their long-term care costs. Such an option might have some presentational advantages because it looks like an insurance scheme, and would present a means of easing the burden on future taxpayers, relative to current taxpayers. However, this approach would not make any difference from a fiscal point of view, except to the extent that it implies raising additional revenue through taxation, which would result in a better fiscal position before demographic pressures mount.

25. Housing assets are often excluded in present means-test criteria. This may have the indirect effect of encouraging more use of home equity conversions, such as reverse mortgages and sale-leaseback, which would allow the elderly to more effectively utilise their private assets (OECD, 1994*d*).

5. Generational accounting

57. The interaction between population ageing and fiscal transfers has also been analysed in an inter-generational accounting framework[26]. Essentially, the generational accounting method is aimed at assessing whether typical members of each generation would receive back in transfer and services over their lifetime what they have paid in taxes (in net present value terms and adjusted for productivity growth), given the need eventually to satisfy an inter-temporal budget constraint that requires the present value of future tax payments (of existing and future generations) to equal the present value of all future government consumption less the initial stock of debt[27]. To allow for summary comparisons of net lifetime transfers[28], the results are presented as a comparison between the newborn generation (in the base year 1993) and unborn generations (Annex 3).

58. The Secretariat has asked experts in various countries for which generational accounting models are available (the United States, Germany, Italy, Sweden and Norway) to calculate generational accounts on a comparable basis[29]. Although generational accounting serves a complementary role to the approaches applied in the previous sections, some caution is needed when comparing the results. Differences may be due to the different methodology, different time horizons[30] and -- in some cases -- different policy assumptions[31] and different population projections[32]. Furthermore, the empirical basis for generational

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26. See, for example, Auerbach *et al.*, 1991; Gokhale *et al.*, 1994; Franco *et al.*, 1992 and Office of Management and Budget, 1994.

27. The inter-temporal budget constraint implies that over an infinite time horizon the present value of net debt must approach zero. The current value of debt may still be positive and rise, but its rate of increase must be lower than the discount rate, which implies that the primary balance must be in surplus. Generational accounts are constructed so that the present generations are not bound by the budget constraint and can continue to accumulate debt in future years. The burden of satisfying the budget constraint, thus falls entirely on future generations (see Haveman, 1994). This means that if existing generations run primary deficits, future generations will have to restore sustainability by turning primary balances into surpluses.

28. For existing generations, this analysis takes into account only the remaining net taxes (tax payments minus transfer receipts). Full lifetime net taxes for all the existing generations would require extensive retrospective calculations. Such estimates for the United States are shown in Auerbach *et al.*, 1994.

29. Calculations were carried out by J. Gokhale, L.J. Kotlikoff and J. Walliser (for United States and Germany), N. Sartor (for Italy), C. John (for Sweden) and C. Gjersem (for Norway).

30. In order to cover full lifetimes of various generations, generational accounting models as applied here have a time horizon of about 200 years.

31. Although it was assumed here that in the medium-term fiscal policy follows broadly the course assumed in the Secretariat's Medium-Term Reference Scenario, generational accounting experts were free to consider their own assessment of past or planned policy measures.

32. In most cases, national sources were used instead of the World Bank's population projections.

accounts differs from country to country and some of the models are in a relatively early stage of development.

59. The calculations reveal generational imbalances in favour of living generations. If policies do not change, generations that are born after the base year 1993 are likely to have a significantly greater tax burden than present generations (as represented by newborn generations in the base year) in all five countries considered. But the size of the imbalance differs considerably among the countries (Table 10). For example, assuming a discount rate of 5 per cent and income (or productivity) growth of 1.5 per cent, future generations in Italy have to pay net taxes more than five times as large (Case A) as the newborn generation (which clearly illustrates from a different perspective that the fiscal situation in Italy is not sustainable). In the United States and Norway, future generations have to pay 100 per cent and about 50 per cent, respectively, more net taxes than today's newborn generation, while in Germany and Sweden the imbalance is smaller, although with unchanged policies, future generations will also have to bear an increase in the net tax burden of about 25 per cent and 30 per cent, respectively[33].

60. The results are sensitive to assumptions about productivity growth and the discount rate, although for most of the discount rate/productivity growth combinations assumed here, the results show a significant generational imbalance against future generations. For a given discount rate, an increase in productivity growth increases the absolute (growth-adjusted) amounts of net tax payments for both the existing and the future generations. For a given productivity growth, an increase in the discount rate reduces these amounts. The results are also sensitive to the assumptions about demographics as is illustrated for Italy. If the Italian fertility rate were to recover to the replacement rate over the next decade instead of by 2030 as assumed in the World Bank's projection, the generational imbalance would be considerably smaller, although still relatively large (Case B).

61. In most of the countries considered, future demographic changes are the major source of generational imbalances, as shown in Table 11. In the absence of demographic changes, generational imbalances would be much lower in all countries and in Germany there would even be an imbalance in favour of future generations. Another source for generational imbalances is the servicing of government debt, accumulated by past and present generations. This factor is particularly important in the case of Italy.

62. As public debt levels are already high, redressing the generational imbalances can only be achieved by changes in policies that result in a strong improvement in fiscal positions. Cutting pension benefits, increasing social security contributions or making more general spending cuts or tax increases would help to reduce generational imbalances. For example, the balance between newborns and future generations would be restored fully by immediate and permanent across-the-board public spending cuts that amounted to about 12 per cent of GDP in Italy, about 4 to 5 per cent of GDP in the United States, about 3 per cent in Norway, about 2 per cent in Sweden, and 1½ to 2 per cent of GDP in Germany.

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33. Generational accounts have been calculated separately for men and women to take account of factors such as participation rates, life expectancies, earnings and transfers, which can differ significantly between men and women. While women of all generations have generally lower life-time net tax payments as compared to those of men, generational imbalances are similar for men and women.

III. Impact of Ageing on National Saving

63. It is clear from the analysis above that government saving is likely to decline quite sharply in some countries in the first half of the next century unless some action is taken to offset the effect of ageing populations. Whether demographics will have a significant effect on national savings and therefore on the productive potential also depends on both the path of private savings and the interaction between private and government savings.

1. Private savings

64. There is an extensive literature on the determinants[34] of the private saving ratio over time and differences across countries (Sturm, 1983; Dean *et al.*, 1990). There are different theories about its likely pattern over the lifetime of an individual. In the life-cycle consumption framework, households are expected to smooth consumption throughout their lifetimes, by saving during their working life and running down their assets (dissaving) during their retirement. Hence, as the elderly become a larger proportion of the population, a simple aggregation of each household's savings would imply that society, as a whole, would save less. However, the existence of generous public pension systems (which tend to reduce the incentives for households to save during working life) and strong bequest motives (which tend to increase overall private saving and saving of the elderly) could smooth out differences in saving patterns among different age groups.

65. Empirical evidence on the effects of demographic factors on past private saving is inconclusive (Leff, 1969; Modigliani and Sterling, 1983; Graham, 1987; Masson and Tyron, 1990; Koskela and Viren, 1989). Cross-country comparisons generally show stronger effects than time-series studies, reflecting relatively small changes in the past in the proportion of workers and retired people in the overall population.

66. The overall impact of different individual saving patterns in a situation of ageing population can be illustrated on the basis of three assumptions about age-specific saving rates and about the relationship between individual household saving and total private saving[35]. Although this approach is simplistic, it does give some idea of the order of magnitude of the impact of demographic changes (as shown in Figure 8). The three alternative assumptions correspond to:

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34. The following factors have been identified as major determinants for household saving: the inter-temporal preferences that motivate private households to save (such as saving for retirement or as a hedge against various risks, saving for the purchase of residences or consumer durables or saving for bequest); the level and growth of household income and its income elasticity of saving (which are interdependent); real interest rates; inflation or inflation expectations; and government policies, in particular concerning the social security system and the tax system (Feldstein, 1994; OECD, 1994*e*).

35. In all three cases, the analysis assumes that private households "see through the corporate veil" and determine total private saving.

-- A "dynasty model" saving pattern that assumes that the elderly continue to save, not for themselves but in order to leave high bequests to their children, and hence have positive net saving. It is assumed that their net saving rate equals half the average net private saving rate.

-- A life-cycle saving pattern that assumes retired people have a negative saving rate of 10 per cent, implying that in many cases some wealth may still be left for bequests.

-- A gradual shift from a dynasty model saving pattern to a life-cycle pattern as demographic pressures mount, which would lead to a stronger decline in average private saving rates.

67. Assuming such saving rates for the elderly and a saving rate of zero for the young, the saving rates for the working-age population are derived as a residual, given average private saving rates in the base year (2000). Empirical evidence suggests that actual saving behaviour of the elderly may in fact be within the range of these alternatives as in the past the elderly had either small negative or positive saving. (Hurd, 1987; Bernheim, 1987; Bosworth *et al.* 1991; Börsch-Supan, 1992; Yashiro, 1994). These illustrations suggest a decline in private saving ratios from 2000 to 2030 between 1/4 and 6½ percentage points, depending on the country and on the assumptions about age-specific saving rates.

2. National savings and the interaction of private and government savings

68. It is not entirely appropriate to calculate the impact of ageing on national saving by adding together the separately-calculated impacts on private and government saving, because this does not take into account possible inter-relationships between the two components. Nevertheless, assuming no interaction would provide a "worst case" scenario for national savings and this is shown in Figure 9. Views differ on the extent to which government saving affects private saving. If the strict Ricardian equivalence hypothesis (or the government debt neutrality hypothesis) applies rigorously, changes in government saving would not affect national saving at all, as households would anticipate fully the changes in future tax burdens associated with government debt servicing and adjust their saving to fully offset the changes in government saving. The strict Ricardian equivalence hypothesis[36] has been rejected by most empirical studies, but some offset of a decline in government saving by an increase in private saving is likely[37], especially in countries with explosive debt dynamics[38]. The impact of ageing on national saving under alternative assumptions about Ricardian equivalence is illustrated in Table 12.

69. These illustrations suggest that the overall impact of ageing on national saving could be significant, and in most cases this is primarily because of the deterioration of government saving. The conclusion of this illustration and of other partial analysis (Kennickell, 1990) differs from the results of

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36. Full Ricardian equivalence requires rational and farsighted consumers, non-distortionary taxes, absence of liquidity constraints (perfect capital markets), and successive generations linked by altruistically motivated transfers, (Bernheim, 1987).

37. Some studies of industrial countries found that a unit government deficit increase (or drop in government saving) is offset by roughly half by an increase in private saving (Bernheim, 1987), while others found evidence for full Ricardian equivalence (Seater, 1993).

38. See Nicoletti, 1992.

various models which are based on the theoretical framework of life-cycle saving and new-classical growth theory and which, in most cases, imply a much more important role for weakening private saving in the decline in national saving (see Annex 4). As these models take into account the inter-relationship between saving, investment and growth and, in some cases, also international repercussions, they provide a broader analytical framework as compared with partial analysis. On the other hand, they assume that the economies are initially in equilibrium (with actual saving equal to optimal saving) and embody other quite restrictive assumptions. Therefore, caution is needed in drawing direct conclusions about the future development of actual saving. Given these inconclusive results, more work is needed to examine these issues further and consider the effects of ageing on private and national saving in OECD countries in a more global framework, including the demographic and economic developments in non-OECD countries.

3. Would a demographically induced fall in savings matter?

70. Views differ about the extent to which a demographically-induced fall in national savings may have a significant impact on national well-being. One view is that lower savings leads to lower investment which leads to lower economic growth and living standards. Another view is that fewer workers would require less additional capital (i.e. investment) to equip them to be productive so that a reduction in saving rates as populations age would not lead to a decline in living standards. This debate involves a more extensive analysis of the long run determinants of economic growth and the relationship between saving and investment than is possible in this paper. It should be noted that the amount of saving, investment and hence capital accumulation is only one factor determining long-term living standards. More important is the rate of growth of technical progress in the future; even maintaining present rates is likely to more than offset the adverse effects of ageing populations on living standards[39].

71. Nevertheless, there is a trade-off between consumption now and consumption later, and increasing savings in anticipation of ageing effects would have the effect of increasing national wealth and generating higher income later. This would also provide greater scope for dealing with the adverse effects of ageing. National saving rates are projected to recover somewhat from their present low levels by 2000 (Figure 10 and Annex 5), but policies aimed at higher saving rates over the next few years might be prudent. Reducing government dissaving may be the most direct way of achieving that aim.

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39. Some argue that ageing slows technical progress as innovation is less profitable in shrinking markets for capital goods and as an ageing society loses "dynamism" (Simon, 1981; Wattenberg, 1987), while others find empirical evidence that innovation increases when labour gets scarce (Habakkuk, 1962; Cutler *et al.*, 1990).

Table 1. **Key indicators for general government in the Medium-Term Reference Scenario**[1]

As a percentage of nominal GDP

	Primary balances[2]		Financial balances[2]		Net financial liabilities			Gross financial liabilities[3]		Gross public debt (Maastricht definition)[4]
	1995	2000	1995	2000	1995	2000	Change 1999-2000	1995	2000	2000
United States	0.4	0.1	-1.8	-2.2	37.6	39.2	0.1	63.0	64.7	..
Japan	-3.5	-0.8	-4.1	-2.0	13.2	23.5	1.3	88.9	101.6	..
Germany	1.2	1.2	-2.3	-1.9	45.8	44.6	-0.4	62.5	61.3	56.9
France	-1.6	1.5	-5.0	-1.6	36.0	40.7	-0.3	59.5	61.7	53.5
Italy	3.3	4.5	-7.8	-3.5	120.5	106.7	-3.9	122.1	108.3	111.1
United Kingdom	-1.7	2.2	-4.2	0.1	47.1	40.2	-2.4	53.4	46.5	47.4
Canada	1.3	3.8	-3.7	-0.1	64.2	54.0	-2.8	94.6	84.4	..
Total of above countries	-0.3	0.8	-3.2	-2.0	41.9	42.8	-0.3	72.5	73.7	66.4
Australia	-0.9	2.1	-2.9	0.5	25.3	20.2	-1.8	36.3	31.3	..
Austria	-1.0	1.6	-4.5	-2.2	..	..	..	60.4	59.9	65.4
Belgium	4.3	6.1	-4.3	-1.5	126.0	112.5	-3.8	138.3	124.8	120.9
Denmark	1.3	3.9	-2.1	0.5	35.7	29.3	-2.1	68.8	62.4	69.4
Finland	-3.9	1.5	-5.0	-0.4	-0.3	6.5	0.0	69.1	88.5	85.9
Greece	2.9	4.7	-11.4	-4.5	..	..	..	120.2	115.8	109.6
Ireland	1.4	1.3	-2.5	-2.1	..	..	..	83.3	66.1	69.1
Netherlands	1.3	3.1	-3.3	-1.2	60.7	57.0	-1.5	79.4	75.7	74.9
Norway	1.3	3.1	1.4	3.7	-14.7	-27.5	-2.6	48.3	43.5	..
Portugal	0.0	1.0	-5.4	-2.4	..	..	..	70.8	65.0	64.1
Spain	-1.1	1.2	-6.2	-3.1	49.9	54.7	-0.1	66.5	71.4	70.1
Sweden	-5.6	4.4	-9.2	0.8	31.5	35.2	-2.5	84.5	79.3	79.1
Total of above European countries	0.2	2.4	-4.8	-1.8	60.2[5]	57.0[5]	-1.6[5]	75.3	71.6	70.0
Total of above countries	-0.3	1.0	-3.4	-1.9	43.5[5]	44.0[5]	-0.5[5]	72.7	73.4	..

1. The projections in this table are based on the historical data presented in the OECD *Economic Outlook 57*, Tables 30, 32, 34 and 35 (except for gross public debt in the Maastricht definition).
2. Surplus (+) or deficit (-).
3. Gross financial liabilities according to SNA definitions. It should be noted that this differs from the definition of debt applied under the Maastricht Treaty projections of which are shown in the final column.
4. The Maastricht definition of gross public debt is based on data provided by the Commission of the European Community for 1993 and 1994, projected forward in line with GDP and gross financial liabilities, while taking account, to the extent possible, of governments' policies for acquisitions of financial assets.
5. Including gross financial liabilities for Austria, Greece, Ireland and Portugal.

Table 2. **Net present value of public pension schemes**[1]
As a percentage of 1994 GDP

	Productivity growth assumption	Discount rate assumption		
		3 per cent	5 per cent	7 per cent
United States	1	-67	-24	-7
	1½	-74	-25	-7
	2	-82	-27	-7
Japan[2]	1	-171	-66	-20
(Scenario A)	1½	-191	-73	-23
	2	-214	-81	-26
	1	-88	-24	4
(Scenario B)	1½	-92	-24	4
	2	-97	-25	5
Germany[3]	1	-221	-124	-80
(Scenario A)	1½	-257	-139	-87
	2	-301	-156	-95
	1	-91	-40	-19
(Scenario B)	1½	-111	-48	-22
	2	-137	-57	-26
France[4]	1	-180	-96	-60
(Scenario A)	1½	-191	-98	-60
	2	-205	-101	-59
	1	-105	-49	-27
(Scenario B)	1½	-108	-48	-24
	2	-110	-45	-21
Italy	1	-207	-108	-65
	1½	-225	-113	-67
	2	-246	-119	-68
United Kingdom	1	-43	-26	-16
	1½	-28	-19	-13
	2	-9	-11	-9
Canada[5]	1	-170	-91	-56
(Scenario A)	1½	-178	-93	-57
	2	-188	-97	-58
	1	-43	-12	-1
(Scenario B)	1½	-35	-8	2
	2	-25	-3	4

1. Net present value of employee and employer contributions less pensions paid until 2070, plus existing assets.
2. Scenario A incorporates tax increases until 1999 only. After 2000 the contribution rate is maintained at 19.9 per cent. Scenario B incorporates tax increases until 2025. By 2025 the contribution rate reaches 29.6 per cent and is maintained at that rate until 2070.
3. Scenario A excludes statutory transfers from the Federal Government. Scenario B includes transfers from the Federal Government.
4. Scenario A includes revenues from the *contribution sociale généralisée* and excludes "fictive" contributions. Scenario B includes revenues from the *contribution sociale généralisée* and "fictive" contributions.
5. Scenario A assumes no transfers from general revenues to finance flat-rate pensions. Scenario B assumes transfers from general revenues sufficient to fund flat rate pensions in 1994. These transfers are kept constant as a per cent of GDP.

Table 3. Public expenditure on health

	Age-dependent spending ratio[2]	Expenditure as per cent of GDP[1]						Change in total expenditures as a per cent of GDP between 2000 and 2030[1]		
		2000			2030					
		<65	65+	Total	<65	65+	Total	Base case[3]	Common spending ratio[3,4]	Slower spending growth[5]
United States	9.0	2.8	3.6	6.4	2.7	6.7	9.3	2.9	1.9	0.6
Japan	4.8	2.9	2.2	5.1	2.6	3.7	6.2	1.2	1.1	-0.4
Germany	2.2	4.3	1.8	6.1	4.1	3.4	7.5	1.4	2.3	-0.5
France	2.4	4.9	2.0	6.9	5.1	3.5	8.5	1.6	2.2	-0.6
Italy	2.2	4.4	1.9	6.3	4.5	3.4	8.0	1.7	2.5	-0.4
United Kingdom	4.3	3.2	2.6	5.8	3.1	3.9	7.0	1.2	1.2	-0.6
Canada	4.5	4.4	2.7	7.1	4.4	5.7	10.1	3.1	2.9	0.5

1. Assuming 1½ per cent productivity growth per year.
2. Ratio of per capita public spending on health for those aged 65 and over and those aged less than 65.
3. Per capita spending grows with same rate as productivity.
4. Assuming age-dependent spending ratio of 4.2 for all countries.
5. Per capita spending growth 1 percentage point below productivity growth.

Table 4. **Public expenditure on eduction**

	Expenditure as a per cent of GDP[1]			School-age population ratio
		Base case[2]	Alternative[3]	
	2000[2]	2030	2030	2030/1990[4]
United States	5.4	5.1	3.8	1.10
Japan	2.8	2.7	2.0	0.75
Germany	3.1	3.0	2.2	0.69
France	5.0	5.0	3.8	0.89
Italy	4.3	4.6	3.4	0.64
United Kingdom	4.9	4.6	3.4	0.90
Canada	6.2	6.1	4.5	1.03

1. Assuming 1½ per cent productivity growth per year.
2. Assuming per capita education expenditures grow at the same rate as productivity.
3. Assuming per capita spending grows 1 per cent slower than productivity each year.
4. School-age population in 2030 divided by the school age population in 1990. Note that a drop in the school age population may not translate into a drop in expenditures as a per cent of GDP if productivity growth exceeds GDP growth.

Table 5. **Fiscal indicators 1995 to 2030**[1]

Per cent of GDP

	Primary balance[2]	Interest rates constant[3]			Interest rate/growth rate differentials constant[3, 4]			Interest rate/growth rate differentials constant and interest rate on old debt approaching interest rate on new debt[3, 5]					
								Average real interest rate on new debt			Country-specific real interest rates on new debt		
		Net interest payments	Financial balance[2]	Net financial liabilities	Net interest payments	Financial balance[2]	Net financial liabilities	Net interest payments	Financial balance[2]	Net financial liabilities	Net interest payments	Financial balance[2]	Net financial liabilities
United States													
1995	0.4	2.1	-1.8	38	2.1	-1.8	38	2.1	-1.8	38	2	-2	38
2000	0.1	2.4	-2.2	39	2.4	-2.2	39	2.4	-2.2	39	2	-2	39
2015	-1.0	3.2	-4.2	50	2.7	-3.7	47	3.2	-4.2	51	4	-5	54
2030	-4.9	8.1	-13.0	122	5.6	-10.5	104	6.1	-11.0	111	7	-12	121
Japan													
1995	-3.5	0.6	-4.1	13	0.6	-4.1	13	0.6	-4.1	13	1	-4	13
2000	-0.8	1.2	-2.0	24	1.2	-2.0	24	1.2	-2.0	24	1	-2	24
2015	-6.5	4.7	-11.2	102	4.0	-10.5	99	3.8	-10.3	98	3	-10	92
2030	-8.0	14.7	-22.8	314	11.7	-19.8	289	11.5	-19.5	285	9	-17	256
Germany													
1995	1.2	3.5	-2.3	46	3.5	-2.3	46	3.5	-2.3	46	4	-2	46
2000	1.2	3.1	-1.9	44	3.1	-1.9	44	3.1	-1.9	44	3	-2	44
2015	1.2	3.4	-2.2	49	3.3	-2.1	49	3.1	-1.9	48	3	-2	45
2030	-4.9	6.6	-11.6	105	4.5	-9.4	93	4.3	-9.2	89	4	-8	81
France													
1995	-1.6	3.3	-5.0	36	3.3	-5.0	36	3.3	-5.0	36	3	-5	36
2000	1.5	3.2	-1.6	41	3.2	-1.6	41	3.2	-1.6	41	3	-2	41
2015	0.3	2.9	-2.5	40	2.4	-2.1	37	1.8	-1.4	31	2	-1	31
2030	-3.8	6.4	-10.2	103	4.8	-8.5	88	3.9	-7.6	75	4	-7	73

Table 5. Continued

	Primary balance[2]	Interest rates constant[3]			Interest rate/growth rate differentials constant[3, 4]			Interest rate/growth rate differentials constant and interest rate on old debt approaching interest rate on new debt[3, 5]					
								Average real interest rate on new debt			Country-specific real interest rates on new debt		
		Net interest payments	Financial balance[2]	Net financial liabilities	Net interest payments	Financial balance[2]	Net financial liabilities	Net interest payments	Financial balance[2]	Net financial liabilities	Net interest payments	Financial balance[2]	Net financial liabilities
Italy													
1995	3.3	11.1	-7.8	121	11.1	-7.8	121	11.1	-7.8	121	11.1	-7.8	121
2000	4.5	8.1	-3.5	107	8.1	-3.5	107	8.1	-3.5	107	8.1	-3.5	107
2015	2.5	6.5	-4.0	82	6.0	-3.5	80	7.4	-4.9	92	8.5	-6.0	100
2030	-4.4	11.3	-15.7	146	8.5	-12.9	127	10.5	-14.9	152	13.0	-17.4	176
United Kingdom													
1995	-1.7	2.6	-4.2	47	2.6	-4.2	47	2.6	-4.2	47	2.6	-4.2	47
2000	2.2	2.1	0.1	40	2.1	0.1	40	2.1	0.1	40	2.1	0.1	40
2015	1.6	0.7	0.9	14	0.7	0.9	14	1.9	-0.3	24	1.9	-0.3	25
2030	0.2	-0.8	1.1	-9	-0.8	1.0	-9	0.8	-0.6	13	0.8	-0.6	13
Canada													
1995	1.3	5.0	-3.7	64	5.0	-3.7	64	5.0	-3.7	64	5.0	-3.7	64
2000	3.8	3.9	-0.1	54	3.9	-0.1	54	3.9	-0.1	54	3.9	-0.1	54
2015	3.7	0.7	3.0	6	0.6	3.1	5	0.3	3.5	1	0.3	3.4	2
2030	-1.6	-0.8	-0.8	-13	-0.6	-1.1	-13	-1.0	-0.6	-20	-1.0	-0.6	-19

1. 1995 and 2000 correspond to the Medium-Term Reference Scenario (MTRS).
2. Surplus (+), Deficit (-).
3. Net interest payments have been projected in two parts. For the net interest payments on the projected stock of debt in 2000 (from the MTRS) the implicit interest rate on government debt (net interest payments as a percentage of net debt) for each country has been used. For new debt, accumulated from 2001 onwards, long-term market interest rates have been applied which were derived (from the MTRS in 2000) from an average real interest rate for the major seven countries and individual inflation rates, except for the scenario "individual real interest rates on new debt" where an estimate of each country's long-term interest rate (from the MTRS in 2000) has been applied.
4. Differentials derived from the MTRS in 2000 and held constant thereafter.
5. For new debt, market interest rate/growth rate differential derived from the MTRS in 2000 and held constant thereafter. The implicit interest rate on old debt approaches the interest rate on new debt over a period of five years.

Table 6. **Pure ageing effects on debt accumulation**
Net financial liabilities as a per cent of GDP

	Interest rates constant[1]	Interest rate/growth rate differentials constant[2]	
		Average real interest rate[1]	Individual real interest rates[3]
United States			
2000	0	0	0
2015	4	4	4
2030	58	53	55
Japan			
2000	0	0	0
2015	47	46	45
2030	206	192	177
Germany			
2000	0	0	0
2015	1	1	1
2030	41	39	38
France			
2000	0	0	0
2015	-2	-1	-1
2030	58	55	55
Italy			
2000	0	0	0
2015	11	11	11
2030	117	109	113
United Kingdom			
2000	0	0	0
2015	7	7	7
2030	28	27	27
Canada			
2000	0	0	0
2015	-7	-6	-6
2030	37	36	36

1. Long-term market interest rates derived (from the MTRS in 2000) from an average real interest rate for the major seven countries and individual inflation rates.
2. Differentials derived from the MTRS in 2000 and held constant thereafter.
3. An estimate of each country's long-term interest rate (from the MTRS in 2000) has been applied.

Note: The pure ageing effect is estimated by measuring the debt accumulation resulting from the change in primary balances from 2000 to 2030.

Table 7. Changes in primary balances required to keep net debt constant
As a per cent of GDP[1]

		Interest rates constant[2]	Interest rate/growth rate differentials constant[2]	Interest rate/growth rate differentials constant and interest rate on old debt approaching interest rate of new debt[2]	
				Average real interest rate on new debt	Country-specific real interest rates on new debt
United States	2005	0.0	0.0	0.3	0.5
	2015	1.7	1.4	1.6	1.8
	2030	6.1	5.5	5.6	5.8
Japan	2005	3.2	3.2	3.1	2.9
	2015	7.4	7.2	7.2	7.0
	2030	8.9	8.8	8.7	8.5
Germany	2005	0.5	0.5	0.3	0.2
	2015	0.3	0.2	0.1	-0.1
	2030	7.0	6.3	6.3	6.1
France	2005	-0.8	-0.8	-1.3	-1.3
	2015	1.3	1.0	0.7	0.6
	2030	5.3	5.0	4.8	4.7
Italy	2005	-2.0	-2.0	-1.2	-0.6
	2015	0.7	0.3	0.8	1.4
	2030	8.7	7.5	7.7	8.3
United Kingdom	2005	-1.6	-1.6	-0.9	-0.9
	2015	-1.0	-1.0	-0.5	-0.4
	2030	1.0	0.6	0.9	0.9
Canada	2005	-3.0	-3.0	-3.3	-3.2
	2015	-2.1	-2.5	-2.7	-2.6
	2030	3.6	2.8	2.7	2.8

1. Higher receipts (+), lower receipts (-).
2. For interest-rate assumptions see Table 5.

Table 8. **Flat-rate pensions: net present value of pension expenditures**[1]
As a per cent of GDP

	Baseline	Flat-rate pensions[2]
United States	167	125
Japan	294	209
Germany	351	159
France	319	173
Italy	312	145
United Kingdom	142	161
Canada	195	134

1. Net present value of pensions paid until 2070, assuming annual productivity growth of 1½ per cent and a discount rate of 5 per cent.
2. Standardised assumptions for all countries of flat-rate pensions equivalent to 25 per cent of average earnings, indexed to wages, and an eligibility rate of 100 per cent.

Table 9. **Pension policy options**
Net present value as a per cent of 1994 GDP[1]

		Base case	Replacement rate 10 percentage points lower[2]	Contribution rate 3 percentage points higher	Retirement age 5 years later
United States	Contributions	136	136	164	143
	Pension payments	167	141	167	135
	Balance[3]	-31	-5	-4	8
Japan	Contributions	184	184	203	198
	Pension payments	294	267	294	239
	Balance[4]	-110	-83	-90	-41
Germany[5]	Contributions	212	212	235	228
	Pension payments	351	294	351	294
	Balance	-139	-82	-115	-66
Germany[6]	Contributions	303	303	336	326
	Pension payments	351	294	351	294
	Balance	-48	9	-14	32
France[7]	Contributions	221	221	243	238
	Pension payments	319	284	319	266
	Balance	-98	-63	-76	-28
France[8]	Contributions	271	271	294	293
	Pension payments	319	284	319	266
	Balance	-48	-12	-25	27
Italy	Contributions	199	199	214	214
	Pension payments	312	284	312	260
	Balance	-113	-85	-98	-46
United Kingdom	Contributions	123	123	153	131
	Pension payments	142	90	142	113
	Balance	-19	32	12	18
Canada	Contributions	96	96	120	103
	Pension payments	195	162	195	151
	Balance[9]	-99	-66	-74	-48

1. Contributions and pension payments assuming a discount rate of 5 per cent. Productivity growth assumed to be 1.5 per cent.
2. For the United Kingdom, the replacement rate was lowered by 5 percentage points instead of 10 percentage points.
3. Excludes pre-existing assets of 5.8 per cent of GDP.
4. Excludes pre-existing assets of 37.1 per cent of GDP.
5. Excludes statutory transfers from the Federal Government.
6. Includes statutory transfers from the Federal Government.
7. Includes revenues from the *contribution social généralisée* and excludes "fictive" contributions.
8. Includes revenues from the *contribution social généralisée* and "fictive" contributions.
9. Excludes pre-existing assets of 5.7 per cent of GDP.

Table 10. **Generational Accounts:**
Thousands of dollars[1]

Productivity growth (per cent)	1			1½			2		
Discount rate (per cent)	3	5	7	3	5	7	3	5	7
United States									
Males									
Present generation[2]	191	105	58	217	121	66	245	139	76
Future generations	384	226	151	422	243	157	468	262	164
Generational imbalance[3]	102	115	161	95	100	137	91	89	117
Females									
Present generation	92	64	39	95	72	43	92	79	49
Future generations	186	138	101	185	143	103	177	149	106
Generational imbalance	102	115	161	95	100	137	91	89	117
Germany									
Males									
Present generation	311	168	91	362	197	107	419	231	126
Future generations	390	211	103	446	250	126	505	293	152
Generational imbalance	25	26	13	23	27	18	20	27	22
Females									
Present generation	133	78	44	150	90	51	166	104	60
Future generations	166	98	50	185	114	60	200	131	72
Generational imbalance	26	26	13	23	27	18	20	27	22
Italy (Case A)[4]									
Males									
Present generation	102	54	22	114	65	29	122	77	36
Future generations	433	340	316	465	354	306	508	374	306
Generational imbalance	326	533	1 336	310	446	970	315	385	741
Females									
Present generation	19	14	2	12	17	5	-1	19	8
Future generations	79	88	26	51	93	50	-5	94	65
Generational imbalance	327	532	1 333	310	446	976	-325	385	737
Italy (Case B)[5]									
Males									
Present generation	122	59	24	144	72	31	166	88	39
Future generations	258	206	192	273	213	185	290	224	185
Generational imbalance	111	249	709	90	195	500	74	155	369
Females									
Present generation	37	19	3	40	24	7	39	29	10
Future generations	79	65	27	76	70	40	68	74	49
Generational imbalance	111	248	703	92	195	499	74	155	368

Table 10 (continued)

Productivity growth (per cent)	1			1½			2		
Discount rate (per cent)	3	5	7	3	5	7	3	5	7
Norway									
Males									
Present generation	181	97	54	207	110	61	235	126	69
Future generations	299	130	48	376	171	72	466	216	98
Generational imbalance	64	34	-13	79	53	16	94	68	39
Females									
Present generation	42	35	25	38	37	26	28	38	26
Future generations	70	47	22	69	57	31	55	65	40
Generational imbalance	66	35	-12	82	55	17	98	72	53
Sweden									
Males									
Present generation	272	136	75	317	156	84	371	180	95
Future generations	333	185	116	372	204	123	414	277	132
Generational imbalance	23	36	56	18	31	47	12	26	40
Females									
Present generation	134	72	42	153	81	47	175	92	52
Future generations	165	98	66	180	107	69	196	116	73
Generational imbalance	23	36	56	18	31	47	12	26	40

1. In constant prices, adjusted for income growth, converted to U.S. dollars using 1993 nominal exchange rates.
2. Newborns in base year.
3. Generational imbalance is calculated as the difference between life-time net payments for someone of the present generation and future generations (growth adjusted and in present value terms), expressed as a percentage of the net payments of the present generation. Generational imbalance in favour of the present generation is positive, generational balance corresponds to 0 and generational imbalance in favour of future generations would be negative.
4. Case A: population projection by the World Bank which assumes a return of the fertility rate to replacement rate by 2030.
5. Case B: more rapid return of fertility rate to replacement rate (by 2010) so that population falls less than in Case A.

Table 11. **Understanding the source of generational imbalances**
Generational imbalance of males
In per cent of net payments of the present generation

	Base case	No demographic change[1]	Zero debt
United States	100	47	82
Germany	27	-45	2
Italy (Case A)[2]	446	62	238
(Case B)[3]	195	62	64
Norway	53	8	66
Sweden	31	12	27

1. The number of persons in each age-group are kept constant.
2. Case A: population projection by the World Bank which assumes a return of the fertility rate to replacement rate by 2030.
3. Case B: more rapid return of fertility rate to replacement rate (over the next decade) so that population falls less than in Case A.

Note: Assumed real income growth is 1.5 per cent; discount rate is 5 per cent.

Table 12. **Impact of demographics on national net savings under stylised assumptions**

As a percentage of GDP

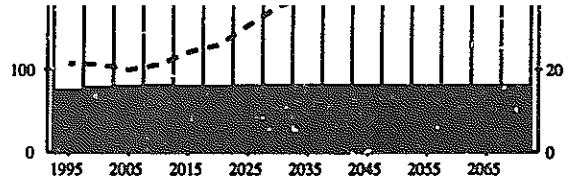
		Private savings			Government savings	National savings					
						without Ricardian equivalence			with partial Ricardian equivalence		
		I	II	III		I	II	III	I	II	III
United States	2000	5.3	5.3	5.3	-2.6	2.7	2.7	2.7	2.7	2.7	2.7
	2030	5.1	3.8	1.8	-10.9	-5.8	-7.1	-9.1	-1.7	-3.0	-5.0
Japan	2000	7.7	7.7	7.7	5.7	13.4	13.4	13.4	13.4	13.4	13.4
	2030	7.5	6.7	3.0	-12.0	-4.5	-5.3	-9.1	4.4	3.6	-0.2
Germany	2000	10.0	10.0	10.0	1.1	11.1	11.1	11.1	11.1	11.1	11.1
	2030	9.4	7.7	4.2	-6.4	3.0	1.3	-2.2	6.8	5.1	1.5
France	2000	7.6	7.6	7.6	1.9	9.5	9.5	9.5	9.5	9.5	9.5
	2030	7.0	4.8	1.7	-5.0	2.0	-0.2	-3.3	5.5	3.3	0.1
Italy	2000	8.7	8.7	8.7	0.4	9.1	9.1	9.1	9.1	9.1	9.1
	2030	7.9	5.3	2.2	-8.9	-1.0	-3.6	-6.7	3.7	1.1	-2.0
United Kingdom	2000	3.2	3.2	3.2	1.6	4.8	4.8	4.8	4.8	4.8	4.8
	2030	3.1	2.3	-0.4	2.5	5.6	4.7	2.1	5.1	4.3	1.7
Canada	2000	5.4	5.4	5.4	1.1	6.5	6.5	6.5	6.5	6.5	6.5
	2030	5.0	2.9	1.1	0.3	5.3	3.2	1.4	5.7	3.6	1.8

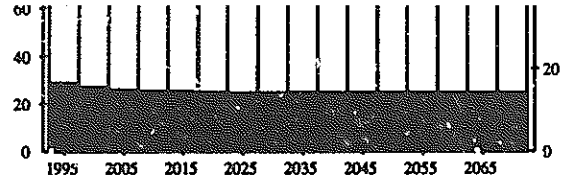
Note: Alternative I: Savings rate of retired population assumed to be constant, equal to half the average private savings rate in 2000.

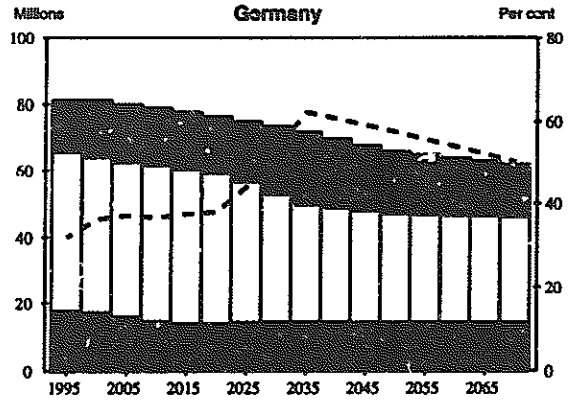
Alternative II: Savings rate of retired population assumed to be equal to -10 per cent.

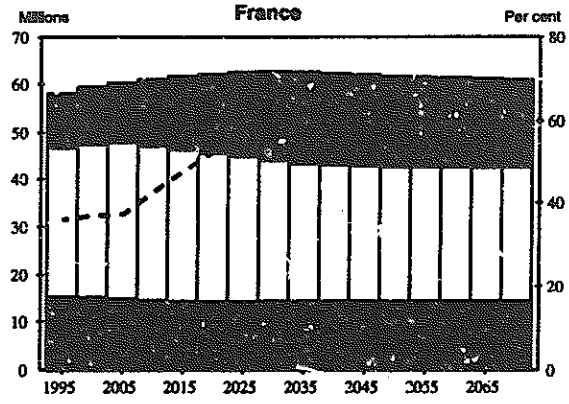
Alternative III: Savings rate of retired population assumed to be equal to half the average private savings rate in 2000, dropping to -10 per cent in 2030.

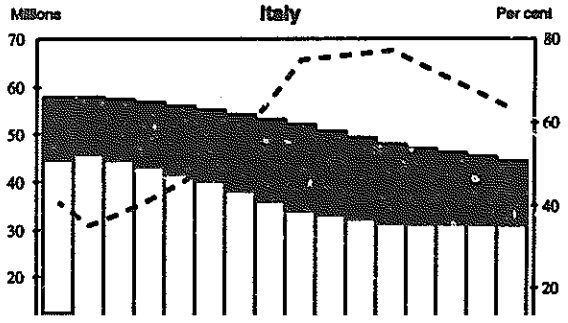
Ricardian equivalence: While without Ricardian equivalence the change in government savings from 2000 to 2030 is fully reflected in national savings, with partial Ricardian equivalence it is assumed that only half of the change in government savings is reflected in national savings.


100
0
20
0
1995 2005 2015 2025 2035 2045 2055 2065


60
40
20
0
20
0
1995 2005 2015 2025 2035 2045 2055 2065


Millions
Germany
Per cent
100
80
60
40
20
0
80
60
40
20
0
1995 2005 2015 2025 2035 2045 2055 2065


Millions
France
Per cent
70
60
50
40
30
20
10
0
80
60
40
20
0
1995 2005 2015 2025 2035 2045 2055 2065


Millions
Italy
Per cent
70
60
50
40
30
20
80
60
40
20

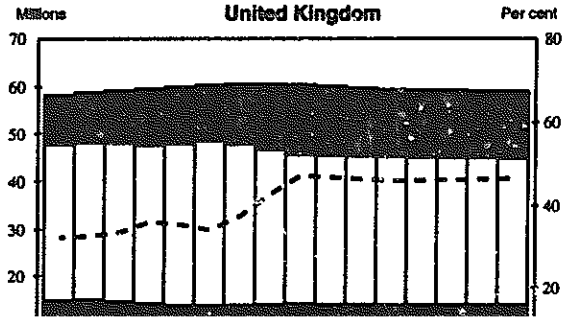
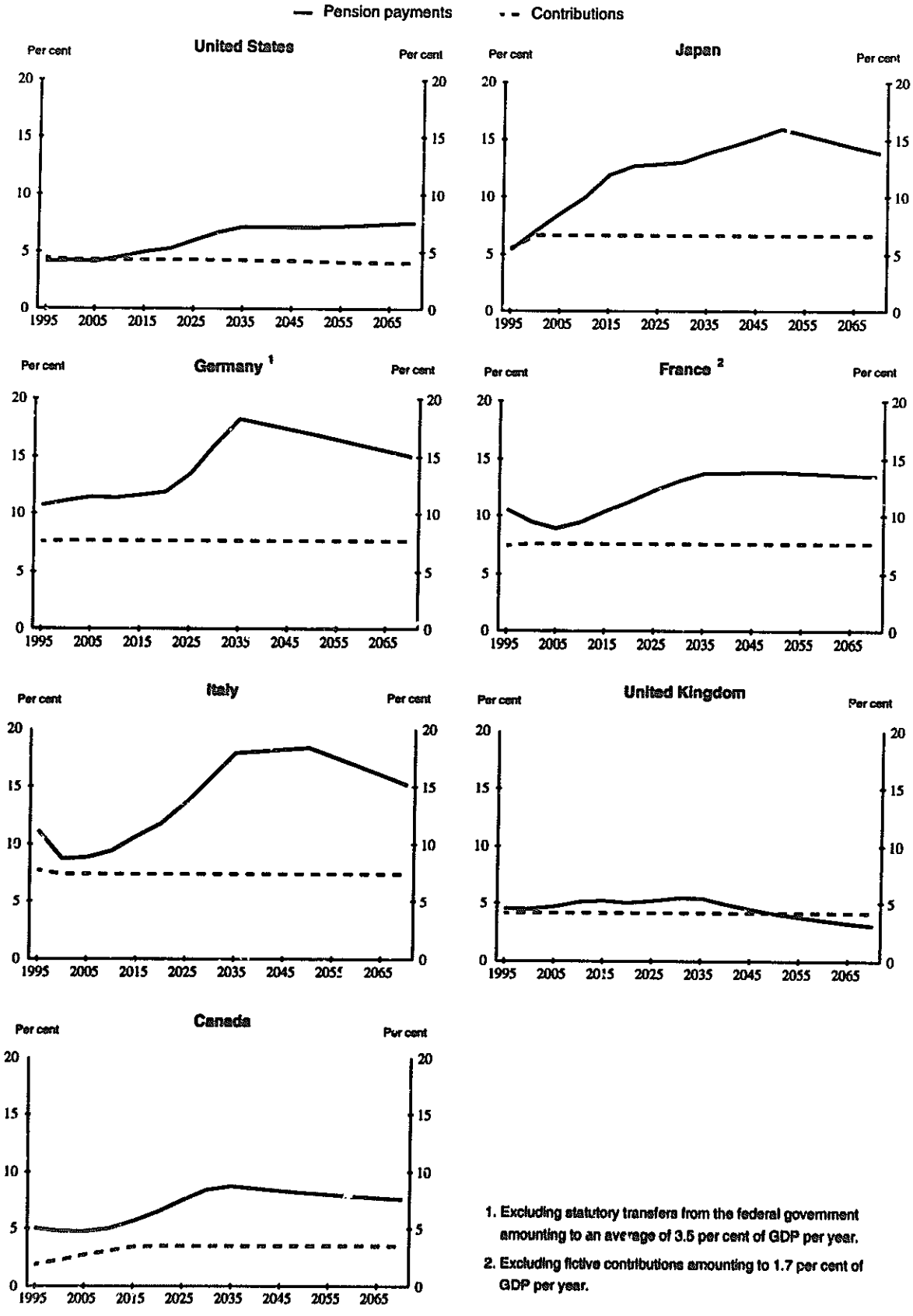

Millions
United Kingdom
Per cent
70
60
50
40
30
20
80
60
40
20

Figure 2. **Pension payments and contributions**

as a percentage of GDP



1. Excluding statutory transfers from the federal government amounting to an average of 3.5 per cent of GDP per year.
2. Excluding fictive contributions amounting to 1.7 per cent of GDP per year.

Figure 3. **General government primary balances**

Surplus (+) or deficit (–) as a percentage of GDP

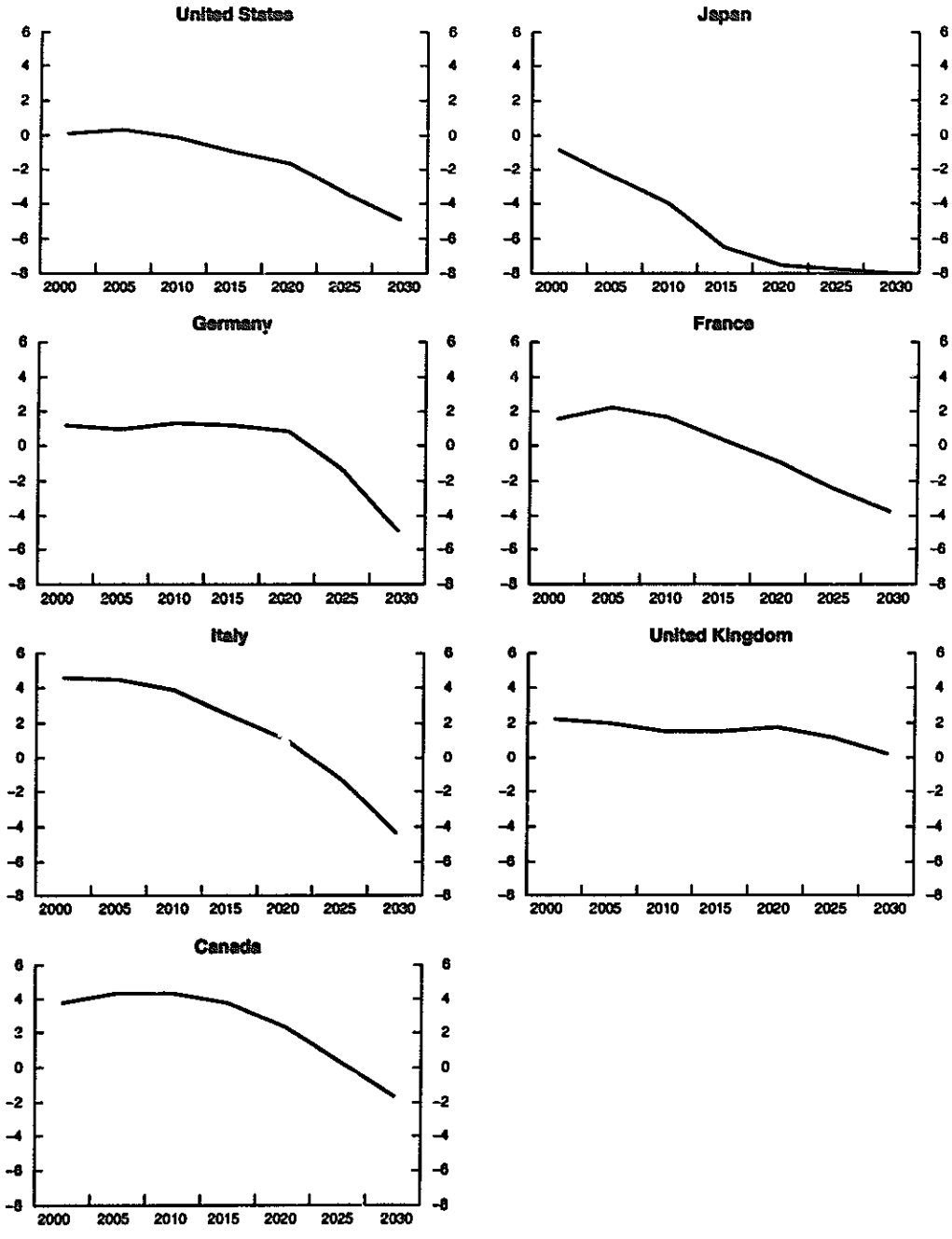


Figure 4. **Primary expenditure components and primary receipts**

As a percentage of GDP

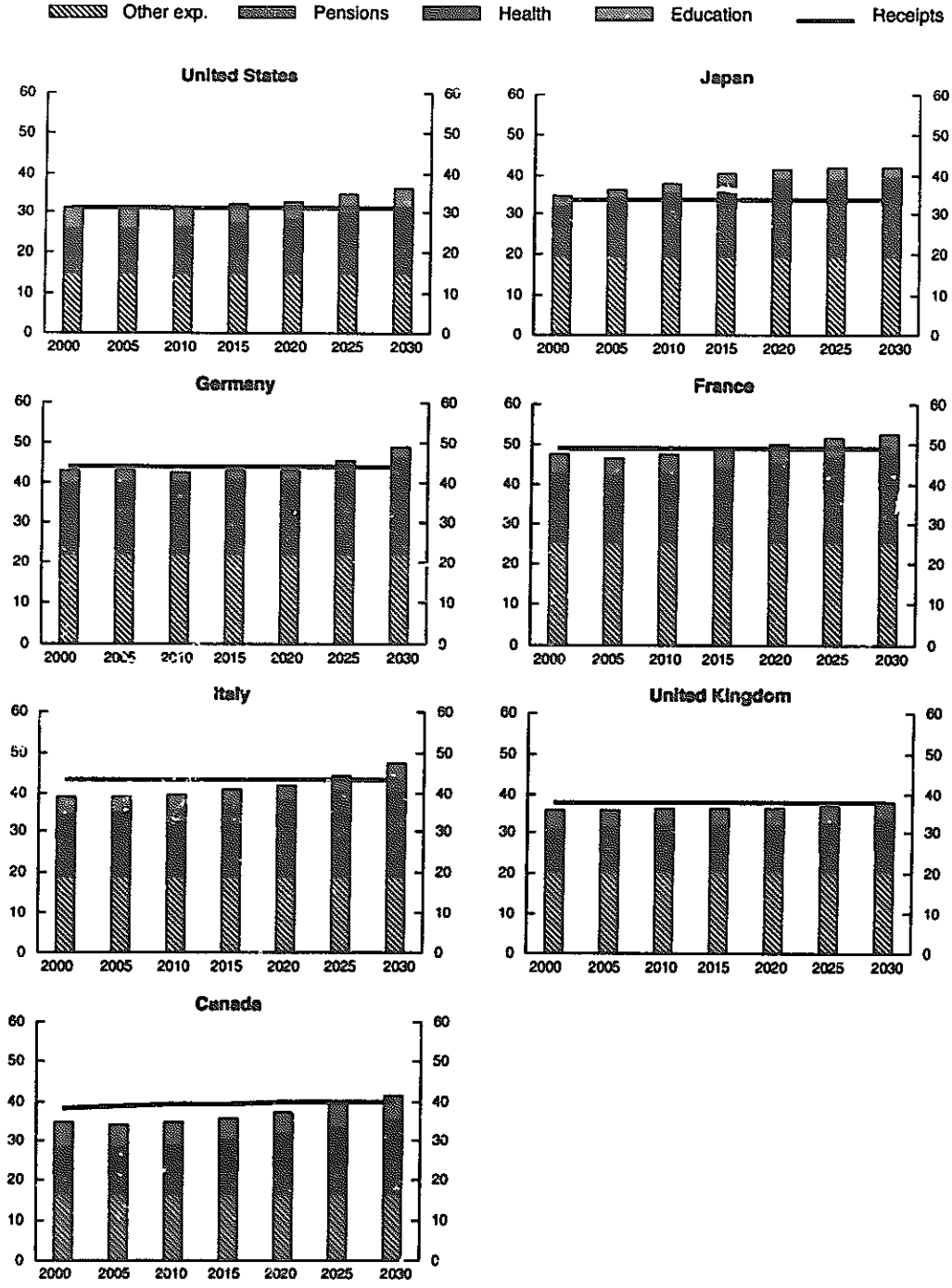
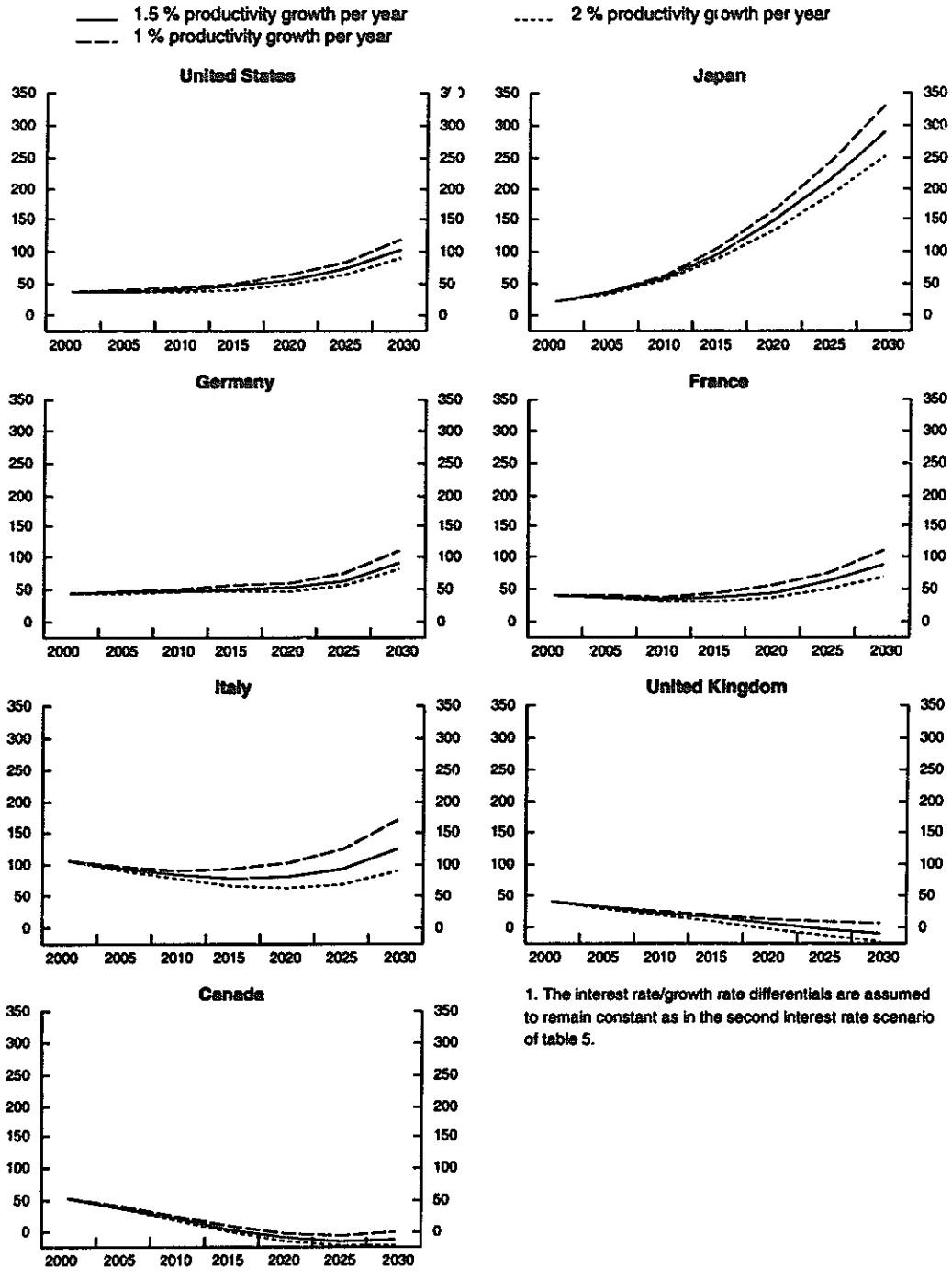


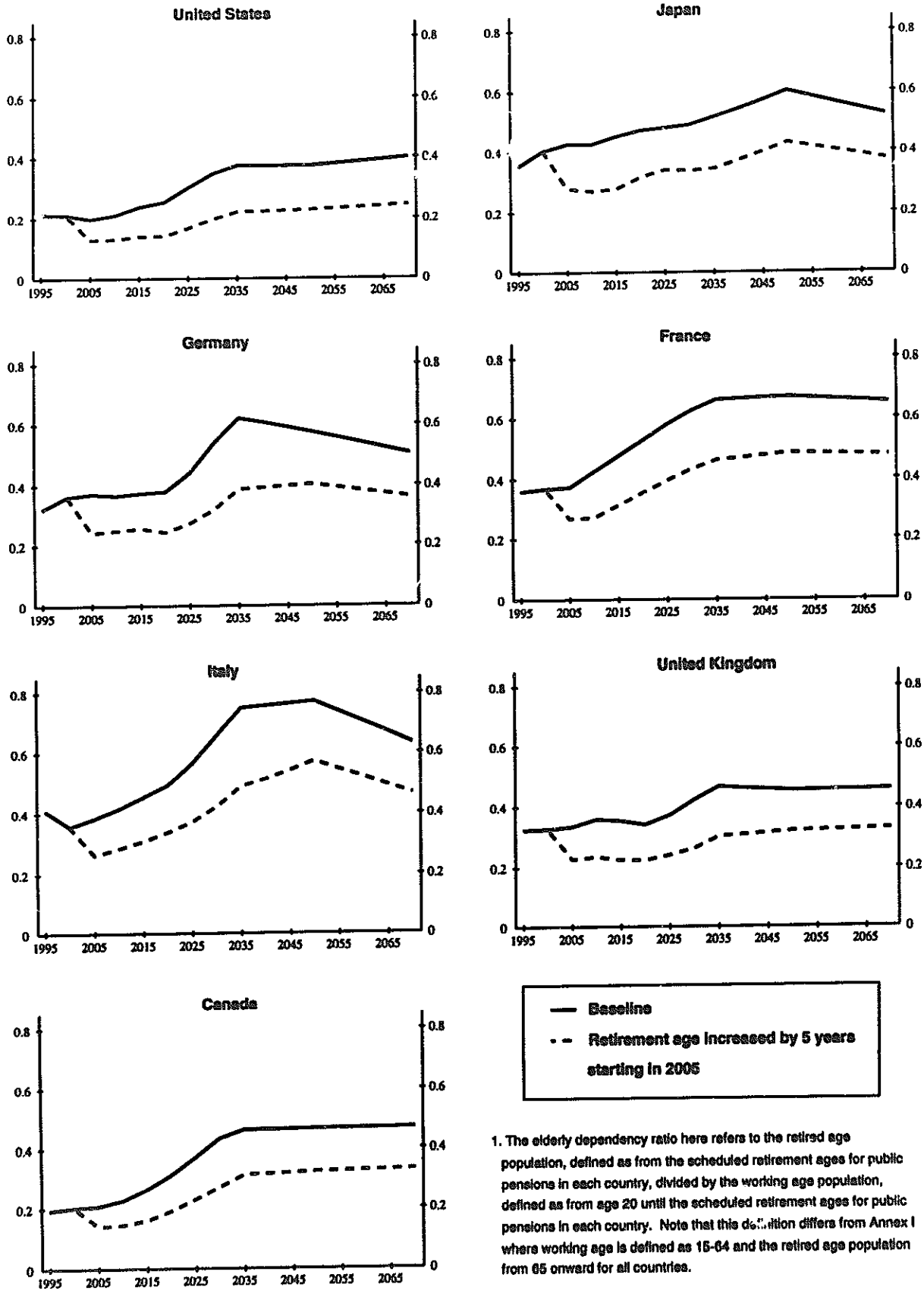
Figure 5. **Net debt – alternative productivity growth assumptions**

As a percentage of GDP (1)



1. The interest rate/growth rate differentials are assumed to remain constant as in the second interest rate scenario of table 5.

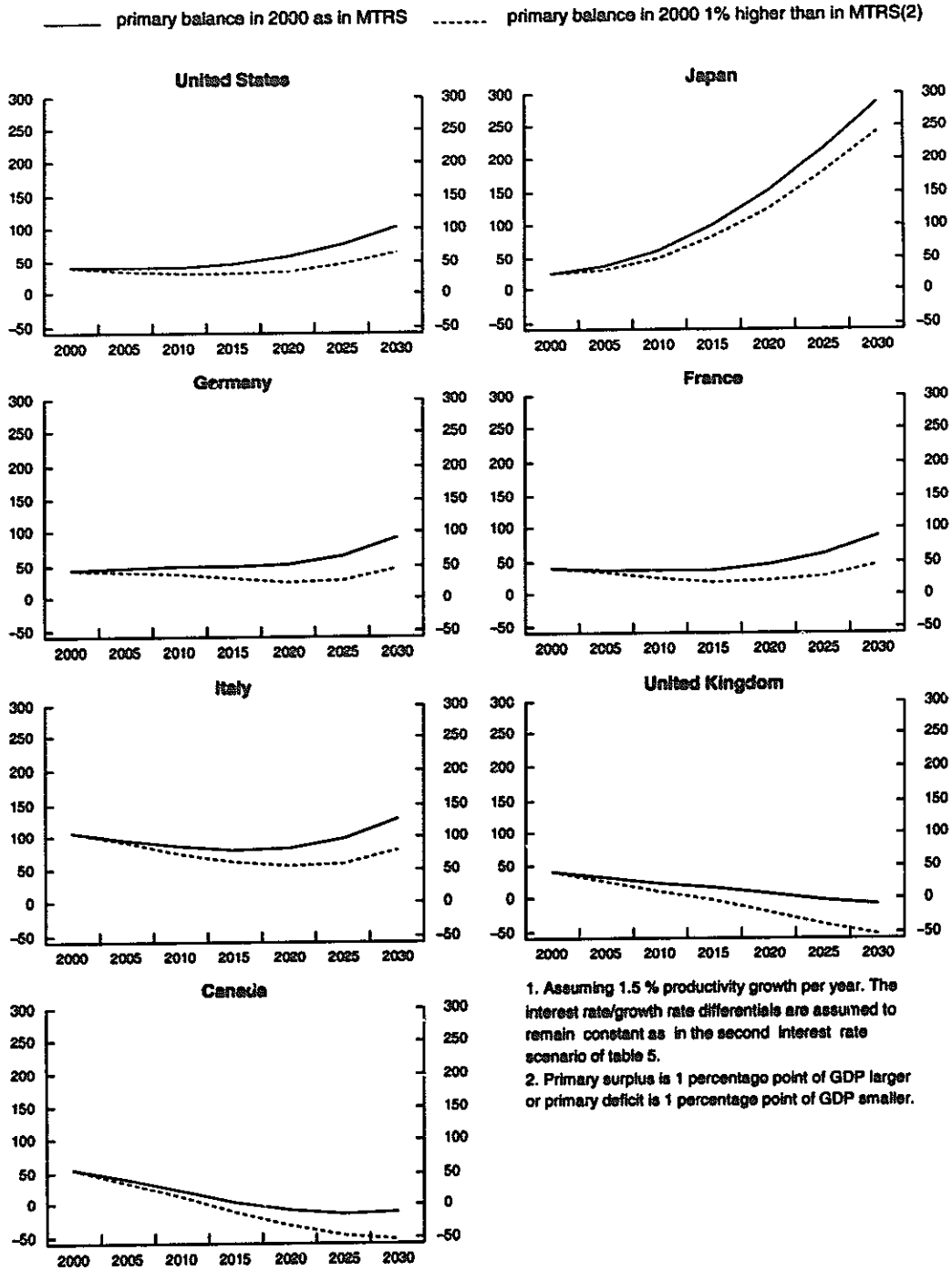
Figure 6. **Impact of raising retirement ages on elderly dependency ratios** [1]



1. The elderly dependency ratio here refers to the retired age population, defined as from the scheduled retirement ages for public pensions in each country, divided by the working age population, defined as from age 20 until the scheduled retirement ages for public pensions in each country. Note that this definition differs from Annex I where working age is defined as 15-64 and the retired age population from 65 onward for all countries.

Figure 7. **Impact of different initial primary balances on net debt**

As a percentage of GDP (1)



1. Assuming 1.5 % productivity growth per year. The interest rate/growth rate differentials are assumed to remain constant as in the second interest rate scenario of table 5.
2. Primary surplus is 1 percentage point of GDP larger or primary deficit is 1 percentage point of GDP smaller.

Figure 8. **Demographic impact on net private savings under stylised assumptions**

As a percentage of GDP

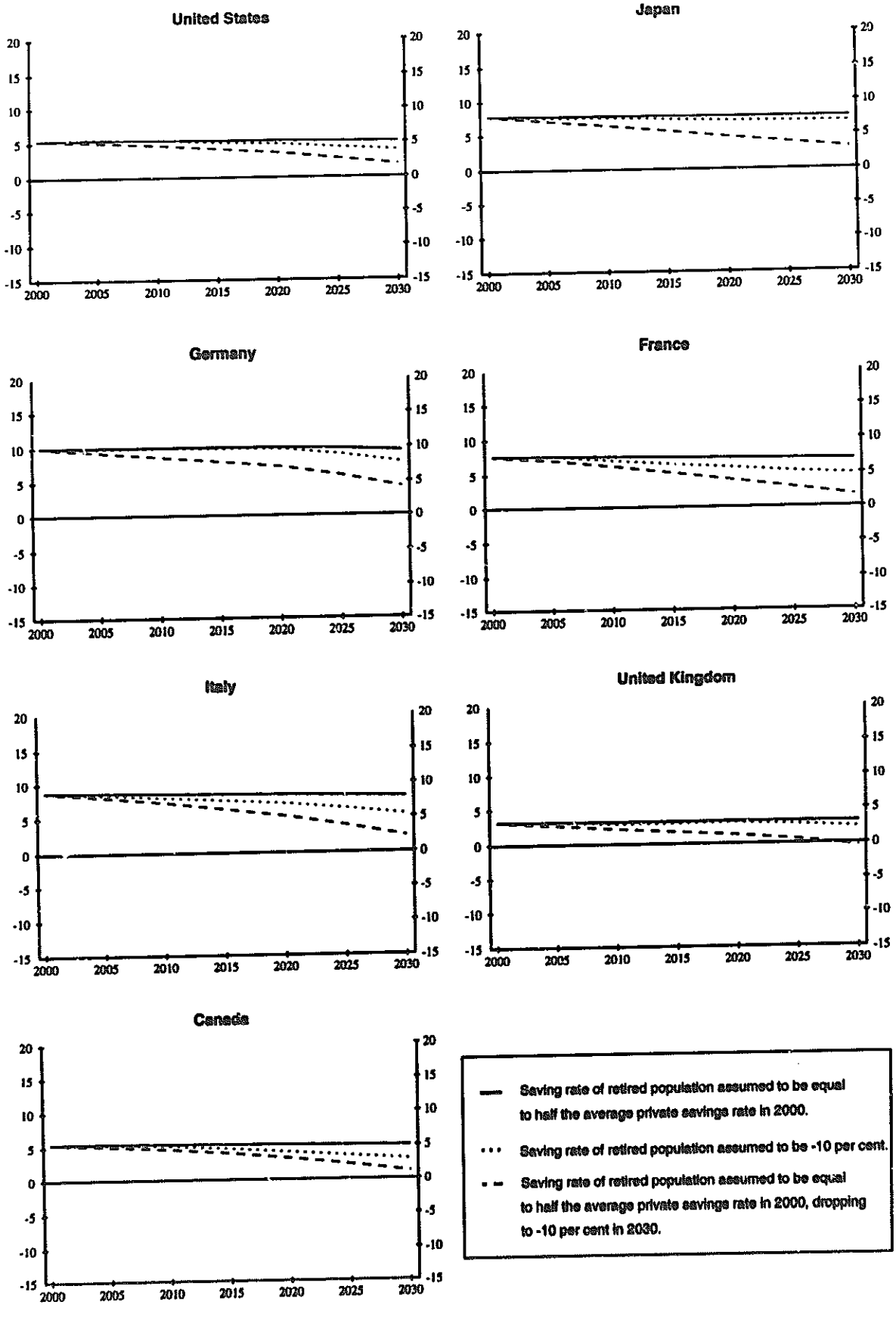
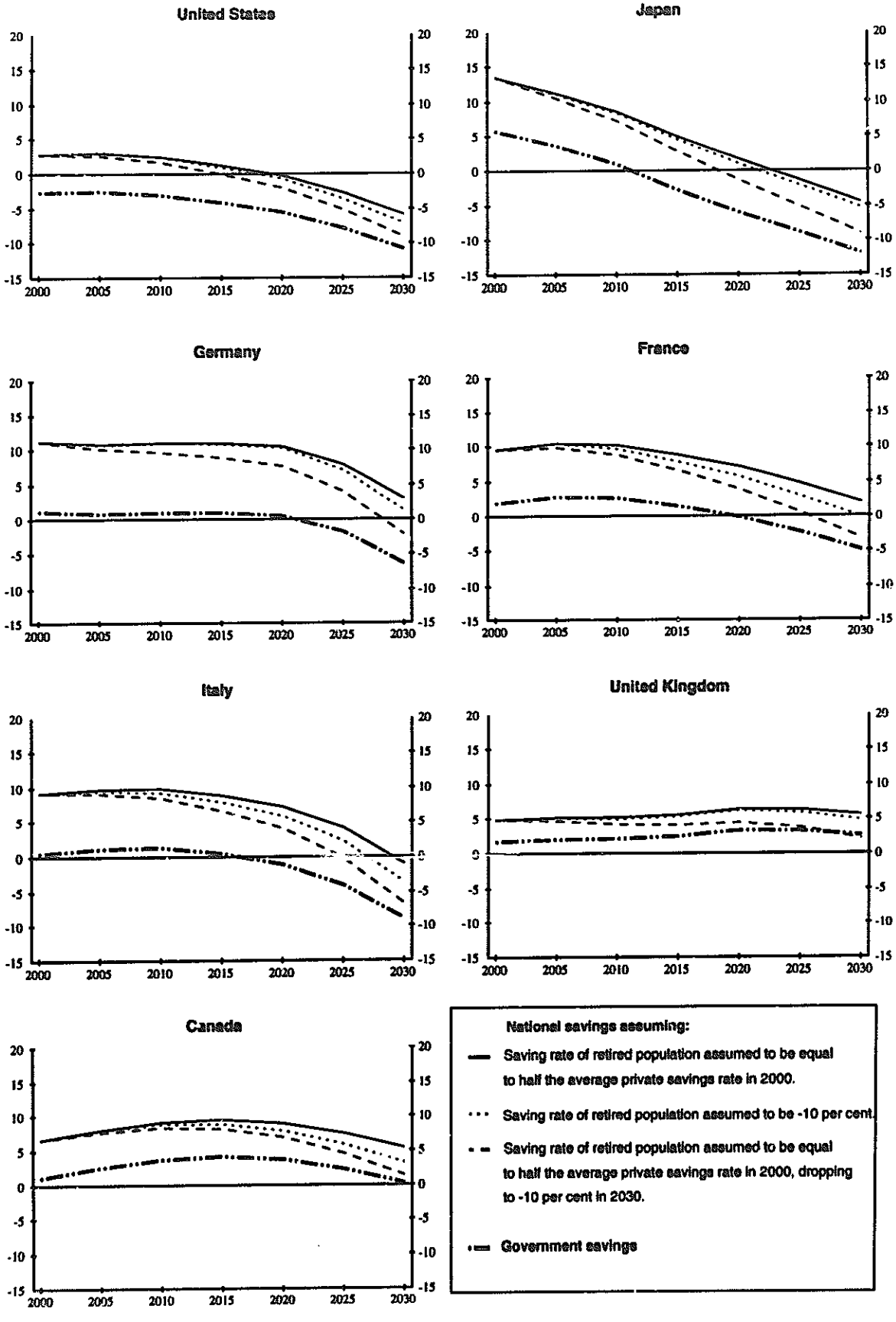


Figure 9. **Demographic impact on net national savings under stylised assumptions**

As a percentage of GDP

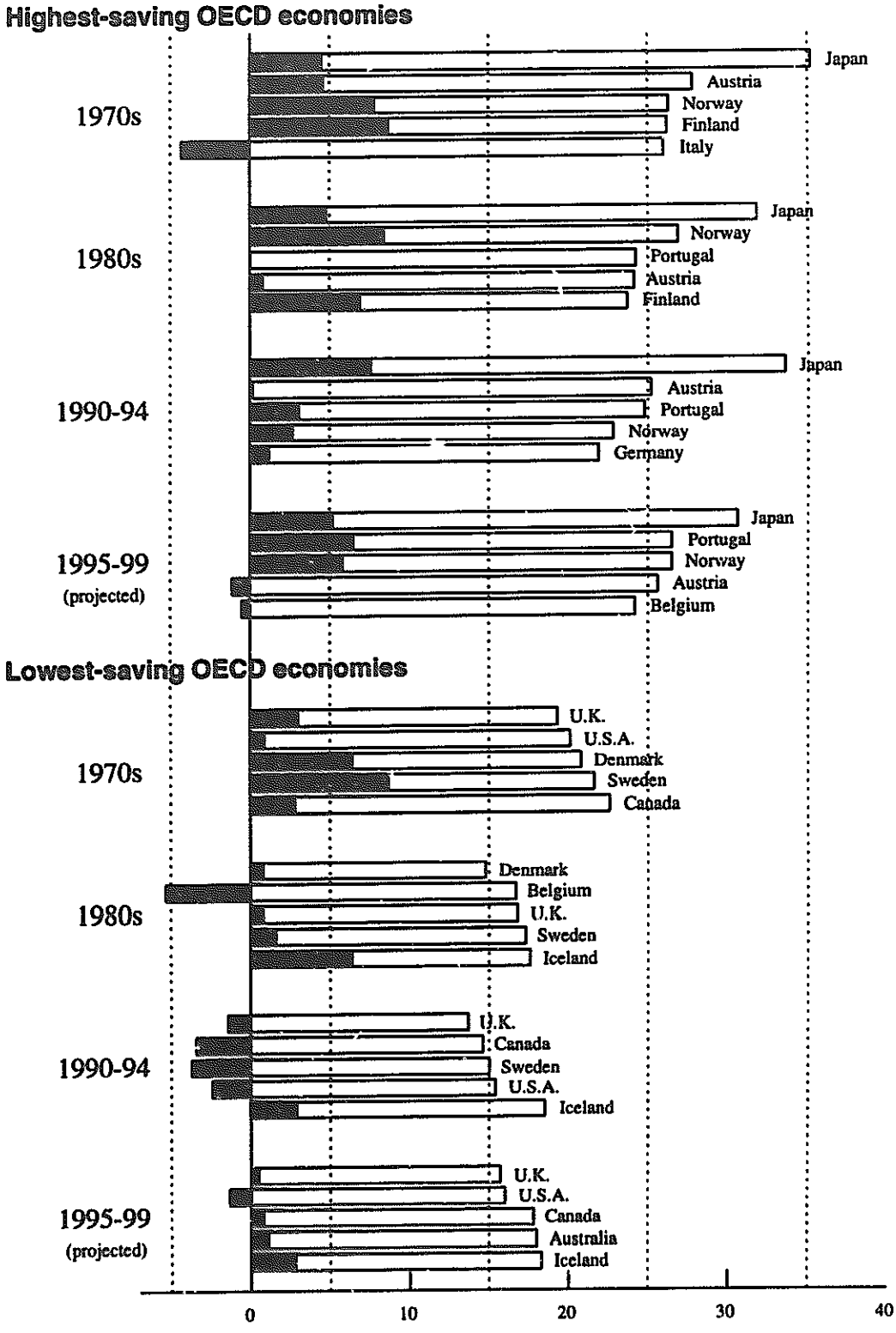


1. We
Aus

Figure 11. **Highest- and lowest-saving OECD economies**

Gross national savings as a percentage of GDP, period averages

of which government savings



Annex 1

Demographics

1. Population growth of OECD countries has been slowing in recent decades from 1.1 per cent per year in the 1960s to 0.8 per cent per year in the 1980s. For the 1990s a deceleration to 0.7 per cent is projected and during the first three decades a further deceleration to a rate of 0.2 per cent per year in the 2020s (Table A1). The total population of present OECD Member countries as a share of world population is projected to decline from almost 18 per cent in 1990 to about 13 per cent by 2030. Within the OECD area, there are some significant country differences. Only the United States, Canada, Australia, Iceland, Ireland, Mexico, New Zealand, Norway and Turkey are projected to continue to experience population growth after 2020. Even in these countries, the rate of growth is projected to slow significantly in the 2020s, to 0.4 per cent annually for the United States, 1.0 per cent for Mexico and 0.8 per cent for Turkey, three of the four most populous OECD countries. However, the population starts to fall in most of the other countries. In the decade ending 2010, the total population is projected to start to fall in Germany, Italy, Belgium, Portugal and Spain and the rate of shrinking is projected to accelerate over subsequent decades. In the decade ending 2020, the overall population starts to fall in Japan, Austria, Denmark and Greece. By the following decade, the population of Finland, Luxembourg, the Netherlands and Switzerland also starts to fall.

2. Working-age populations are projected to fall even faster. By the 2020s, working-age populations are falling everywhere except Ireland, Mexico and Turkey, and in twelve countries, including Germany and Italy, the working-age population is becoming smaller at a rate of more than ½ per cent per year. The working-age populations of Japan, France, the United Kingdom and Canada are projected to shrink at slightly slower rates (roughly ½ per cent) in the 2020s. By 2030, the working-age population of the OECD area will be 4½ per cent smaller than at its peak level in 2010, but in many countries the fall in working-age population from peak levels is much more pronounced -- 24 per cent in Germany, 18 per cent in Italy, 17 per cent in Japan and 15 per cent in both the Netherlands and Spain.

Increasing dependency ratios

3. As working-age populations are shrinking faster than overall population, the share of population aged 65 and over (elderly share) and the ratio of those 65 years and over to the working-age population (elderly dependency ratios[1]) are growing and are projected to increase sharply after 2010. Between 1990 and 2030, the elderly share in the population for the OECD as a whole is projected to rise from just under 13 per cent to 22½ per cent, and the elderly dependency ratio is projected to rise from 19 per cent to 37 per cent -- a near doubling of the elderly dependency rate within 40 years (Tables A2 and A3).

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1. Note that this standard definition rests on the assumption that the working-age population is 15-64, whereas the elderly dependency ratios for the major seven countries shown in the main text have taken the retirement ages in each country into account.

4. Almost all OECD countries will be affected. but the increase is particularly sharp for Japan. In 1980, Japan had an elderly dependency ratio of 13½ per cent, the lowest in the OECD area apart from Mexico and Turkey. But by 2030, Japan's dependency ratio is projected to be one of the highest, more than tripling to reach 44½ per cent. Dependency ratios are also projected to exceed 40 per cent by 2030 in Germany, Italy and eight smaller countries and to be between 35 and 40 per cent in the United States, France, the United Kingdom, Canada and a further three smaller countries. These ageing population trends also reflect significant increases in the proportion of the population aged 75 and over. This proportion is projected to almost double for the OECD as a whole, from 5½ per cent in 1990 to 10½ per cent in 2030.

5. The increase in the elderly dependency ratio is often used as an indicator of the increase in the burden on the working-age population. However, an increase in the number of elderly dependent persons may be accompanied by a decline in the number of young dependent persons. This effect is reflected in the ratio of total dependent persons (children and elderly) to the working-age population (total dependency ratio). This ratio declined on average between 1960 and 1990 and will remain rather flat between 1990 and 2010, before rising again after 2010. It has been argued that the total dependency ratio may also be a misleading indicator of the effective burden of demographics on the working-age population as the resources spent on an elderly person and on a child may differ. To illustrate this for the United States, Cutler *et al.* (1990) have calculated a so-called needs-weighted support ratio which considers such differences. The support ratio is the ratio of the working-age population to the total (needs-weighted) population. The same weights[2] can be applied (as a first approximation) to calculate needs-weighted support ratios for other OECD countries.

6. All three indicators of the demographic burden on the working-age population point to the same general conclusion that the burden on the working-age population will increase significantly in the future. In Japan this increase is already underway, while in the United States it will be felt only after 2010. In Europe, the elderly dependency ratio starts to increase in the current decade, but the total burden on the working-age population as measured by the total dependency ratio or the needs-weighted support ratio shows a significant deterioration only after 2010.

Key assumptions underlying population projections

7. All population projections are driven by three key factors: fertility, life expectancy and migration. Fertility rates are already low in OECD countries -- at, or below, replacement rates in all countries except Mexico and Turkey. Even in these two countries, fertility is projected to fall to replacement rates by 2010 and 2005, respectively. The United States, Iceland, New Zealand and Sweden all reach replacement rate in 1995 and fertility is assumed to remain at replacement rates. In those countries where fertility is currently below replacement rates, it is assumed to rise back to replacement rates by 2030. For Spain, which currently has the lowest fertility rate in the OECD, the rate is therefore assumed to almost double by 2030.

8. Life expectancy is also projected to increase by four to five years in all OECD countries, except for Mexico and Turkey, where life expectancy increases more rapidly, in part due to reductions in infant

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2. Cutler *et al.* consider age-specific use of private non-medical consumption, medical care and public education and attach an overall weight of 0.72 to the people under 20, of 1 to the people aged 20-64 and 1.27 to those aged 65 and over.

mortality rates. Estimated inward migration rates during the period 1990-1995 are largest in the United States, Canada and Australia, which also receive the largest absolute number of immigrants. Immigration rates are also relatively high in several European countries, including Germany, Austria, Greece and Switzerland. Only Ireland, Mexico and Portugal have net outward migration for the period 1990-1995. Migration rates in most countries are, however, projected to fall quite quickly, with only the United States, Canada and Australia projected to continue receiving immigrants after 2010. By 2030, migration flows are assumed everywhere to be zero. Where immigration has been predominantly male, it is assumed that it is predominantly in the age group 15-30. However, where immigration has been more balanced between male and female, it is assumed that the immigrants are more widely distributed across age groups, including children and elderly.

9. The key demographic assumptions for OECD countries for fertility, life expectancy and migration that underpin the population projections (Bos *et al.*, 1994) used in this analysis are shown in Table A4.

Table A1. **Population indicators**

	Total Population (thousands)						Annual rates of change									
							Total population					Population aged 15 to 64 (working-age population)				
	1960	1990	2000	2010	2020	2030	1960-1990	1990-2000	2000-2010	2010-2020	2020-2030	1960-1990	1990-2000	2000-2010	2010-2020	2020-2030
United States	180 684	250 372	275 636	297 205	315 258	327 987	1.1	1.0	0.8	0.6	0.4	1.4	0.9	0.9	0.1	-0.3
Japan	93 260	123 537	126 840	127 946	126 026	122 154	0.9	0.3	0.1	-0.2	-0.3	1.2	0.0	-0.5	-0.8	-0.5
Germany[1]	55 433	79 452	81 087	78 867	76 393	73 495	0.4	0.2	-0.3	-0.3	-0.4	1.3	0.1	-0.5	-0.8	-1.5
France	45 684	56 735	59 425	60 993	62 121	62 661	0.7	0.5	0.3	0.2	0.1	0.9	0.4	0.4	-0.4	-0.4
Italy	48 967	57 661	57 930	56 824	55 139	53 172	0.5	0.0	-0.2	-0.3	-0.4	0.6	-0.1	-0.4	-0.8	-1.2
United Kingdom	52 599	57 411	58 882	59 568	60 315	60 570	0.3	0.3	0.1	0.1	0.0	0.3	0.2	0.2	-0.3	-0.6
Canada	17 870	26 522	29 841	32 166	34 019	35 001	1.3	1.2	0.8	0.6	0.3	1.8	1.1	0.8	0.0	-0.5
Australia	10 275	17 065	19 292	20 971	22 113	22 824	1.7	1.2	0.8	0.5	0.3	2.0	1.3	0.9	0.1	-0.3
Austria	7 048	7 712	8 138	8 180	8 169	8 093	0.3	0.5	0.1	0.0	-0.1	0.4	0.5	-0.1	-0.4	-1.0
Belgium	9 154	9 967	10 126	10 055	9 944	9 800	0.3	0.2	-0.1	-0.1	-0.1	0.4	0.0	0.0	-0.6	-0.9
Denmark	4 581	5 140	5 267	5 277	5 261	5 213	0.4	0.2	0.0	0.0	-0.1	0.6	0.2	-0.1	-0.5	-0.7
Finland	4 430	4 986	5 183	5 272	5 322	5 318	0.4	0.4	0.2	0.1	0.0	0.7	0.3	0.1	-0.7	-0.5
Greece	8 327	10 089	10 692	10 748	10 616	10 442	0.6	0.6	0.1	-0.1	-0.2	0.7	0.6	-0.1	-0.5	-0.7
Iceland	176	255	283	308	330	347	1.2	1.0	0.9	0.7	0.5	1.6	1.3	1.0	0.4	0.0
Ireland	2 834	3 503	3 723	4 019	4 262	4 460	0.7	0.6	0.8	0.6	0.5	0.9	1.4	0.7	0.5	0.3
Luxembourg	315	382	420	422	422	418	0.6	1.0	0.0	0.0	-0.1	0.7	0.8	0.0	-0.6	-0.9
Mexico	..	81 724	98 787	114 020	128 455	142 334	..	1.9	1.4	1.2	1.0	..	2.5	2.2	1.5	0.9
Netherlands	11 486	14 952	15 794	15 999	16 064	15 912	0.9	0.5	0.1	0.0	-0.1	1.3	0.3	0.1	-0.7	-1.0
New Zealand	..	3 363	3 679	3 920	4 135	4 300	..	0.9	0.6	0.5	0.4	..	0.8	0.7	0.2	0.0
Norway	3 585	4 242	4 443	4 547	4 650	4 726	0.6	0.5	0.2	0.2	0.2	0.6	0.5	.4	-0.2	-0.4
Portugal	8 865	9 868	9 875	9 861	9 839	9 792	0.4	0.0	0.0	0.0	0.0	0.5	^.3	0.0	-0.2	-0.7
Spain	30 303	38 959	39 237	39 058	38 543	37 753	0.8	0.1	0.0	-0.1	-0.2	1.0	0.3	-0.2	-0.5	-1.0
Sweden	7 480	8 559	8 947	9 117	9 287	9 397	0.5	0.4	0.2	0.2	0.1	0.4	0.3	0.1	-0.2	-0.2
Switzerland	5 352	6 712	7 268	7 353	7 357	7 282	0.8	0.8	0.1	0.0	-0.1	0.9	0.6	-0.2	-0.5	-1.0
Turkey	27 755	56 098	66 130	74 897	83 442	90 761	2.4	1.7	1.3	1.1	0.8	2.7	2.2	2.0	1.1	0.7
Total OECD	636 463	935 266	1 006 935	1 057 593	1 097 492	1 124 212	0.9	0.7	0.5	0.4	0.2	1.1	0.7	0.5	0.0	-0.3
Total OECD[2]	581 030	770 727	823 372	860 786	888 599	904 083	0.9	0.7	0.4	0.3	0.2	1.2	0.6	0.4	-0.1	-0.4
World	3 019 000	5 266 007	6 113 680	6 944 433	7 742 124	8 474 017	1.9	1.5	1.3	1.1	0.9	..	1.7	1.6	1.2	0.8
OECD Europe	334 374	432 683	452 860	461 365	467 476	469 612	0.7	0.5	0.2	0.1	0.0	0.8	0.5	0.2	-0.2	-0.6

1. 1960 to 1990 West Germany, 1990 to 2030 total Germany.
2. Germany, Mexico and New Zealand excluded.

Source: Bos *et al.*, 1994.

Table A2. **Population sub-groups**

In per cent of total population

	Population aged 65 and over (elderly share)						Population aged 0-14 and 65 and over						Population aged 75 and over				
	1960	1990	2000	2010	2020	2030	1960	1990	2000	2010	2020	2030	1990	2000	2010	2020	2030
United States	9.2	12.6	12.5	13.6	17.5	21.9	40.3	34.1	34.2	33.5	36.5	40.5	5.3	5.8	6.2	7.1	10.0
Japan	6.1	11.9	16.5	21.1	25.6	26.1	36.1	30.3	32.1	36.2	40.4	41.4	4.7	6.3	9.4	12.1	14.7
Germany	10.8	14.9	16.2	20.2	22.5	28.1	32.2	31.2	31.8	33.3	36.4	42.9	7.2	6.9	8.4	10.9	12.4
France	11.6	13.8	15.5	16.3	20.2	23.3	38.0	33.8	34.6	33.9	37.3	40.4	6.5	6.7	8.1	8.5	11.4
Italy	9.0	14.8	17.9	20.6	23.6	27.9	32.4	31.3	32.3	34.0	37.0	42.1	6.5	7.7	9.9	11.4	13.4
United Kingdom	11.7	15.7	15.9	17.0	19.7	23.0	34.9	34.6	35.1	34.4	36.8	40.5	6.8	7.3	7.9	8.8	10.6
Canada	7.6	11.3	12.3	13.8	18.2	23.1	41.3	32.2	32.6	32.2	36.0	40.8	4.5	5.3	6.2	7.3	10.3
Australia	8.5	10.7	11.3	12.6	16.3	20.3	38.7	32.9	32.4	32.3	34.9	38.5	4.1	4.8	5.3	6.4	8.9
Austria	12.2	15.1	15.6	18.3	20.8	25.7	34.3	32.5	33.0	33.9	36.2	41.6	7.1	7.2	8.3	10.1	11.6
Belgium	12.0	15.0	16.6	17.1	20.3	24.3	35.5	32.9	33.7	33.0	36.3	40.8	6.7	7.1	8.2	8.5	10.9
Denmark	10.6	15.4	14.5	16.4	20.1	22.6	35.8	32.4	32.9	33.9	36.7	40.1	6.7	6.6	6.6	8.3	10.4
Finland	7.3	13.3	14.4	16.2	21.3	24.1	37.7	32.6	33.0	33.5	38.5	41.5	5.6	6.2	7.3	8.4	12.1
Greece	8.1	14.2	17.1	19.0	21.2	24.6	34.2	33.2	32.8	34.1	36.4	39.9	6.4	6.7	9.3	10.1	11.8
Iceland	8.1	10.6	11.3	12.0	15.5	19.6	42.9	35.3	34.3	32.8	33.2	38.6	4.3	4.9	5.5	6.4	8.6
Ireland	10.9	11.4	11.2	11.9	14.2	16.4	41.4	38.1	33.3	33.9	34.5	35.3	4.6	4.9	5.1	5.9	7.4
Luxembourg	10.8	13.6	14.8	17.3	20.9	25.6	32.1	30.6	32.6	33.4	36.7	42.1	6.0	6.0	7.6	9.0	11.5
Mexico	..	3.7	4.3	5.3	7.2	10.0	..	41.7	38.1	33.4	31.3	32.5	1.3	1.3	1.8	2.4	3.5
Netherlands	9.0	13.2	14.1	16.4	21.5	26.0	39.0	30.8	32.3	32.2	36.7	42.3	5.6	6.3	7.2	8.8	12.1
New Zealand	..	11.1	11.3	12.6	15.9	18.9	..	33.7	34.2	33.4	35.4	38.1	4.4	4.8	5.2	6.3	8.3
Norway	10.9	16.3	15.5	15.8	19.7	23.0	36.8	35.2	35.1	34.1	36.9	40.6	7.0	7.9	7.7	8.3	11.2
Portugal	8.0	13.0	14.3	15.0	16.9	20.9	37.1	33.7	31.7	31.8	33.3	37.4	5.2	5.8	6.7	7.2	8.6
Spain	8.2	13.2	16.2	17.6	20.1	24.9	35.5	33.0	31.2	31.9	34.5	39.3	5.4	6.6	8.6	9.4	11.2
Sweden	11.8	17.8	17.0	18.4	21.6	23.1	34.1	35.6	36.7	36.9	39.4	41.3	7.9	8.7	8.6	9.9	12.1
Switzerland	10.3	15.0	15.8	19.1	23.3	27.5	34.0	31.6	33.2	34.9	38.4	43.5	7.1	7.2	8.7	11.0	13.6
Turkey	3.7	4.3	5.7	6.4	8.0	10.9	44.9	39.9	36.7	31.9	31.6	32.7	1.5	1.5	2.3	2.7	3.7
Total OECD	9.4	12.9	13.9	15.6	18.9	22.5	36.9	33.7	33.6	33.6	36.1	39.8	5.5	6.0	7.0	8.2	10.4
OECD Europe	9.7	13.7	14.7	16.4	19.5	23.2	36.5	33.6	33.5	33.6	36.3	40.2	6.0	6.4	7.5	8.6	10.8

Source: Bos *et al.*, 1994

Table A3. **Dependency and support ratios**

	Elderly dependency ratio[1]						Total dependency ratio[2]						Needs-weighted support ratio[3]					
	1960	1990	2000	2010	2020	2030	1960	1990	2000	2010	2020	2030	1960	1990	2000	2010	2020	2030
United States	15.4	19.1	19.0	20.4	27.6	36.8	67.4	51.7	52.0	50.5	57.4	68.0	63.7	67.7	67.6	67.8	63.9	59.1
Japan	9.5	17.1	24.3	33.0	43.0	44.5	56.6	43.5	47.2	56.7	67.8	70.5	68.5	71.1	67.9	62.9	58.0	57.0
Germany	16.0	21.7	23.8	30.3	35.4	49.2	47.4	45.3	46.7	50.0	57.3	75.1	70.0	69.2	68.2	65.5	62.2	55.2
France	18.8	20.8	23.6	24.6	32.3	39.1	61.3	51.1	52.8	51.2	59.6	67.9	64.7	67.5	66.2	66.5	62.2	58.7
Italy	13.3	21.6	26.5	31.2	37.5	48.3	47.9	45.5	47.8	51.5	58.8	72.7	70.5	69.1	67.1	64.8	61.4	55.9
United Kingdom	17.9	24.0	24.4	25.8	31.2	38.7	53.7	52.9	54.0	52.3	58.3	68.0	67.3	66.1	65.6	65.8	62.8	58.7
Canada	13.0	16.7	18.2	20.4	28.4	39.1	70.5	47.5	48.3	47.5	56.3	69.0	63.3	69.7	69.1	68.8	64.0	58.4
Australia	13.9	16.0	16.7	18.6	25.1	33.0	63.2	48.9	48.0	47.6	53.7	62.6	65.3	69.4	69.6	69.2	65.6	61.2
Austria	18.6	22.4	23.3	27.7	32.6	44.0	52.1	48.2	49.3	51.3	56.7	71.4	67.7	68.0	67.4	65.7	63.0	57.0
Belgium	18.5	22.4	25.1	25.6	31.9	41.1	55.0	49.2	50.9	49.3	57.0	68.9	66.7	67.7	66.5	66.9	63.1	58.1
Denmark	16.5	22.7	21.6	24.9	31.7	37.7	55.8	47.9	49.1	51.3	57.9	67.0	67.0	68.0	67.9	66.4	62.8	59.2
Finland	11.7	19.7	21.5	24.3	34.7	41.1	60.6	48.4	49.2	50.4	62.7	70.9	66.6	68.6	67.9	66.8	60.9	57.6
Greece	12.3	21.2	25.5	28.8	33.3	40.9	52.0	49.6	48.8	51.7	57.1	66.3	69.3	67.9	67.0	65.3	62.7	58.7
Iceland	14.1	16.6	17.3	18.1	24.1	32.1	75.0	55.2	52.4	49.5	54.7	63.2	61.8	67.2	67.9	68.7	65.5	61.3
Ireland	18.6	18.4	16.7	18.0	21.7	25.3	70.6	61.4	49.8	51.3	52.6	54.5	62.1	64.8	68.9	68.1	66.8	65.3
Luxembourg	15.9	19.9	21.9	25.9	33.2	44.2	47.4	44.8	48.4	50.0	58.5	72.7	70.0	69.8	68.1	66.6	62.4	56.6
Mexico	..	6.4	7.0	8.0	10.4	14.8	..	71.6	61.5	50.2	45.5	48.1	..	64.5	67.5	71.2	72.2	70.1
Netherlands	14.7	19.1	20.8	24.2	33.9	45.1	63.9	44.5	47.7	47.5	58.1	73.2	64.9	70.2	68.6	67.8	62.3	56.3
New Zealand	..	16.7	17.1	18.9	24.6	30.5	..	50.9	51.9	50.2	54.7	61.6	..	68.6	68.1	68.2	65.4	62.1
Norway	17.3	25.2	23.9	24.0	31.2	38.7	58.2	54.4	54.1	51.7	58.6	68.3	66.1	65.3	65.7	66.5	62.8	58.7
Portugal	12.7	19.5	20.9	22.0	25.3	33.5	59.1	50.7	46.4	46.6	50.0	59.8	66.9	67.9	69.0	68.6	66.7	61.9
Spain	12.7	19.8	23.5	25.9	30.7	41.0	55.1	49.3	45.3	46.9	52.7	64.8	68.2	68.3	68.7	67.6	64.6	59.1
Sweden	17.8	27.6	26.9	29.1	35.6	39.4	51.8	55.3	57.9	58.5	65.1	70.4	68.0	64.5	63.9	63.2	60.1	58.0
Switzerland	15.5	22.0	23.6	29.4	37.8	48.6	51.5	46.1	49.6	53.7	62.4	77.0	68.7	68.8	67.2	64.6	60.4	54.9
Turkey	6.7	7.1	8.9	9.4	11.7	16.2	81.4	66.3	57.9	46.9	46.1	48.6	61.6	65.9	68.2	72.0	71.6	69.5
Total OECD	14.9	19.3	20.9	23.5	29.8	37.7	59.0	51.2	50.7	50.6	56.8	66.4	66.5	67.8	67.6	67.0	63.7	59.5
OECD Europe	15.3	20.6	22.1	24.7	30.8	39.2	57.9	50.9	50.4	50.6	57.1	67.4	66.7	67.6	67.4	66.7	63.4	59.0

1. Population aged 65 and over as a per cent of working age population
2. Population aged 0-14 and 65 and over as a per cent of working age population.

Source: Bos *et al.*,1994.

Table A4. **Key demographic factors**

	Fertility rate[1]		Life expectancy at birth		Net Migration rate[2]	
	1990-1995	2025-2030	1990-1995	2025-2030	1990-1995	2025-2030
United States	2.1	2.1	76.6	81.8	2.5	0.0
Japan	1.5	2.0	79.1	82.8	0.0	0.0
Germany	1.3	2.0	75.8	80.6	5.6	0.0
France	1.8	2.0	77.2	81.8	1.2	0.0
Italy	1.3	2.0	77.4	82.0	1.0	0.0
United Kingdom	1.8	2.0	76.2	81.0	0.9	0.0
Canada	1.9	2.1	77.8	82.2	4.4	0.0
Australia	1.9	2.1	76.7	81.0	5.7	0.0
Austria	1.6	2.0	76.6	81.5	5.1	0.0
Belgium	1.6	2.0	75.6	79.6	1.7	0.0
Denmark	1.8	2.0	74.7	79.1	1.9	0.0
Finland	1.9	2.1	75.4	80.8	1.6	0.0
Greece	1.4	2.0	77.4	81.7	6.8	0.0
Iceland	2.2	2.1	78.2	81.9	0.8	0.0
Ireland	2.0	2.1	75.2	80.6	-0.6	0.0
Luxembourg	1.7	2.0	75.7	80.6	10.2	0.0
Mexico	3.2	2.1	70.3	77.0	-2.3	0.0
Netherlands	1.6	2.0	77.3	81.5	2.6	0.0
New Zealand	2.1	2.1	75.7	80.5	1.2	0.0
Norway	1.9	2.1	77.2	81.7	1.9	0.0
Portugal	1.5	2.0	73.7	78.3	-0.8	0.0
Spain	1.2	2.0	76.8	81.2	0.5	0.0
Sweden	2.1	2.1	77.9	82.3	2.3	0.0
Switzerland	1.7	2.0	78.4	82.6	7.3	0.0
Turkey	2.9	2.1	67.3	74.8	0.0	0.0

1. Number of children per woman of childbearing age.
2. Number of net immigrants per 1 000 people.

Source: Bos *et al.*, 1994.

Annex 2

Description of Pension Systems and Methodology Used in Simulations

United States

Description

-- The main old-age public pension scheme is the Old Age and Survivors Insurance (OASI) programme, commonly referred to as "Social Security," which covers all private sector and almost all public sector employees, including federal civilian employees since 1984, military personnel and state and local government employees. Federal civilian employees who began employment with the Government before 1984 are covered by an unfunded pension scheme that was closed to new entrants in 1984.

-- The combined OASI employee and employer contributions rate is currently 10.52 per cent, which is also the rate for the self-employed. In 2000, the OASI tax rate is scheduled to decline to 10.38 per cent. Contributions are made on earnings up to a ceiling ($60 600 per year in 1994) and indexed to the growth in nominal wages.

-- Pension beneficiaries with income above a threshold are subject to personal income tax on up to 85 per cent of their pensions. The threshold is not indexed for inflation, and the tax on benefits is forecast to produce significant revenues in later decades. The tax revenues are assigned automatically to the OASI and hospital insurance (HI) trust funds.

-- The social security system is partially funded and held assets equivalent to 6 per cent of GDP in 1993. Additional revenue is generated by interest income on assets held by the pension system[1].

-- On average, newly retired workers in 1994 received pensions equal to 42.5 per cent of their last salary, and this replacement rate is projected by the SSA to stay virtually constant over the forecast time horizon. After retirement, pensions received are indexed to consumer price inflation.

-- The retirement age is scheduled to rise from 65 to 67, for both men and women between 2000 and 2022. Early retirement is possible from the age of 62, but is penalised with an offsetting actuarial reduction in pension payments. Later retirement is also possible with a corresponding actuarial increase.

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1. However, interest on income earned on holdings of federal, state and local government bonds is consolidated out for the general government sector as a whole.

-- The overall eligibility ratio for pension benefits is projected by the Social Security Administration (SSA) to increase from 77 per cent to 90.5 per cent over the forecast period, reflecting a steady increase in the female eligibility ratio.

Simulation model

-- The model covers the Old Age and Survivors Insurance (OASI) and the railroad retirement system, which was treated as if it were a part of social security for purposes of the simulations.

-- Total contributions into the system were calculated by using the "intermediate" scenario of the SSA forecasts of the future evolution of the contributions base, contribution rates and taxes on pensions (Board of Trustees, 1994).

-- Average benefits were calculated by dividing total benefits by total beneficiaries, using 1993 as the base year. Pensions for new retirees were then calculated using SSA forecasts of benefit replacement rates as a percentage of final salary. Final salaries were assumed to grow in line with productivity growth. The ratio of beneficiaries to the total retired population used in the SSA forecasts was then applied to the World Bank population projections used in this analysis.

-- The model accounts for future changes in the OASI tax rate and the retirement age.

-- Pensions for each cohort of new retirees were indexed to inflation.

Japan

Description

-- Japan has six public pension schemes, divided into flat-rate and earnings-related components (Takayama, 1992). The flat-rate scheme, the *Kokumin-Nenkin* (KN), provides pensions to all retirees. The principal earnings-related scheme is the *Kosei-Nenkin-Hoken* (KNH), which provides benefits to non-agricultural workers in the private sector. Dependent wives of men in the KNH scheme are entitled to pensions without making contributions. The other schemes cover central government employees, local government employees, private school teachers, and agricultural workers respectively (Social Development Research Institute, 1991).

-- The contribution rate applied to wage income is currently 16.5 per cent, will be raised to 17.35 per cent in October 1996, and then will be reviewed every five years. There is provision for rates to be raised by 2.5 percentage points at each review.

-- As an additional revenue raising measure, bonuses will be subject to a 1 per cent contribution rate from April 1995 onwards.

-- The Japanese public pension system is partially funded, and pension assets were equivalent to 37 per cent of GDP in 1992. The system is currently operating in approximate balance.

-- In the KNH scheme, benefits are accrued at a rate of 0.75 per cent of indexed monthly wages, multiplied by the number of months of insurance coverage.

-- The main earnings-related scheme is still maturing and consequently the replacement ratio will rise in the future.

-- After retirement, benefits are indexed to inflation.

-- The retirement age is currently 60 for men and women, but will gradually be raised to 65 by 2014 for men and 2019 for women.

-- Overall eligibility is 100 per cent for both men and women.

Simulation model

-- As there is some uncertainty about contribution rate increases scheduled beyond 2000, two scenarios have been constructed. In Scenario A, contribution rates are not increased beyond 1999 and in Scenario B, contribution rates are increased by 2½ percentage points every five years until a rate of 29.6 per cent is reached in 2025.

-- As an initial starting point, data on total contributions for 1993, total benefits for 1993, and total financial assets in 1992, were obtained from the Japanese national accounts.

-- The simulation model takes into account the maturation of the main earnings-related scheme and future increases in the retirement age.

-- Pensions for each new cohort of retirees were indexed for inflation.

Germany

Description

-- Public pensions in Germany are related to earnings, with the main schemes covering wage earning (*Rentenversicherung der Arbeiter*) and salaried (*Rentenversicherung der Angestellten*) employees. Dependent spouses are covered only if they contribute voluntarily. Widows and widowers are eligible for survivors' benefits, which currently provide close to half of the pension payments received by women. Other schemes exist for various occupations, with the most important being for civil servants with the status of *Beamte,* who do not pay pension contributions.

-- Contribution rates are set each year at the levels required to balance the system. In 1994, the contribution rate was 19.2 per cent, applied to annual wage income up to a ceiling, (DM 94 000 in 1994) that is adjusted every year.

-- The average pension for a retiring worker who earned the average manufacturing wage is equal to 53 per cent of the gross wage (Eurostat, 1993).

-- After retirement, benefits are indexed to the growth in net wages. Among the seven major countries, Germany is now the only country which continues to index pension benefits to wage growth.

-- The retirement age is currently 63 for men (under certain conditions it is 65) and 60 for women and will be raised gradually to 65 by 2009 for men and by 2018 for women (*Bundesminister für Arbeit und Sozialordnung,* 1991). Early retirement is possible, and widely taken for a variety of reasons ranging from having reached 35 years of contributions needed for full pension to unemployment or disability. Early retirement as a substitute for unemployment has been used extensively.

-- The eligibility ratio for men is virtually 100 per cent. Dependent wives are only eligible for old-age pensions if they make voluntary contributions to the schemes, but are eligible for survivors' benefits.

Simulation model

-- In Scenario A statutory transfers from general revenues are included. In Scenario B transfers were not included. Inclusion of the transfers changes the net pension liability, but not the overall fiscal impact.

-- The net pension liability for the schemes covering wage earning employees (*Arbeiter*), salaried employees (*Angestellte*), miners (*Knappschaft*) and civil servants with the status of *Beamte* was estimated.

-- Legislated changes in the contribution rate up until 1998 were taken into account. The ceiling on contributions was also taken into account. After 1998, the contribution rate was kept at the 1998 level.

-- Early retirement is widespread in Germany. To account for this, data on the total number of pensions paid in 1993 were obtained from the German national accounts.

-- Data for the number of civil servants with the status of *Beamte* and total pensions paid to *Beamte* pensioners in 1994 were obtained from the Ministry of Finance.

-- Pensions were indexed to wages.

-- Legislated increases in the retirement age were taken into account.

France

Description

-- There are over 500 separate public pension schemes in France (*Livre blanc sur les retraites,* 1991), but they can be functionally divided into four groups; the *régime général,* which pays earnings-related benefits to private sector workers, the *régimes complémentaires* which provide earnings-related supplements, the plan for civil servants, which pays benefits broadly comparable to those of the *régime général* and *régimes complémentaires* combined, and occupational schemes for groups such as miners, farmers, railway employees and other specific occupational groups. The average retiree receives 2.8 pensions from different sources. There is also a means-tested minimum benefit, which is paid to a small and shrinking minority of pensioners.

- Contribution rates vary widely by scheme and there is also a wide variation in the base on which they are calculated. For the civil servants' scheme, the explicit contribution rate is quite low and the Government allots "fictive" contributions from general revenues to balance the system (although these are essentially a bookkeeping measure).

- In the scheme for civil servants the initial benefit is based on 75 per cent of the final salary. In the *régime général* benefits have been based on the best ten years of lifetime earnings. In the future, they will be based on the best 25 years of earnings, with this reform to be phased in over the next 13 years.

- Indexation formulas for pension benefits vary according to the scheme, but as a result of the 1993 reforms, benefits are in practice indexed to inflation.

- The standard retirement age is 60 for both men and women, although some of the occupational schemes have even lower retirement ages. There are no plans at present to raise the statutory retirement age and early retirement has been encouraged as a way of dealing with unemployment among older workers. However, the number of years of contributions required to qualify for a full pension was extended to 37.75 years in 1994 and will be raised to 40 years over the next nine years at a rate of 3 months each year.

- Eligibility is 100 per cent for both men and women.

Simulation model

- The "fictive" contributions into the civil servants scheme (and some of the smaller schemes) were not counted as a part of total contributions in Scenario A, in order to better reflect the underlying balance of that scheme. Scenario B includes "fictive" contributions. This changes the net pension liability but not the overall fiscal impact.

- The schemes were separated into the four broad groups, with benefit and contribution rates calculated on the basis of total benefits paid and total contributions collected for the year 1993.

- Expenditures on the means-tested minimum pension were included.

- Revenues from the *contribution sociale généralisée* were included.

- Pensions for each new cohort of retirees were assumed to be indexed to inflation.

- Future increases in contribution rates for the *régimes complémentaires* were incorporated.

- Future reductions in benefit replacement rates as a result of the 1993 reforms were incorporated.

Italy

Description

- There are many public pension schemes, with a wide variety of rules regarding eligibility and benefit payments. The main scheme, *Instituto Nazionale de Previdenza Sociale,* (INPS) which pays earnings-related benefits to private sector workers, administers 70 per cent of pension expenditure (Franco and Frasca, 1992).

- In general, workers must contribute for 15 years or more in order to qualify for a public pension, with 35 years required for a full pension, and a maximum contribution period of 40 years.

- For those workers without sufficient years of contributions to qualify for the earnings-related scheme, there is also a means-tested flat-rate pension.

- The full INPS pension for a new retiree is equal to 78 per cent of the average gross wage (Eurostat, 1993). Pensions for women, who typically have fewer years of contributions, are lower on average. Eurostat estimates indicate that the pension for a new retiree with 20 years of contributions is equal to 45 per cent of the average gross wage.

- Also as part of the 1993 reform, pension benefits will eventually be based on lifetime earnings. Previously, benefits in the INPS scheme were based on the last five years of earnings, while benefits for state employees were based on the final salary.

- As a result of the 1993 pension reform, benefits are now indexed to inflation.

- The retirement age of 60 for men and 55 for women is being raised to 65 for men and 60 for women. In 1995, the statutory retirement ages were raised to 62 for men and 57 for women and the increases will be fully phased in by 2001.

- Overall eligibility is 100 per cent for men and women.

Simulation model

- The contribution rate for financing old age, survivors, and disability pensions under INPS is 26.82 per cent. This contribution rate was used throughout the time horizon to calculate total pension contributions.

- It is assumed that men have 35 years of contributions on average and so retire with benefits equal to 78 per cent of average gross wages. For women, the average benefit replacement rate necessary to balance the system in 1993 was calculated. This calculation implicitly included expenditures on disability pensions. This replacement rate, equal to 52 per cent of average gross wages, was held constant in this model.

- Pensions for each cohort of new retirees were indexed to inflation.

- The legislated increase in the retirement age was taken into account.

-- The proposed 1995 reforms were not incorporated in the simulation model.

United Kingdom

Description

-- The United Kingdom has both flat-rate and earnings-related public pension schemes (National Insurance Fund, 1990), although it is possible to opt out of the earnings-related scheme.

-- To receive full flat-rate and earnings-related pension rights, contributions must normally have been paid for at least 90 per cent of a working life. No pension is paid at all if contributions were paid for less than a quarter of a working life. Years spent at home due to child-raising responsibilities or to care for disabled persons are excluded from the definition of a working life, enabling easier satisfaction of the contribution conditions.

-- At present, 99 per cent of men and approximately 75 per cent of women qualify for a flat-rate pension. Since women have averaged fewer working years before retirement than men, their flat-rate pensions average only 75 per cent of men's pensions. The eligibility ratio for women is expected to rise to 100 per cent by the year 2010, and women's flat-rate pensions are also expected to rise to 91 per cent of the value for men. This increase in relative pension values is expected to occur by 2020.

-- The flat-rate pensions are indexed to inflation and as there is no built-in mechanism for adjusting for real wage growth, the relative value of flat-rate pensions is expected to decline over time.

-- The earnings-related scheme is still maturing, and it will be 1998 before retirees are able to claim full earnings-related benefits. From 1999, earnings-related benefits will be based on lifetime earnings. Retirement ages are the same as in the flat-rate scheme.

-- As the relative value of flat-rate pensions declines, and the earnings-related scheme matures, the National Insurance Fund forecasts earnings-related pensions to eventually account for approximately a third of pension expenditure. Currently, almost no earnings-related benefits are paid out.

-- Earnings-related benefits are also indexed for inflation.

-- Eligibility ratios for men and women are comparable to those for the flat-rate scheme.

-- Retirement ages in both the flat-rate and earnings-related pension schemes are 65 for men and 60 for women, although the retirement age for women is being raised to 65 between 2010 and 2020 as a result of a reform passed in 1994.

Simulation model

-- It was assumed that all workers remained in the earnings-related scheme, rather than opting out.

-- Total retirement-related national insurance contributions in 1993 were divided by total wages in that year to calculate an implied pension contribution rate. This rate was then kept constant.

-- Earnings-related pensions were modelled by using National Insurance Fund forecasts of total pensions paid in future decades, divided by their forecasts of future retirees, to calculate earnings-related pensions payable in a given year. These estimates of future expenditure were then applied to the World Bank population data to get total earnings-related expenditure. As the pension formula becomes less favourable with the move to lifetime earnings from 1999 onwards, the average earnings-related benefit, as a proportion of average wages, peaks in the first two decades of the next century and then declines.

-- Flat-rate and earnings-related pensions for each cohort of new retirees were indexed to inflation.

Canada

Description

-- Canada has both flat-rate and earnings-related public pension schemes (Old Age Security Program, 1991; Canada Pension Plan, 1991). The flat-rate programmes are financed out of general revenues, while the earnings-related schemes are financed from payroll contributions.

-- There are three flat-rate schemes; Old Age Security (OAS), the Guaranteed Income Supplement (GIS), and the Spouse's Allowance Program (SPA). The GIS and SPA are means-tested to target poorer retirees, whereas the OAS is payable to all eligible retirees.

-- Eligibility for a full pension is dependent on 40 years of residence in Canada between the ages of 18 and 65. Eligibility for the earnings-related schemes are also dependent on years of contributions. Benefits are reduced proportionately for fewer years of residence in Canada.

-- The flat-rate schemes are indexed to inflation only, and will decline relative to average earnings over time unless the government of the day acts to raise them. They have been raised in real terms in the past.

-- The earnings-related schemes are the Canada Pension Plan (CPP) and the Quebec Pension Plan (QPP). The QPP provides benefits to retired workers in Quebec, the CPP to retired workers in the rest of Canada. The two plans have virtually identical contribution and benefit characteristics.

-- In 1994 the aggregate contribution rate was 5.2 per cent, paid equally by employees and employers. The self-employed pay the combined rate. Contributions were payable on annual wage income between C$ 3 400 and C$ 34 400. The wage floor and ceiling are adjusted every year in line with the growth in nominal earnings.

-- In 1995 the contribution rate will rise to 5.4 per cent and it will continue to increase in subsequent years until 2016 when it will reach 10.1 per cent.

-- The earnings-related scheme is designed to pay benefits equal to 25 per cent of average wages.

-- All benefits are financed from employee and employer contributions, and earnings on assets held by the reserve fund. The fund currently has assets approximately equivalent to two years' expenditures, invested in debt securities issued by the Provinces.

-- Benefits are indexed to inflation.

-- Currently, 98 per cent of male retirees qualify for an earnings-related pension, and 85 per cent of female retirees. By 2050 the Government forecasts that 90 per cent of female retirees will be eligible for an earnings-related pension.

-- The retirement age is 65 for both men and women.

Simulation model

-- The flat-rate and earnings-related schemes were modelled separately.

-- In Scenario A, it was assumed that no transfers from general taxation revenues were made to these schemes. In Scenario B, it was assumed that the levels of transfers each year corresponded to the amount required to balance the flat-rate schemes in 1994 and consequently the net pension liability is drastically reduced, although the overall fiscal impact remains unchanged.

-- It was assumed that the parameters of the CPP applied to the whole of Canada.

-- The contribution rate increases were incorporated until 2016.

-- Pensions benefits were indexed to inflation.

Smaller OECD countries

-- ***Australia*** has a means-tested flat-rate scheme financed entirely from general revenues. Benefits are indexed to consumer price inflation. A new scheme, the superannuation guarantee charge, was announced in 1992 which obliges employers to contribute to fully funded private pension plans. The retirement age is 65 for men and 60 for women.

-- ***Austria*** provides almost universal coverage through a variety of earnings-related public pension schemes which operate on a pay-as-you-go basis, with contributions from employers and employees and transfers from general government revenue amounting to approximately 25 per cent of annual pension expenditures. The retirement age is 65 for men and 60 for women.

-- ***Belgium*** operates a number of earnings-related schemes on a pay-as-you-go basis, financed by employee and employer contributions. A full pension for private sector employees requires contributions for 45 years and replaces 60 per cent of average lifetime earnings with benefits generally indexed to inflation. Public sector employees receive more generous pension benefits. Public sector retirees receive pensions averaging 75 per cent of their salary over their last five years and have their benefits indexed to nominal wage growth. There is also a means-tested minimum pension. The retirement age is in general 65 for men and 60 for women, but the

retirement age for miners is as low as 55. Men can retire from 60 with no actuarial reduction. Benefits are taxable.

-- ***Denmark*** has a flat-rate scheme (the Social Pension) and a means-tested scheme, both of which operate on a pay-as-you-go basis. The Social Pension scheme is universal and requires 40 years of residence for a full pension. There is also a fully funded supplementary scheme which pays benefits based on the number of hours worked. The retirement age for men and women is 67, but early retirement is possible from 60 on under the *Efterløn* scheme if workers contribute to a supplemental unemployment insurance fund for at least 20 of the 25 years preceding retirement.

-- ***Finland*** has both flat-rate and earnings-related public pension schemes. There are 85 earnings-related schemes organised primarily along occupational lines. Earnings-related benefits are inversely related to the amount of pension income retirees receive from private occupational pensions. The earnings-related public pension schemes are partly funded and currently hold assets equivalent to 38 per cent of GDP. The standard retirement age is 65 but early retirement is possible from 60 subject to an actuarial reduction in benefits.

-- ***Greece*** has a variety of earnings-related public pension schemes operating on a pay-as-you-go basis. The schemes are financed by employee and employer contributions and government transfers. Benefits vary between 30 and 70 per cent of earnings in the two years preceding retirement. The retirement age in most schemes is 65 for men and 60 for women, with a common age of 65 for those entering the work force after 1 January 1993.

-- ***Iceland*** has both flat-rate and earnings-related public pension schemes. The earnings-related schemes are fully funded and pay much larger benefits on average than the flat-rate scheme. The flat-rate scheme operates on a pay-as-you-go basis and is financed by a dedicated payroll tax and by general revenues in roughly equal proportions. Eligibility is 100 per cent in the flat-rate scheme. The retirement age for the flat-rate scheme is 67, except for mariners who can retire at 60. As the retirement age in the earnings-related schemes is generally 70, most of the non-seafaring population retire at that date.

-- ***Ireland*** has a flat-rate public pension scheme for retired workers and a means-tested scheme. The standard scheme is financed out of employee and employer contributions. The means-tested scheme is financed out of general revenues. Both schemes operate on a pay-as-you-go basis. The standard retirement age is 65 for men and women.

-- ***Luxembourg*** has a system of earnings-related schemes operated on a pay-as-you-go basis. Financing is by employee and employer contributions and government transfers in roughly equal proportions. There is also a means-tested scheme for low-income pensioners with at least 15 years of residence. The standard retirement age is 65 for men and women with early retirement possible from 60 for men and 55 or 60 for women depending on the scheme.

-- ***Mexico*** has both flat-rate pay-as-you-go public pension schemes and a fully funded earnings-related scheme. The flat-rate schemes are financed by employee and employer contributions and government transfers. In the flat-rate schemes benefits are based on the number of years of contributions and family status. The earnings-related scheme is financed by employee and employer contributions. In the fully funded scheme the rate of return is guaranteed and benefits

are directly related to contributions. The retirement age is 65 for men and women with early retirement possible from 60 subject to a reduction in benefits.

-- The *Netherlands* has a flat-rate public pension scheme which covers all residents, financed by employee contributions. A full pension requires 50 years of residence (with the pension reduced by 2 per cent per year of absence) and is linked to the minimum wage. There are also mandatory fully funded private pension schemes. The retirement age is 65 for men and women.

-- *New Zealand* has a flat-rate public pension scheme covering all residents, financed entirely from general revenues. A surcharge tax is imposed on all income above a threshold, although half of the income from private pensions is exempt. The retirement age is being gradually raised from 60 to 65 by 2001.

-- *Norway* has both flat-rate and earnings-related pension schemes. Eligibility for the flat-rate pension is independent of lifetime income or contributions but 40 years of contributions are necessary for a full flat-rate pension. The pension is reduced proportionately for fewer years of contributions. The earnings-related pension was introduced in 1967 and is still maturing. Benefits will eventually be based on earnings valued over 40 years. The retirement age is 67 for men and women and there are no provisions for early retirement.

-- *Portugal* has earnings-related pension schemes organised along occupational lines. The schemes operate on a pay-as-you-go basis. Benefits are financed by employee and employer contributions except for a means-tested scheme which is financed out of general revenues. Under a reform enacted in 1993 benefits are calculated as a proportion of average earnings in the best 10 of the 15 years preceding retirement. For a person earning average wages this results in benefits averaging 70 per cent of average wages. The eligibility requirement is 120 months of contributions with a retirement age of 65 for men and 62 for women.

-- *Spain* has a variety of earnings-related schemes operated on a pay-as-you-go basis. The schemes are financed by employee and employer contributions and statutory government transfers. A full pension can pay benefits of up to 100 per cent of previous average earnings during the eight years preceding retirement. The Government has estimated the net liability of the public pension schemes to be 123 per cent of GDP. The retirement age is 65 for men and women.

-- *Sweden* has both flat-rate and earnings-related public pension schemes which operate on a pay-as-you-go basis. The public pension schemes have a reserve fund equal to five years' contributions. The principal earnings-related scheme is mandatory and covers both private and public sector employees. The flat-rate scheme covers all residents. The earnings-related schemes are financed by employer contributions. The flat-rate scheme is financed by employer contributions and government transfers. Average flat-rate and earnings-related benefits sum to approximately 70 per cent of average earnings. The standard retirement age is 65 for men and women with early retirement from 60 possible but subject to an actuarial reduction of 6 per cent per year.

-- *Switzerland* has an earnings-related scheme with universal coverage operated on a pay-as-you-go basis. The scheme is financed by employee and employer contributions and federal government and cantonal transfers. Benefits are based on all years of contributions over the age of 20 and a partial pension is payable on the basis of one or more years of contributions. There is also a

means-tested scheme. The retirement age is 65 for men and 62 for women with no provision for early retirement.

-- ***Turkey*** has a variety of earnings-related public pension schemes organised generally along occupational lines. The schemes are pay-as-you-go and are financed by employee and employer contributions with benefits based on 70 per cent of average earnings during the five years preceding retirement. Benefits are adjusted at least once every two years according to the growth in nominal wages. There is also a means-tested pension available to those 65 and older who do not qualify for an earnings-related pension. The retirement age is 55 for men and 50 for women.

Annex 3

Generational Accounting: the Methodological Framework

1. The approach of Generational Accounting is based on the so-called inter-temporal budget constraint which means that the government's current net wealth plus all future taxes paid to the government minus all transfers paid by the government (future net taxes) must cover all future government spending on goods and services. The sum of future net taxes is split into an amount paid by all existing generations (annual cohorts of the population) from the base year onwards to the end of their lives and the remaining amount which has to be paid by all future generations during their lives. Hence:

Present value of all future government consumption	=	Stock of current government net wealth	+	Present value of all future net tax payments of all living generations	+	Present value of all net tax payments of all future generations

or in algebraic form:

$$\sum_{s=t}^{\infty} G_s(1+r)^{t-s} = W_t^G + \sum_{s=0}^{D} N_{t,t-s} + \sum_{s=1}^{\infty} N_{t,t+s}$$

Where:

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

G_s	=	government consumption in period s
W^G_t	=	government net wealth in the base year t (minus in the case of net debt)
$N_{t,k}$	=	present value in the base year t of all future net tax payments of the generation born in year k
$T_{s,k}$	=	average per capita net tax payments in year s of the cohort born in year k
$P_{s,k}$	=	number of surviving members in year s of the cohort born in year k
r	=	real interest rate (discount rate)

2. The term on the left-hand side of the equation is the discounted sum of government spending on goods and services for every future period s, starting in the base year t. The right-hand side describes the three ways of financing for such spending: government's net wealth in the base year, the present value of future net tax payments (taxes minus transfers) of all generations alive in the base year ($N_{t,\,t-s}$, where D denotes their maximum age) and the sum of the present value of net tax payments by generations born after the base year ($N_{t,\,t+s}$). If net wealth is negative, i.e. if the government is in a net debt position, all future net tax payments must be equal to current net debt plus all future government consumption. The inter-

temporal budget constraint implies that if government consumption increases without a corresponding increase in net taxes of existing generations (or if net taxes of existing generations are reduced without a corresponding reduction in government consumption) net taxes of future generations have to increase in order to keep the government budget on a sustainable path.

3. The generational accounts are the discounted future per capita net tax payments of members of all annual cohorts of the population of the base year (existing generations) and of those born after the base year (future generations). To calculate generational accounts for the annual cohorts of the population, the different effects of government receipts and outlays on different age-groups have to be taken into account. For example, labour income taxes and social security contributions are paid during working years and pensions are received during retirement. Generational accounting models attempt to consider all age-specific differences in household's tax payments (labour income taxes, capital income taxes, social security contributions, indirect taxes) and transfer receipts (pensions, welfare) or other government spending (health, education). For all other government revenues and spending (for example, defence) uniform effects on age-groups are assumed. While in principle the method is straightforward, in practice numerous simplifying assumptions have to be made. In particular, the age-specific distribution of tax payments and government spending is often difficult to estimate in practice. As it is also difficult to assess the real value of non-marketable government assets, the wealth variable is generally proxied by net government financial assets (or net liabilities). Some of the models include, however, the present value of future government revenues from generated real assets.

4. Table A5 shows that the generational accounts (net tax payments) have a significant life-cycle pattern. While younger generations make positive net payments to the government over their remaining lifetimes, older generations are net recipients. Present values of future net tax payments are higher for younger generations because they have more future years of paying taxes on labour and social security contributions, as well as future years of receiving social benefits (pensions, health), whereas older generations have fewer remaining years of taxes. There are also significant differences in net payments estimated for existing generations across countries. For example, in Germany a 20-year old male is expected to pay the equivalent of about $375 000 in present value terms over his remaining lifetime, compared with about $260 000 in Sweden, about $220 000 in the United States, about $195 000 in Italy and less than $180 000 in Norway. These differences reflect mainly the levels of spending on goods and services in different countries rather than differences in the overall size of the government sector, as high tax payments may be accompanied by high transfer receipts.

5. As these generational accounts include only future net tax payments and exclude past net payments, they represent payments over full lifetimes for newborns and for future generations only. Therefore, a comparison of generational accounts between existing and future generations is only meaningful if the newborns in the base year are taken to represent the existing generations. Generational accounts are considered to be balanced if both the newborns and the (average) future generations have to pay similar per capita net taxes over their whole lives (in present value terms and adjusted for growth). In that case, the net tax ratio relative to life-time income would remain constant over time.

Table A5. **International comparison of generational accounts**
Present values of future net tax payments per capita (males)
Thousands of dollars[1]

Generation's age in 1993	United States	Germany	Italy	Norway	Sweden
0	121.1	197.4	64.9	110.2	155.9
5	141.3	233.2	79.9	127.6	179.2
10	164.3	274.2	109.1	145.2	204.6
15	192.4	333.8	155.8	165.3	231.4
20	218.3	374.3	195.9	176.7	259.3
25	224.4	369.0	204.7	185.5	268.6
30	214.7	333.6	186.9	179.4	277.7
35	196.6	279.4	145.1	159.5	266.5
40	168.1	202.7	88.3	133.9	252.6
45	126.1	135.3	33.9	99.8	211.5
50	72.1	26.7	-31.2	55.4	161.0
55	8.9	-73.7	-97.2	11.5	98.5
60	-58.4	-150.5	-148.1	-29.2	20.9
65	-108.0	-163.4	-144.0	-56.8	-5.7
70	-111.9	-132.4	-131.4	-57.9	-38.7
75	-104.4	-100.0	-169.5	-57.6	-36.2
80	-89.4	-67.8	-115.0	-43.4	-29.3
85	-78.4	-39.3	-60.9	-32.4	-20.9
90	-60.4	1.6	-8.5	-23.1	-3.8
Future generations	242.7	250.4	354.4	170.9	204.2
Percentage difference[2]	100.4	26.8	446.1	52.7	31.0

1. In constant prices, adjusted for income growth.
2. Between future generations and the generation born in 1993.

Note: Assuming real income growth of 1.5 per cent and a discount rate of 5 per cent.

Annex 4

Demographic Impact on National Saving: Results of Models

1. Various models based on the theoretical framework of life-cycle saving and neo-classical growth theory have been applied to examine the effects of demographics on national saving. This analysis generally suggests that the projected demographic changes lead to a decline in national saving, assuming that the economies are initially in equilibrium, with actual saving equal to optimal saving.

2. Using three different models (Life-Cycle Model, Family Model, Reduced-Form Model), Auerbach *et al.* (1990) assess the effects of demographics on U.S. national saving (Table A6). The life-cycle and family models show a moderate demographics-induced increase in the saving ratio between 1990 and 2000 and a sharp decline subsequently, with most of these simulations showing negative net saving after 2030. The reduced-form model predicts a continuous decline in the saving ratio. These declines in saving reflect the retirement of the United States large baby-boom cohort which was born between the mid-1940s and the mid-1960s.

3. Applying a general equilibrium model to four countries (the United States, Japan, Germany and Sweden), Auerbach *et al.* (1989) found that ageing depresses national saving ratios significantly in Japan and Germany, where ageing is more pronounced, and more moderately in the United States and Sweden (Table A7). They also find that policies that reduce the future government liabilities, such as increases in retirement ages or benefit reductions, increase national saving and this in turn then leads to higher national incomes (see also Hagemann and Nicoletti, 1989). With higher growth, lower tax rates would be sufficient to fund other government programmes.

4. Cutler *et al.* (1990) apply a so-called dependency ratio model to examine the effects of demographics for the United States and other countries (using similar model parameters as for the United States). They also find a long-term negative impact of demographics on national saving in all countries, although the impact is much smaller than in the models described above. At first, the national saving ratio in the United States declines slightly, while it increases in Japan. Then, in the early part of the next century, there is a temporary increase in the U.S. saving ratio, while saving ratios decline in Japan and all other OECD countries (Table A8). As these differences in national saving patterns could induce international capital flows, the effects of demographics are examined further in an open-economy version of the model. In this version, the United States increases investment initially and from 1990 to 2005 draws on foreign saving by running a current-account deficit. But for the subsequent 15 years, higher saving in the United States results in current-account surpluses and reduces foreign ownership again. However, after 2020 the United States would again run current balance deficits.

5. Some of these simulations also show explicitly the effects of demographics on consumption per head. Using their dependency ratio model, Cutler *et al.* find that ageing leads to a long-term decline in consumption per head in all countries and the decline is stronger in Japan and Europe than in the United States, where ageing starts later and is less pronounced. For the United States, demographic factors even lead to a temporary increase in consumption per head at the beginning of the next century. This result

arises because slower growth in the working-age population means less additional capital (i.e. investment) is needed to equip the labour force. In the open economy version of the model, the initial positive consumption response in the United States is even larger, since there is access to foreign capital.

6. Using a similar transmission mechanism as mentioned above by Cutler *et al.* (1990) in three different models[1], Yoo (1994) shows that the United States baby-boom initially reduced consumption per head as more resources were allocated to producing the investment goods needed to employ the growing labour force, but with the retirement of the baby-boomers more resources can be used to produce consumer goods and services. Yoo concludes that concerns about an economic decline in the United States following the retirement of the baby-boomers are unfounded.

1. A Ramsey-type growth model, a Dependency Ratio Model (similar to Cutler *et al.*) and an Overlapping Generation Model with individuals maximising utility and firms maximising profits.

Table A6. **Net national saving ratios in the United States: results of three models**
As a per cent of GDP

	Saving ratio in the life-cycle model				Saving ratio in the family model				Saving ratio in the reduced-form model
Parameter Assumptions									
Rate of growth	2.0	2.4	2.4	2.4	2.0	2.4	2.4	2.4	--
Rate of interest	5.0	3.0	5.0	7.0	5.0	3.0	5.0	7.0	--
1988	3.7	3.7	3.7	3.7	9.2	4.0	4.2	3.6	3.4
Decade beginning:									
1990	7.3	7.2	7.7	7.6	10.2	4.3	4.8	4.3	3.5
2000	9.0	7.8	9.6	10.2	11.0	4.0	5.0	4.8	0.6
2010	5.3	2.7	6.0	7.7	10.3	2.0	3.7	4.1	-1.9
2020	-0.6	-4.3	0.2	3.0	8.2	-1.6	0.7	1.8	-3.6
2030	-9.0	-12.3	-7.8	-4.4	6.4	-4.6	-2.1	-0.6	-4.8
2040	-21.1	-21.0	-18.8	-16.9	5.7	-6.0	-3.6	-1.9	-5.0
Peak saving rate	9.6	8.9	10.2	10.7	11.1	4.4	5.1	4.9	4.4
Year of peak	(2003)	(2001)	(2003)	(2003)	(2006)	(1998)	(2003)	(2007)	(1992)

Source: Auerbach *et al.* (1990).

Table A7. **Demographic impact on national saving rates as measured by a dynamic general equilibrium model**

	United States	Japan	Germany	Sweden
	National saving as a per cent of GDP			
1960	10.1	24.4	23.3	15.9
1985	10.0	20.2	21.5	11.4
1990	9.1	21.3	19.7	11.9
2010	7.2	12.5	19.1	8.9
2030	5.1	3.1	13.9	6.3
2050	4.6	13.3	2.7	8.8
Long run	5.3	13.2	16.6	10.9
	Change in national savings as a per cent of GDP			
1960-1985	-0.1	-4.2	-1.8	-4.5
1985-1990	-0.9	1.1	-1.8	0.5
1990-2010	-1.9	-8.8	-0.6	-3.0
2010-2030	-2.1	-9.4	-5.2	-2.6
2030-2050	-0.5	10.2	-11.2	2.5
Long run	0.7	-0.1	13.9	2.1

Source: Auerbach *et al.*, 1989.

Table A8. **Response of consumption and national saving to demographic shocks (closed economy case) United States and various nations, 1990-2050**[1]

	United States	Japan	EC	Non-US OECD	Total OECD
			Consumption response		
Initial steady state	100.0	100.0	100.0	100.0	100.0
Initial adjustment	100.1	99.2	100.1	100.0	100.1
Time path:					
2000	100.6	97.2	99.7	99.3	99.8
2010	101.5	92.2	98.8	97.8	99.2
2020	99.1	89.0	97.1	95.5	97.0
2030	94.4	88.5	92.8	92.1	93.0
2040	92.0	86.3	89.1	88.8	89.9
2050	92.1	84.8	88.2	87.9	89.1
New steady state	92.3	84.4	87.9	87.8	89.0
			National saving rate response		
Initial adjustment	-0.1	0.7	-0.1	0.0	0.0
Time path:					
2000	0.1	-1.4	-0.9	-1.0	-0.6
2010	0.5	-3.0	-0.7	-1.1	-0.5
2020	-1.4	-2.6	-1.5	-1.8	-1.6
2030	-2.4	-1.3	-2.8	-2.5	-2.5
2040	-1.5	-3.1	-2.9	-2.9	-2.3
2050	-1.4	-1.5	-0.8	-1.2	-1.3
New steady state	-1.5	-1.3	-0.7	-1.1	-1.3

1. The values in the table are the optimal consumption and national saving paths for each country without international capital flows. Consumption is relative to the initial steady state, which is normalized to 100. Saving paths are defined as the percentage point difference between the saving rate along the path and the initial steady state. The elasticities of substitution in production and consumption are both equal to unity.

Source: Cutler *et al.* (1990).

Annex 5

Saving and Investment Rates

1. Gross and net national saving ratios declined steadily over recent decades in most OECD countries. Despite a projected stabilisation of the average gross and net saving ratios during the remainder of the current decade, many OECD countries, in particular the United States and the United Kingdom, are set to enter the 21st century with relatively low national saving rates (Table A9 and Figure 11). Despite some decline, Japan is likely to remain the country with the highest gross national saving ratio (as both private and government saving are relatively high) and it is now the largest single contributor to overall OECD saving, while the share of the United States has fallen steadily (Table A10). The long-term decline in national saving reflects a long-term decline in government saving and in private saving. Between 1983 and 1989, government saving increased, but was largely offset by a decline in private saving so that national saving remained virtually unchanged. The decline in government saving during the early 1990s was reflected in corresponding changes in national saving as private saving remained more or less constant. Similarly, the projected increase in government saving during the remainder of the decade is expected to be reflected in higher national saving.

2. Domestic nominal investment ratios show a broadly similar development as national saving ratios. They also declined, on average, from the 1970s to the 1980s and during the first half of the 1990s (Table A11). Since relative investment prices have declined, the long-term decline in real investment ratios was less pronounced (Table A12). Some increase in nominal and real investment ratios is projected in the period to 2000, reflecting, in part, a cyclical recovery from low investment ratios during the recession.

3. There is a close correlation between national saving and domestic investment for the total OECD, reflecting the relatively small external balance of the OECD area *vis-à-vis* the rest of the world. For many individual countries, the evolution of saving and investment was also found to be correlated, although to a lesser extent (Obstfeld, 1994; Hakim and Wallich, 1986; Lluch, 1986). This correlation does not seem consistent with high and increasing international capital mobility (the so-called Feldstein-Horioka puzzle). A possible explanation may be that governments change policies to reduce current-account imbalances (especially deficits). This may lead to a high correlation between national saving and investment (Caprio and Howard, 1984; Summers, 1988; Bayumi, 1990). Other factors could reduce the impact of international capital mobility, including higher transaction costs when purchasing foreign securities, exchange-rate risks, and asymmetric information between foreign investments and domestic investments, (Feldstein and Horioka, 1980; French and Poterba, 1991; Gordon and Bovenberg, 1994).

4. A positive correlation between saving and investment could also be explained by productivity shocks or other factors that may affect both saving and investment in the same way. For example, Taylor (1994) looked at richer and poorer countries and found that higher saving rates in richer countries could be explained, in part, by lower child dependency ratios and lower prices of investment goods relative to consumption in richer countries. He also found that higher participation rates and lower relative prices of investment were able to explain, to a considerable extent, the higher investment rates of richer countries. One possible implication for richer countries is that future increases in overall dependency rates and

reductions in the labour force may lead to a decline in both saving and investment rates. But the correlation between national saving and domestic investment could become weaker in the future, especially if the effects of ageing on national saving and investment differ within and among countries and if international capital market imperfections are reduced further.

Table A9. **Gross and net national, government and private sector saving[1]**
Average ratios, per cent of GDP

		Gross				Net			
		1970-79	1980-89	1990-94[2]	1995-99[2]	1970-79	1980-89	1990-94[2]	1995-99[2]
United States	National	20.1	17.8	15.4	16.0	8.5	4.4	2.7	2.4
	Government	0.9	-1.6	-2.4	-1.3	-0.6	-3.0	-3.5	-2.5
	Private sector	19.2	19.4	17.7	17.4	9.0	7.4	6.2	4.9
Japan	National	35.2	31.8	33.6	30.6	22.2	18.1	18.0	13.9
	Government	4.5	4.8	7.6	5.2	4.0	4.1	7.0	4.5
	Private sector	30.7	27.0	26.0	25.4	18.2	13.9	11.0	9.4
Germany	National	24.4	22.4	21.9	23.9	13.5	9.8	8.6	9.8
	Government	4.3	2.3	1.2	1.5	3.8	1.6	0.5	0.9
	Private sector	20.0	20.1	20.6	22.4	9.7	8.2	8.1	8.9
France	National	25.9	20.4	20.1	21.5	15.3	7.9	6.9	7.9
	Government	4.5	2.4	1.5	2.1	3.3	0.7	-0.5	0.0
	Private sector	21.4	18.0	18.5	19.4	12.0	7.2	7.4	7.9
Italy[3]	National	26.0	21.8	18.4	20.4	14.8	9.8	6.4	7.8
	Government	-4.3	-4.4	-4.0	-1.5	-4.6	-4.6	-4.4	-2.0
	Private sector	30.3	26.2	22.4	21.9	19.4	14.4	10.8	9.9
United Kingdom	National	19.3	16.8	13.7	15.7	8.8	5.0	2.8	4.7
	Government	3.0	0.8	-1.4	0.5	1.8	-0.4	-2.5	-0.5
	Private sector	16.3	16.0	15.1	15.2	7.0	5.5	5.3	5.2
Canada	National	22.6	20.2	14.6	17.8	11.6	8.5	2.2	5.0
	Government	2.8	-1.3	-3.4	0.8	1.4	-2.8	-4.8	-0.6
	Private sector	19.8	21.5	18.0	17.0	10.2	11.4	7.1	5.5
Australia	National	23.9	20.0	16.3	18.0	9.9	4.6	0.7	2.4
	Government	3.3	1.9	-1.0	1.1	1.2	-0.2	-2.8	-0.5
	Private sector	20.5	18.1	17.2	16.9	8.7	4.8	3.4	2.9
Austria	National	27.8	24.1	25.2	25.6	16.2	11.8	12.8	13.0
	Government	4.6	0.8	0.2	-1.1	3.9	0.0	-0.5	-1.7
	Private sector	23.2	23.3	25.0	26.7	12.4	11.7	13.3	14.7
Belgium	National	23.2	16.7	21.7	24.2	13.8	7.2	12.0	14.3
	Government	0.4	-5.3	-3.6	-0.5	0.1	-5.6	-3.9	-0.8
	Private sector	22.9	22.0	25.3	24.7	13.7	12.8	15.9	15.1
Denmark	National	20.8	14.8	17.4	18.9	12.9	5.9	8.0	9.4
	Government	6.4	0.8	-0.2	1.2	5.8	0.0	-1.2	0.2
	Private sector	14.3	14.0	17.6	17.7	7.1	5.8	9.2	9.2

Table A9 (continued)

		Gross				Net			
		1970-79	1980-89	1990-94[2]	1995-99[2]	1970-79	1980-89	1990-94[2]	1995-99[2]
Finland	National	26.2	23.7	16.3	22.5	12.3	8.9	-0.7	4.6
	Government	8.7	6.9	0.3	-0.4	7.8	5.7	-1.3	-1.7
	Private sector	17.4	16.7	16.0	22.9	4.5	3.2	0.6	6.4
Iceland	National	25.3	17.6	15.6	18.3	..	..	2.8	4.6
	Government	..	6.3	2.9	2.8	..	..	2.3	2.1
	Private sector	..	11.3	12.7	15.5	..	..	0.5	2.5
Norway	National	26.3	26.9	22.8	26.5	11.6	12.3	7.3	10.4
	Government	7.8	8.4	2.7	5.8	7.0	7.6	1.8	4.8
	Private sector	18.5	18.5	20.1	20.7	4.6	4.7	5.5	5.7
Portugal	National	25.7	24.2	24.8	26.5	..	..	..	..
	Government	..	..	3.1	6.5	..	..	..	..
	Private sector	..	..	21.7	20.1	..	..	..	..
Sweden[3]	National	21.6	17.3	15.0	22.3	10.6	4.7	1.5	8.7
	Government	8.7	1.6	-3.7	-4.9	7.0	-0.3	-5.5	-6.5
	Private sector	12.9	15.7	18.7	27.3	3.6	5.0	7.0	15.3
OECD[4]	National	24.5	21.1	19.4	21.7	13.0	8.5	6.4	8.2
	Government	4.0	1.3	-0.4	0.6	3.0	0.2	-1.5	-0.5
	Private sector	20.5	19.8	19.9	21.1	10.0	8.3	7.9	8.6
European countries[4]	National	24.2	20.5	19.2	22.1	13.0	8.3	6.6	9.1
	Government	4.4	1.4	-0.7	0.3	3.6	0.5	-1.8	-0.7
	Private sector	19.7	19.1	19.9	21.9	9.4	7.9	8.3	9.8
OECD[5]	National	26.1	22.9	21.3	22.0	12.7	8.3	6.6	6.5
	Government	2.4	0.3	0.0	0.6	1.2	-0.8	-1.1	-0.5
	Private sector	23.7	22.5	21.3	21.4	11.5	9.1	7.7	7.0
European countries[5]	National	24.1	20.5	19.0	21.1	13.2	8.3	6.6	8.2
	Government	2.6	0.5	-0.6	0.6	1.8	-0.4	-1.6	-0.5
	Private sector	21.5	20.0	19.6	20.6	11.4	8.7	8.2	8.7

1. Current receipts minus current expenditures. Gross saving minus depreciation equals net saving. Based on OECD SNA data, Secretariat estimates and medium-term scenario.
2. For Germany, averages 1991-1994, 1995-2000 include eastern Germany.
3. 1970-1979: estimates based on a previous SNA system.
4. Unweighted average, excluding Portugal and Iceland.
5. Weighted average (1991 GDP weights), excluding Portugal and Iceland.

Table A10. **Gross and net national savings in OECD countries**
Annual averages in US dollars

		1970-1979		1980-1989		1990-1994		1995-1999[1]	
		$ billions	% of total OECD	$ billions	% of total OECD	$ billions	% of total OECD	$ billions	% of total OECD
United States	gross	328	36	682	34	934	26	1 220	23
	net	137	24	166	21	141	11	150	8
Japan	gross	182	20	557	28	1 266	36	1 965	38
	net	114	20	317	40	671	53	935	50
OECD Europe	gross	347	38	685	34	1 213	34	1 850	35
	net	243	43	273	34	415	33	715	38
Total OECD	gross	902	100	2 020	100	3 540	100	5 220	100
	net	562	100	797	100	1 261	100	1 860	100

1. Secretariat projections.

Table A11. **Gross and net domestic, government and private sector investment in current prices**
Average ratios, per cent of GDP

		Gross				Net			
		1970-79	1980-89	1990-94[1]	1995-99[1]	1970-79	1980-89	1990-94[1]	1995-99[1]
United States	Domestic	19.8	19.4	16.6	18.3	8.2	6.1	3.8	4.6
	Government	..	..	..	..	..	..	..	..
	Private sector	..	..	..	..	..	..	..	..
Japan	Domestic	34.5	29.6	31.0	28.5	21.5	16.0	15.4	11.9
	Government	5.4	5.3	5.9	6.9	5.0	4.7	5.3	6.2
	Private sector	29.0	24.3	25.2	21.6	16.5	11.3	10.2	5.6
Germany	Domestic	23.4	20.4	22.9	25.0	12.5	7.7	9.7	10.8
	Government	3.9	2.7	2.7	2.6	3.3	2.0	2.0	2.0
	Private sector	19.6	17.7	20.2	22.3	9.2	5.8	7.7	8.8
France	Domestic	25.5	20.9	19.9	20.3	14.9	8.4	6.8	6.7
	Government	3.4	3.2	3.5	3.5	2.2	1.5	1.5	1.4
	Private sector	22.1	17.7	16.4	16.8	12.7	6.9	5.2	5.3
Italy[2]	Domestic	25.8	22.7	19.0	18.4	14.6	10.7	6.9	5.9
	Government	3.1	3.5	2.9	2.3	2.8	3.3	2.5	1.8
	Private sector	22.7	19.2	16.1	16.2	11.8	7.4	4.5	4.2
United Kingdom	Domestic	19.9	17.6	16.3	16.4	9.4	5.8	5.4	5.3
	Government	4.1	1.9	2.0	1.5	2.9	0.7	0.9	0.5
	Private sector	15.8	15.7	14.3	14.8	6.5	5.1	4.5	4.8
Canada	Domestic	23.9	21.5	18.7	19.0	12.8	9.9	6.4	6.1
	Government	3.4	2.5	2.4	2.4	1.9	1.1	0.9	1.0
	Private sector	20.5	19.0	16.4	16.6	10.9	8.8	5.5	5.1
Australia	Domestic	25.0	24.7	20.1	23.0	11.1	9.2	4.5	7.4
	Government	3.8	2.7	2.2	2.0	1.6	0.6	0.4	0.4
	Private sector	21.2	22.0	17.9	21.0	9.4	8.6	4.1	7.0
Austria	Domestic	28.6	24.4	25.3	27.2	17.0	12.1	12.9	14.6
	Government	4.8	3.7	3.2	2.8	4.1	2.9	2.5	2.2
	Private sector	23.8	20.8	22.2	24.4	12.9	9.2	10.5	12.4
Belgium	Domestic	22.7	17.3	18.9	19.1	13.2	7.8	9.1	9.1
	Government	3.7	2.5	1.5	1.6	3.4	2.1	1.2	1.3
	Private sector	18.9	14.8	17.4	17.4	9.8	5.6	8.0	7.8
Denmark	Domestic	23.7	18.1	15.6	16.1	15.7	9.1	6.2	6.6
	Government	4.0	2.5	2.1	1.9	3.3	1.6	1.1	0.9
	Private sector	19.7	15.6	13.5	14.2	12.4	7.5	5.1	5.7

Table A11 (continued)

		Gross				Net			
		1970-79	1980-89	1990-94[1]	1995-99[1]	1970-79	1980-89	1990-94[1]	1995-99[1]
Finland	Domestic	28.4	25.7	19.3	21.1	14.6	10.9	2.3	3.3
	Government	3.5	3.4	3.1	2.1	2.5	2.2	1.6	0.8
	Private sector	25.0	22.3	16.2	19.0	12.1	8.8	0.7	2.5
Iceland	Domestic	28.7	20.8	17.2	16.3	..	8.5	4.4	2.6
	Government	3.8	5.6	6.1	5.7	..	5.0	5.5	4.9
	Private sector	24.9	15.3	11.0	10.7	..	3.5	-1.2	-2.3
Norway	Domestic	31.8	26.4	19.4	19.5	17.1	11.7	3.9	3.5
	Government	4.7	3.4	3.3	2.9	4.0	2.5	2.4	1.8
	Private sector	27.1	23.0	16.1	16.6	13.2	9.2	1.5	1.6
Portugal	Domestic	28.4	29.2	27.1	29.1	..	..	..	..
	Government	2.6	3.6	4.1	4.4	..	..	..	..
	Private sector	25.8	25.6	23.0	24.7	..	..	..	..
Sweden[2]	Domestic	22.0	18.9	16.7	16.3	11.0	6.3	3.2	2.7
	Government	3.7	2.7	2.4	2.5	2.0	0.9	0.6	0.9
	Private sector	18.3	16.2	14.3	13.8	9.0	5.5	2.6	1.8
OECD[3]	Domestic	25.6	21.9	19.8	20.3	13.8	9.4	6.7	6.7
European countries[3]	Domestic	25.5	21.2	19.1	19.6	13.4	8.7	5.7	5.8
OECD[4]	Domestic	23.6	21.4	20.0	20.6	12.2	8.7	7.1	7.0
European countries[4]	Domestic	24.0	20.5	19.8	20.4	13.9	8.3	7.4	7.5

1. For Germany, averages 1991-1994, 1995-2000 include eastern Germany.
2. 1970-79: net figures are estimates based on old SNA data.
3. Unweighted average, excluding Portugal.
4. Weighted average (1991 GDP weights), excluding Portugal.

Table A12. **Domestic investment**

Average ratios as a per cent of GDP, in constant prices

	1970-1979	1980-1989	1990-1994[1]	1995-1999[1]
United States	19.5	19.0	18.9	22.6
Japan	32.9	29.6	33.3	32.8
Germany	24.5	20.7	23.3	26.0
France	25.9	21.8	21.8	23.0
Italy	26.4	22.8	21.3	21.0
United Kingdom	19.3	17.6	18.0	19.2
Canada	19.2	21.1	21.8	23.4
Australia	25.9	24.7	20.6	22.7
Austria	27.3	24.7	26.8	29.9
Belgium	21.7	17.2	20.3	21.4
Denmark	24.4	18.2	15.8	15.9
Finland	28.2	26.6	20.3	22.6
Iceland	25.3	20.0	17.3	16.3
Norway	33.0	27.0	19.2	18.7
Portugal	29.3	27.3	32.2	37.3
Sweden	21.1	18.0	17.2	17.5
OECD[2]	25.2	22.3	21.8	23.1
European countries[2]	25.5	21.8	21.1	22.4
OECD[3]	23.6	21.7	22.4	24.4
European countries[3]	24.4	20.9	21.4	22.7

1. For Germany, averages 1991-1994, 1995-2000 include eastern Germany.
2. Unweighted average.
3. Weighted average (1991 GDP weights).

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